390

THE PLANNING-PROGRAMING-BUDGETING SYSTEM: PROGRESS AND POTENTIALS

HEARINGS

BEFORE THE

SUBCOMMITTEE ON ECONOMY IN GOVERNMENT

OF THE

JOINT ECONOMIC COMMITTEE
CONGRESS OF THE UNITED STATES

NINETIETH CONGRESS

FIRST SESSION

SEPTEMBER 14, 19, 20, AND 21, 1967

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THE PLANNING-PROGRAMING-BUDGETING SYSTEM: PROGRESS AND POTENTIALS

THURSDAY, SEPTEMBER 14, 1967

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON ECONOMY IN GOVERNMENT
OF THE JOINT ECONOMIC COMMITTEE,
Washington, D.C.

The subcommittee met, pursuant to recess, at 10:03 a.m., in room 1318, New Senate Office Building, Hon. William Proxmire (chairman of the subcommittee) presiding.

Present: Senators Proxmire and Jordan.

Also present: John R. Stark, executive director; Daniel J. Edwards, economic consultant; and George R. Iden, staff economist.

Chairman PROXMIRE. Today, we start the first of 4 days of hearings on the Planning-Programing-Budgeting System.

These hearings reflect the continuing concern of the Subcommittee on Economy in Government of the Joint Economic Committee with improvement in the management of Government. At the present time, the cash flow through the Federal sector amounts to approximately $175 billion. In addition, State and local governments now account for more than $60 billion. Certainly at a time when approximately 30 percent of our national income flows through the public sector, it is of the utmost importance that our policymakers be armed with the best possible tools for evaluating the effectiveness of our public programs and expenditures.

Proponents of PPB claim that for the first time it provides decision-makers with a rational basis for choosing between alternative policies. In their view, PPB, by employing the techniques of operations research or cost-effectiveness studies, presents decisionmakers with a systematic and comprehensive comparison of the costs and benefits of alternative approaches to a policy goal.

The administration has directed all Federal agencies to apply PPB. The achievements of this new application have been listed as follows by the administration:

(1) Identify our national goals with precision and on a continuing basis;

(2) Choose among those goals the ones that are most urgent;

(3) Search for alternative means of reaching those goals most effectively at the least cost;

(4) Inform ourselves not merely on next year's costs, but on the second, and third, and subsequent years' costs of our programs;

(5) Measure the performance of our programs to insure a dollar's worth of service for each dollar spent.

However, there are some critics who view PPB advocates as a new breed of technocrat who think the computer can take the politics out

of decisionmaking. They point out that PPB tends to centralize decisionmaking within the executive departments and to stifle healthy dissent. These skeptics say that, while it is fine to talk about long-range planning, our ability to forecast the future is not sufficiently good to commit the Government in advance to 5 years of expenditures. And, finally, the skeptics suggest that too often the planners write plans and programs that rationalize their own hunches.

The program is very new and we obviously cannot make any definitive assessment yet as to its efficacy in improving the effectiveness of public programs. But 2 years have elapsed since its beginning, and it appears to us to be a reasonable time period for some prospects to develop. Efforts to achieve a more efficient and more effective expenditure program by Government are so basic to the whole concept of economy in Government, that we want to follow developments closely, and that accounts for our calling these brief hearings at the present time.

Today we have three witnesses who are responsible for applying PPB in their respective agencies. Their firsthand knowledge will be very helpful to the subcommittee's deliberations. We welcome William Gorham, Assistant Secretary for Program Coordination, Department of Health, Education, and Welfare; William Ross, Deputy Under Secretary for Policy Analysis and Program Evaluation, Department of Housing and Urban Development; and Harry Shooshan, Deputy Under Secretary for Programs, Department of the Interior.

Next Tuesday we will hear witnesses who have been directly involved in applying PPB at the State and local level. Their experience will help us formulate guidelines for Federal action.

Our hearings on Wednesday will explore the vital issue of interest rate guidelines for Federal decisionmaking. A panel of academic experts will discuss the importance of monetary factors in amortizing the costs and benefits of public investments, and whether the Congress should consider specifying a range of interest rates on alternative programs.

We have our last day of hearings scheduled for next Thursday. On that day, witnesses will attempt a general assessment of PPB in terms of alternatives, applications by Congress, and future prospects.

I think maybe the most sensible way to proceed is just to do this on an alphabetical basis and ask Mr. William Gorham, Assistant Secretary for Program Coordination of the Department of Health, Education, and Welfare, to be our first witness, followed by William Ross and Harry Shooshan.

We will include the hearings announcement and schedule at this point in the record.

(Announcement and schedule follows:)

CONGRESS OF THE UNITED STATES JOINT ECONOMIC COMMITTEE

SENATOR WILLIAM PROXMIRE ANNOUNCES SCHEDULE OF HEARINGS ON THE PLANNING-PROGRAMING-BUDGETING SYSTEM

Senator William Proxmire (D.-Wisc.), Chairman of the Joint Economic Committee. today issued the schedule of hearings to be held before the Subcommittee on Economy in Government, which he also heads, on the Planning-Programing-Budgeting System. An earlier announcement of the hearings was made on Friday, September 1.

SUBCOMMITTEE ON ECONOMY IN GOVERNMENT—PROGRAM OF HEARINGS ON THE PLANNING-PROGRAMING-BUDGETING SYSTEM, SEPTEMBER 14, 19, 20 AND 21, 1967

THURSDAY, SEPTEMBER 14, 10:00 A.M., ROOM 1318, NEW SENATE OFFICE BUILDING

Case Studies of Civilian PPB

William Gorham, Assistant Secretary (Program Coordination), Department of Health, Education, and Welfare
William Ross, Deputy Under Secretary for Policy Analysis and Program Evaluation, Department of Housing and Urban Development
Harry Shooshan, Deputy Under Secretary for Programs, Department of the Interior

TUESDAY, SEPTEMBER 19, 10:00 A.M., ROOM S-407 THE CAPITOL

Case Studies of State and Local Applications

Warren Exo, Director of Management Services, Department of Administration, State of Wisconsin
Fred O'Reilly Hayes, New York City Budget Director
John J. Daley, Lieutenant Governor, State of Vermont

WEDNESDAY, SEPTEMBER 20, 10:00 A.M., ROOM S-407, THE CAPITOL

Interest Rate Guidelines for Federal Decision Making

Jacob Stockfisch, Senior Research Associate, Institute for Defense Analyses
Morton Kamien, Professor, Graduate School of Industrial Administration, Carnegie Mellon University
William Baumol, Professor of Economics, Princeton University

THURSDAY, SEPTEMBER 21, 10:00 A.M. ROOM 1202, NEW SENATE OFFICE BUILDING

Future Applications of PPB

Henry Rowen, President, RAND Corporation
John Haldi, former Chief, Program Evaluation Staff, Bureau of the Budget
Otto Davis, Professor, Graduate School of Industrial Administration, Carnegie Mellon University
Frank H. Weitzel, Assistant Comptroller General of the United States

Chairman PROXMIRE. I might say that with the tolerance of my good friend, Senator Jordan, I may have to leave temporarily for the floor, and I hope that you will preside in my absence, Senator Jordan.

Senator JORDAN. I will be happy to do so, Mr. Chairman.

Chairman PROXMIRE. Thank you Senator Jordan. Mr. Gorham?

STATEMENT OF WILLIAM GORHAM, ASSISTANT SECRETARY (PROGRAM COORDINATION), DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Mr. GORHAM. Mr. Chairman, members of the subcommittee. I have been asked by the chairman to describe for you the Planning-Programing-Budgeting System as it is developing in the Department of Health, Education, and Welfare and to give some examples of its accomplishments so far. I feel somewhat as if I had been asked to review a novel after reading only the first few chapters. I do not know how the story will end, and, worse than that, I do not know how much relative significance will attach to the various incidents and characters of the early chapters as the plot develops. PPBS is still in a very experimental stage. I can only give you a progress report and some impressions of one who has been thoroughly involved in the process of getting the experiments started.

In spite of the fact 2 years have elapsed since the order which the President put forth causing the implementation of PPB to begin, we are very much at the beginning of a process, not at the middle, not at the end.

PPB is not the first attempt, and it certainly is not going to be the last attempt to improve budgetary decisionmaking in the executive branch of the Federal Government. It is based on the assumption that the allocation of Federal resources will be more rational if budgetary decisions are made in the light of explicitly formulated multiyear objectives, and as much information as possible about the effectiveness of alternative programs for reaching these objectives.

Only rather general guidance has been given by the Bureau of the Budget to departments and agencies of the Federal Government on steps to be taken in improving their budgetary decisionmaking. The Bureau of the Budget has specified that each agency is to develop a program structure classifying its programs by their objectives and to develop measures of the program output. Each agency is to develop a 5-year program and financial plan. It is to submit this plan in the fall along with program memorandums explaining why specific decisions were made and analytical studies showing the basis for these decisions.

This general guidance from the Bureau of the Budget has been applied differently in different agencies. I will try to give you today some picture of what has actually happened inside the Department of Health, Education, and Welfare as we have endeavored to implement the system I will talk first about the program budget and the information system which we have developed for the Department. Second, I will talk about some of the analytical studies we have done and give you some examples of analyses completed or underway which are relevant to budgetary decisionmaking. Finally, I will talk about the actual process of planning and how we are going about developing a 5-year program and financial plan this year.

The Program Budget and Information System

The first step toward improving budgetary decisionmaking in a huge, complicated organization like HEW is to provide comprehensible information about the current allocation of resources and a mechanism for showing how future changes in programs would affect this allocation. As a start, one should be able to answer such questions as: What share of the Department's resources is going into health programs? What share is directed toward improving the lives of the poor? What share is directed at assisting old people and how many people are affected? What share of the Department's budget is devoted to research and is the share growing or declining?

Surprising as it may seem, none of these questions can be answered easily by looking at the conventional budget of the Department. Health programs appear in several different agencies. In fact, in our Department we have programs in the Public Health Service, the Social and Rehabilitation Service, the Social Security Administration, the Food and Drug Administration, the Administration on Aging, and the Office of Education. Activities such as research and training are often buried in other programs. The groups affected by programs are not identified in a conventional budget; nor are measures of output or

accomplishment—classrooms built, patients treated, students supported—readily available.

For those reasons—and in accordance with instructions from the Bureau of the Budget—we have developed a new information system for the Department which serves both as a classification system and as a planning tool. Under this system an individual Department program is classified in a number of different ways—by objective, by the target group in the population at which it is directed, by type of financing—project grants, loans, etc.—by activities used in carrying out the program—construction, training, etc. The result is a flexible information system which can answer a great many questions quickly and easily and can give a clearer picture of how the Department's dollars are being used.

Along with the dollar information we are also developing measures of output of programs in nondollar terms. This, perhaps, is the largest departure from former attempts at developing and improving the budgetary structure. At present, these outputs are limited to measures of initial impact of programs—square feet constructed, children enrolled, persons rehabilitated. Eventually, we may be able to provide measures of more ultimate benefits of programs—cases cured, students graduated, individuals rescued from poverty—which will aid in evaluating the effectiveness of programs in meeting their goals.

Analytical Studies

This is a long, tough job, and it is going to take many years to develop the kinds of output measures we need to understand what we are getting for our money.

If the first step toward rational decisionmaking is a good information system, the second is a strong capability for analyzing the consequences of alternative courses of action. In the past year and a half, we have undertaken a series of analytical studies of DHEW programs and possible programs. Some of these studies have been completed. Many are still in process. I will talk briefly about several of these studies—what they have shown, how they are relevant to actual decisions, and what they have revealed about the uses and limitations of analysis.

Let me hasten to point out that we have not attempted any grandiose cost-benefit analyses designed to reveal whether the total benefits from an additional million dollars spent on health programs would be higher or lower than that from an additional million spent on education or welfare. If I was ever naive enough to think this sort of analysis possible, I no longer am. The benefits of health, education, and welfare programs are diverse and often intangible. They affect different age groups and different regions of the population over different periods of time. No amount of analysis is going to tell us whether the Nation benefits more from sending a slum child to preschool, providing medical care to an old man or enabling a disabled housewife to resume her normal activities. The "grand decisions"—how much health, how much education, how much welfare, and which groups in the population shall benefit—are questions of value judgments and politics. The analyst cannot make much contribution to their resolution.

Again, let me point out that we have not attempted to do the sort of studies which would put us in a position where we can decide how much money to add to health versus education, versus social service. The tools of cost-benefit analysis are simply not adopted to such large choices. One would hope that in the future, as we develop better measures of output and accomplishment, we will improve the ability of the Congress and the Executive to choose among education or health or welfare—or at least to know what is being bought with incremental dollars in each area. But specific hard analysis of the choices, I think, is not in the offing.

The less grand decisions, those among alternative programs with the same or similar objectives within health—can be substantially illuminated by good analysis. It is this type of analysis which we have undertaken at the Department of Health, Education, and Welfare.

One of the first analytical studies of the PPB era at Health, Education, and Welfare was a study of disease control programs. The basic concept of the study was a simple one. HEW supports or could support a number of categorical disease control programs, whose objectives are to save lives or to prevent disability by controlling specific diseases. It seemed to us that the effectiveness of these disease control programs could be compared. But in the past, these sorts of comparisons were not made.

The study was an attempt to answer the question: If additional money were to be allocated to disease-control programs, which programs would show the highest payoff in terms of lives saved and disability prevented per dollar spent? The study defined disease liberally. We included motor accidents, since the results of motor vehicle accidents are the same as those of diseases—they kill, they maim, they disable. The diseases we chose to study were tuberculosis, syphilis, cancer, arthritis, and, as I said, motor vehicle accidents.

Although the concept of the study was simple, in practice it was difficult to carry out because very little is known about the effectiveness of many disease control programs. For some diseases, such as cervical cancer, we have good knowledge of the impact of control programs. If we added so much money, we could save so many lives, with virtually no question about it. Guesswork and the opinions of knowledgeable experts had to be substituted for hard data in many cases. In the case of motor vehicle accidents, we were dealing with some questions which were imponderable. For example, we had good information on impact of seatbelt use on deaths from automobile accidents. But the problem was getting people to use seatbelts. We did not know much about the effectiveness of campaigns to convince people to put their seatbelts on. At one point in the discussion of this program, large billboards were suggested, very simple ones—that lump you're sitting on, tie it around you. The guesses which the study group make are subject to a wide margin of error.

Chairman PROXMIRE. It sounds like an appeal to a contortionist.

Mr. GORHAM. Despite its limitations, the disease-control study provided at least a strong suggestion that certain types of programs to prevent motor vehicle accidents would have a high payoff in terms of lives saved per dollar. The cost of saving a life with an effective seatbelt program might be as little as $87. Another potentially high payoff program appeared to be the detection and treatment of cervical

cancer, a disease which takes the lives of many young and middle-aged women especially in poor areas and which can be controlled by relatively inexpensive detection and treatment. Cost per life saved was estimated to vary from $2,200 to above $4,000 depending on the size of the program.

While the disease-control study did not cause major reallocations of resources among categorical disease programs last year, the impact of the study and its methodology on future planning for disease-control programs at Federal, State, and local levels will be considerable. It dramatized the need for good information on the effectiveness of disease-control programs in saving lives and preventing disability. It provided for the first time a rational and usable basis for allocating incremental funds among categorical disease programs. Interest in the study among health planners, especially at the State level, has been nationwide.

Senator PROXMIRE. Just for a minute on that particular point—does that mean that the marginal dollar would pay off to that extent, that $2,200 to $4,000 additional on cervical cancer research would save one life?

Mr. GORHAM. Not research. This has to do with control programs. It excluded research. It does mean exactly what you said, that as you begin expanding the program, the cost per life saved would be about $2,200. Then, as you expand the program further, the cost would increase. The reason for the increase is that you move from programs centered in large hospitals to more expensive programs for the harder-to-reach population.

The use of these kinds of analyses at State and local governments will be extremely important in the future. The partnership for health legislation shifts to the States' responsibility for allocation of funds among categorical programs. So we see the future of this kind of study to be much more at State and local level than at Federal levels.

Also last year, we did a rather different kind of study in the field of health: A study of alternative ways of improving the health of children. The President had focused public attention on the problem of child health and expressed a desire to introduce new legislation in this field. The Department of Health, Education, and Welfare study was addressed to two questions: To assess the state of health of the Nation's children—to what extent the children have correctible health problems and in what groups in the population were the problems concentrated—and to estimate the cost and effectiveness of various kinds of programs to improve the health of children.

Again, this study proved more difficult than we anticipated. We have stopped anticipating easy analyses, by the way. Hard information on the state of health of children is difficult to come by. Surprisingly, estimates of improvement in health attributable to medical care are almost nonexistent.

We simply do not know whether children who receive medical checkups and continuous medical attention are healthier than those who do not.

Despite the information difficulties, several conclusions emerged clearly from the study. Two of these conclusions resulted in new legislation being requested from Congress. First, it seemed clear that a program of early case findings and treatment of handicapping conditions would have considerable payoff. It was also clear that, looking

toward the future, if the large number of children who do not now have access to good medical care were to be provided with pediatric services, an acute shortage of doctors would be precipitated. Ways have to be found to use medical manpower more efficiently. So the second part of our recommendation was programs aimed at stretching the services of pediatricians.

H.R. 12080, the social security bill, includes provisions for both of these programs. I have copies of the disease control and child health studies here, and if you are interested, we can either submit them as an appendix to this testimony or provide them to the committee on another basis. (See p. 10 for child health study.)

Another study which is in process at the moment focuses on alternative ways of improving the education of disadvantaged children. Title I of the Elementary and Secondary Education Act provides substantial funds to improve the educational opportunities of children from low-income families. Head Start and other Federal programs also contribute to this end, but remarkably little is known about effective ways of reaching these children. The study which we have in progress is an attempt to see what can be learned about the relative effectiveness of spending money in different ways. Part of the study is focused on title I of the Elementary and Secondary Education Act. A team of analysts have been visiting 12 major cities over the last several months trying to find out exactly how their title I money was spent—what programs were mounted and what kinds of services were received by what kinds of children. The teams have also been looking at test scores, attendance, and dropout rates, and other evidences of impact of the compensatory education program. They have brought back a mass of interesting information and are now in the process of analyzing it to see whether improvements appear to have occurred and, more importantly, whether any pattern emerges which would indicate that specific types of programs are working well with children of specific ages.

In addition, we have looked at evidence relating to preschool programs and to compensatory education programs financed from sources other than title I.

This type of study is also difficult and must be undertaken with caution and humility. Test scores are often poor measures of what children know. Immediate changes in the behavior or achievement of severely deprived children should not be expected to result from moderate increases in school expenditures. There is a danger that very little if any improvement will be found and that the study will be used—perhaps erroneously—to justify cutting back promising and exciting programs whose real impact cannot be measured quantitatively or will not be apparent for many years.

We have made the judgment that these risks should be assumed, that the value for enhancing the effectiveness of very large and important Federal expenditures in education exceeds the risks associated with coming out with the sort of evidence that can be used against a continuation of the program.

Planning and the Budget Cycle

Finally, let me say some words about the planning and budgeting cycle, which very frankly, Mr. Chairman, we are very excited about

in HEW. We feel we have just made very important progress this year in bringing together budgeting and planning.

Budget decisions are always complex; specific decisions are a result of many compromises among competing considerations. It is difficult—and will remain difficult—to point to specific decisions and say "that one was different because of PPB."

What is changing profoundly in DHEW as a result of PPB is the way in which budget decisions are made. Two aspects of the change seem to me most important: (1) the bringing together of funding decisions on existing programs with decisions about requests for new legislation, and (2) the development of a 5-year plan which provides the context of which current budget decisions are taken.

Until this year, budgetary decisions in DHEW were made on the assumption that there would be no new legislation. Proposals for new programs were also considered, but by different people and no explicit attempt was made to compare the relative merits of increasing the funding for old programs with adding funds for new ones. In other words, there were two separate ball games going on—there was the legislative ball game and the budget ball game. Somehow, they never got onto the same field.

Moreover, until this year, long-range planning in the Department was sporadic and generally not departmentwide. No mechanisms existed for focusing attention on longer range objectives, deciding which types of programs should be given highest priority over the next several years and then drawing up a budget consistent with those objectives and priorities.

This year we are experimenting with a new procedure for making budget decisions in the context of a long-range plan. It is too soon to say whether or in what sense the experiment will be "successful," but I think all of the participants agree that so far it has been well worth the effort.

The procedure involves several steps. First, very early in the calendar year we drew up a list of significant issues which would have to be addressed in formulating a fiscal year 1969 budget and legislative program. We discussed this list of issues within the office of the Secretary, with the operating agencies, and with the Bureau of the Budget. We decided which of these issues seemed likely to be illuminated by analytical work, and initiated studies of many of them.

The second step was the development of a set of tentative departmental objectives for 1973. We began by asking the operating agencies to formulate their objectives for 1973 in program terms. We gave each agency two ceilings for 1973—a "low" which implied continued budget stringency and a "high" which implied somewhat greater availability of funds. We asked each of them to answer the question: How would you allocate these sums in 1973 among existing programs or new programs which could be developed between now and then?

The agencies took this assignment seriously, despite the difficulties of forcing busy administrators to take the time away from daily crises to think 5 years into the future. The 1973 objectives which the agencies sent back to the Secretary obviously reflected considerable thought and effort on the part of agency heads and their bureau chiefs.

The agency 1973 objectives were reviewed and revised somewhat by the Secretary and his staff and a tentative set of departmental objectives for 1973 was formulated. These departmental objectives,

reflecting the Secretary's judgment about priorities for 1973, were then transmitted back to the operating agencies to serve as guidance for formulating their fiscal year 1969 budget submissions and fiscal years 1969–73 suggested program and financial plan. We are now in the process of reviewing those submissions.

I have described this process in some detail because I think the process itself is more significant than the product. The Department's tentative 5-year plan has no status or significance in any sense. It is a planning document. It will be continuously revised, changed, and updated. Certainly no one expects it to be followed.

What is significant is that a real effort was made to look ahead, to see where the Department ought to be going and then to see what steps could be taken in fiscal year 1969 to bring us closer to these future objectives. This is quite a change from the usual process of building next year's budget by adding incremental percentages to last year's budget. I believe it is a change which presages more rational budgetmaking in years to come.

(The following supplementary material was submitted by Mr. Gorham for the record:)

Maternal and Child Health Care Programs—October 1966*

Program Analysis

Foreword

Our nation is committed to the goal that all our children should have the health care they need to participate fully in the nation's work and its rewards.

To assist him in making decisions among proposed child health care programs, Secretary Gardner established in May 1966 a Program Analysis Group on Child Health Care, with responsibility for defining explicit objectives for the health of children, examining the effectiveness of current programs in meeting these objectives, and estimating the costs of meeting these objectives through new or expanded programs.

This report, prepared by Joseph S. Wholey, of my staff, and the Programs Analysis Group Chairman, Dr. George A. Silver, Deputy Assistant Secretary for Health and Scientific Affairs, grew out of discussions, suggestions, and comments by members of the Program Analysis Group, and was the basis for Secretary Gardner's recommendations to the President for maternal and child health care programs for fiscal year 1968.

William Gorham,
Assistant Secretary for Program Coordination.

Acknowledgments

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Any flaws in the report are ours.

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I. Introduction

This report proposes specific objectives and reviews national needs in child health, describes major ongoing maternal and child health care programs, and estimates the costs and effects of maternal and child health programs designed to meet the proposed objectives. The report was prepared to assist the Secretary of Health, Education, and Welfare in establishing priorities among proposed maternal and child health care programs for fiscal year 1968.

Primarily addressed to the costs and effects of medical care, the report does not discuss important related questions of the effects on child health of changes in income level, environmental health programs, improved nutrition, communicable disease control, or accident prevention programs; nor does it go into the problems of the unequal geographical distribution of physicians, the need for strengthening obstetric and pediatric departments, or the status of State laws governing medical and nursing practice.

This report is mainly concerned with the question of needs for health care among children in low-income families. In 1965, there were approximately 14.8 million children under 18 living in poverty, poor children making up 21% of the child population and 43% of the population in poverty (according to the definition of the Office of Economic Opportunity: roughly $3,000 or less income per year for a family of four). For simplicity, in this analysis the number of children living in poverty is assumed to be roughly constant over the next several years. Only a small (4%) increase in the total child population is expected by 1972.

This analysis is organized as follows: Chapter II proposes specific objectives for the health of children living in poverty: reduction of infant mortality, prevention, correction, or amelioration of chronic handicapping conditions, and reduction of unmet dental needs. The Appendix discusses major ongoing child health care programs, program costs, numbers of children reached, and inadequacies in the present programs.

Chapter III, the heart of the analysis, examines estimated total costs, manpower requirements, and effects of fourteen child health care programs, grouped under seven major headings: (1) comprehensive maternal and child health care programs, (2) programs to provide early case-finding and treatment of congenital and other chronic disorders, (3) a program to provide early case-finding and treatment of vision and hearing defects, (4) programs to reduce unmet dental needs, (5) intensive care units for high-risk premature and other infants, (6) a program to provide treatment for Selective Service medical rejectees, and (7) a program of support for expanded family planning services.

Chapter IV compares the costs, manpower requirements, and estimated effects of these programs in a low-income urban or rural community of 50,000 people, then compares the cost-effectiveness of these programs in accomplishing each of the child health objectives. Conclusions appear in Chapter V.

II. Proposed Objectives and National Needs in Child Health

This chapter introduces the notion of a "health-depressed" area, proposes objectives, and reviews national needs in child health. Although all of the objectives relate to the health of the general child population, priority in accomplishing the objectives would be given to children in the most disadvantaged areas, characterized below as "health-depressed" areas.

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A. "HEALTH-DEPRESSED" AREAS

Infant mortality has long been used as the best single indicator of the health status of a community. Generally speaking, infant mortality rates are highest in areas characterized by low incomes and poor housing. "Health-depressed" areas could probably be best defined in terms of the variables *infant mortality rate, proportion of families who are in poverty,* and *proportion of housing that is substandard.* For simplicity, we here define a *health-depressed* area as an area within which the infant mortality rate is high. In urban areas, health-depressed areas could be specified as census tracts or combinations of contiguous census tracts; in rural areas, health-depressed areas would be counties with high infant mortality rates.

B. PROPOSED OBJECTIVES

This section proposes one general and three specific maternal and child health objectives. Costs of meeting these objectives are discussed in the following chapters.

1. Make needed maternal and child health services available and accessible to all, in particular, to all expectant mothers and children in health-depressed areas.

There is no universal index of good or bad health among children. Therefore, in looking at the problem of assuring needed health care, we necessarily primarily concern ourselves with some particular health problems which are highly prevalent, which are highly adverse, and which can be mitigated or even avoided given proper health care. Three such health problems are mortality (infant mortality, in particular), chronic handicapping conditions, and bad teeth. Health care directed toward these problems would also yield important benefits to the general health of the mothers and their children.

Progress toward the above major objective can therefore be measured, to some extent, by progress toward accomplishment of the following subordinate objectives:

2. Reduce numbers of chronic handicapping conditions, in particular reduce the incidence of preventable handicapping conditions and the prevalence of uncorrected handicapping conditions: in particular, congenital defects; mental retardation; vision, hearing and speech defects; and mental and emotional disorders.
3. Reduce infant mortality rates, particularly in "health-depressed" areas.
4. Reduce unmet dental needs, particularly in "health-depressed" areas.

C. NATIONAL CHILD HEALTH NEEDS

The Appendix describes major ongoing child health care programs; Federal, State, and local costs of those programs for fiscal years 1965, 1966, and 1967 (as available); and numbers of children reached. Taken together, present programs fall short of providing adequate health care for all mothers and children living in poverty; the majority of low-income mothers fail to receive adequate maternity care; most children of low-income families go without adequate preventive or remedial health care (even after handicapping conditions have been identified in screening programs). While we estimate that at least 800,000 mothers living in poverty require comprehensive prenatal services, only about a third of a million receive care in maternity clinics under our Maternal and Child Health programs today. While some four to five million children under five years of age are in the poverty group requiring care, only about one million and a half are under care in the Maternal and Child Health Program well-child conferences.

1. Mortality

In the United States, the infant mortality rate dropped from 69 deaths per 1,000 live births in 1925–1929, to 47 deaths per 1,000 in 1940 and 26.4 per 1,000 in 1955. This improvement was due chiefly to a reduction in mortality from infectious diseases. In the past decade, there has been little change in infant mortality in this country.

Meanwhile, infant mortality rates in other countries have continued to decline: in 1964, the United States had an infant mortality rate of 24.8 (almost 100,000 infant deaths among slightly over 4 million live births); Sweden ranked first, with an infant mortality rate of 14.2.[1] Assuming the same U.S. birth rate, if the Swedish

[1] Although there have been slight differences noted in the divisions among *stillbirths* and *infant deaths* in the United States and in other countries, these differences would account for only a difference of approximately one death per 1,000 live births.

infant mortality rate had applied in the United States, 42,600 fewer infants would have died in the United States; if the British rate of 20.6 had applied, 16,800 fewer infants would have died.

The existence of wide disparities among infant mortality rates within the United States is another indicator that a great many infants are dying needlessly. In 1964, State rates ranged from 19.8 in Massachusetts to 39.4 in Mississippi; in the nation as a whole, the rate was 21.6 for white infants and 41.1 for non-white infants (see Table 2.1). Rates for the nation's 3130 counties vary even more greatly,[1] and rates within counties vary even further. Rates for white and for non-white infants born in the largest cities are generally similar to those for the country as a whole.

TABLE 2.1—INFANT MORTALITY IN THE UNITED STATES, 1964

	Number of deaths	Rate per 1,000 live births
Infant (under 1 year):	99,783	24.8
White	72,728	21.6
Nonwhite	27,055	41.1
Neonatal (under 28 days):	72,026	17.9
White	54,593	16.2
Nonwhite	17,433	26.5
Postneonatal (1 to 11 months):	27,757	6.9
White	18,135	5.4
Nonwhite	9,622	14.6

Higher infant mortality, as well as higher prematurity rates and higher incidence of mental retardation, results from lack of adequate maternity care. Less than 50% of low-income women receive care in maternity clinics (see Appendix, Table A–2). In most of the major cities, in fact, one-third to one-half of the women delivered at city hospitals have had *no* prenatal care. In some counties there are large numbers of "excess" infant deaths, i.e., deaths that would not have occurred if an infant mortality rate of 18.3 per 1,000 (the 10th percentile county rate) had prevailed instead of the actual rate. One-fourth of the excess deaths (and one-fifth of the births) occurred in only 21 of the nation's 3,130 counties, containing the following major cities:

TABLE 2.4—COUNTIES WITH AT LEAST 800 EXCESS INFANT DEATHS, 1956–60

Major city	County	County infant mortality rate
Atlanta	Fulton	31.6
Baltimore		33.8
Birmingham	Jefferson	30.1
Chicago	Cook	26.2
Cleveland	Cuyahoga	27.3
Dallas	Dallas	26.3
Detroit	Wayne	26.5
Houston	Harris	28.2
Indianapolis	Marion	27.4
Los Angeles	Los Angeles	24.6
Memphis	Shelby	30.7
Miami	Dade	29.3
Milwaukee	Milwaukee	24.5
Newark	Essex	29.9
New Orleans	New Orleans	33.9
New York		26.0
Philadelphia		32.0
Pittsburgh	Allegheny	23.5
San Antonio	Bexar	31.7
St. Louis		30.3
Washington, D.C		36.1

The data on deaths of children over age 1 also reveal large disparities between the white and the non-white population and among the States, but the numbers of deaths are much smaller.

[1] A list of tables appears following the table of contents. Maps indicating mortality rates in counties of the Nation, numbered 2.2 and 2.3 in original printing of this exhibit, are not reproduced in this volume.

2. Chronic conditions.

Chronic conditions include orthopedic, cardiovascular, genito-urinary, neurological, mental and emotional, hearing, vision, speech, nutritional, and skin disorders, as well as allergies and non-acute respiratory conditions. Except for data from studies of congenital malformations, little hard data exist on the incidence and prevalence of chronic conditions in childhood.[1] Populations examined (and conditions counted) in the major studies are usually not comparable. Neither are definitive data available on the extent of disability caused by chronic illness. The following estimates are based on the major studies undertaken over the past decade.[2]

Between 20 and 40% of children suffer from one or more chronic conditions. Only 40% of these conditions are under treatment in low-income areas.[3] In 1963, 19% of those examined in school health programs were referred for further examination or treatment, but only 8% of those examined completed referral (see Appendix, Table A–2).

In 1964, Crippled Children's programs served one-half of one percent of the population under 21 (420,000 children) but the Children's Bureau estimated that more than twice as many needed help under that program.

Tables 2.5–2.7 give some estimates of the proportions of children with chronic handicapping conditions. In addition, based on a survey of the pertinent literature, Table 2.7 presents some rough estimates of the proportions of the major handicapping conditions in each diagnostic category that could be prevented or corrected by child health care: approximately 62% of these handicapping conditions could be prevented or corrected by comprehensive care up to age 18; approximately 33% of these conditions could be prevented or corrected by case-finding and treatment at appropriate ages in early childhood (see Chapter III for descriptions of comprehensive health care and of case-finding and treatment programs).

TABLE 2.5—APPROXIMATE PROPORTIONS OF CHILDREN WITH CHRONIC CONDITIONS, BOTH TREATED AND UNTREATED

[In percent]

Conditions	Ages			
	0	3	5 to 6	8 to 9
Congenital malformations [1]	7	6.6	6.6	6.6
Vision problems [2]	-------	3.0	8.0	11.0
Hearing problems [3]	-------	1.5	3.0	4.0
Psychiatric problems [4]	-------	----------	4.0	5.0
Other medical [5]	-------	25.0	25.0	15–20

[1] These figures assume no treatment to correct the congenital disorders. Approximately ⅓ of congenital malformations, however, are easily corrected, with no remaining handicap to the child. Assuming optimum treatment, by age 8 to 9, only 3.6 percent of children would still have congenital chronic conditions requiring care.

[2] Peters, H. B., School of Optometry, University of California, 1965; Mindlin, R. L., NYC school vision program study, 1962; MCH program statistics; National Society for the Prevention of Blindness; statistics from public health programs in Michigan, Jacksonville, Fla., Brookline, Mass., Baltimore, Oakland, and Chicago.

[3] Michigan State hearing conservation program, MCH program statistics; "Survey of School Health Services" in 83 school systems (unpublished), USPHS; Oakland, Baltimore, and Chicago school health programs.

[4] Mental health service program, NIMH; Winston-Salem school health program; "Services for Children with Emotional Disturbances," APHA, New York, 1961.

[5] Jacobziner, H., AJPH, 53: 1937, 1963.

[1] The National Center for Health Statistics, through its Health Examination Survey, is now obtaining data on the health of children aged 6–17, including dental conditions, vision, hearing, and psychological factors.

[2] U.S. National Health Survey, July 1959–June 1961. PHS Project /19, 1963, University of Pittsburgh Graduate School of Public Health. Yankauer, A., AJPH, 47: 1491, 1957. Eisner, V., Pediatrics, 38: 40, 1966. J. of School Health, 32: 283, 1962.

[3] Pittsburgh study; Yankauer; Jacobson, AJPH, 53: 1936, 1963.

TABLE 2.6—ESTIMATED NUMBERS AND PROPORTIONS OF CHILDREN WITH HANDICAPPING CONDITIONS, 1965

	Estimated number handicapped	Age group	Estimated proportion handicapped (percent)
Eye conditions needing specialist care	11,404,000	5–17	23.0
Emotionally disturbed	4,600,000	5–19	8.5
Speech disorders	2,829,000	5–20	5.0
Mentally retarded [1]	2,440,000	0–20	3.0
Orthopedic	2,153,000	0–20	2.8
Hearing impairments	2,130,000	0–20	2.8
Cerebral palsy [2]	406,000	0–20	.5
Epilepsy	400,000	0–20	.5

[1] Only 1/10 of these are more than mildly retarded (estimate by National Association of Retarded Children).
[2] It is estimated by the Children's Bureau that 60 to 70 percent of the children with cerebral palsy are mentally retarded.

Source: Children's Bureau, 1966 (percentages added).

It is estimated that approximately 23% of school children require eye care (mainly glasses) but that only approximately 17% wear glasses; hence, approximately 3 million more school children ought to have glasses. Amblyopia (blindness in one eye) now occurs in 2–3% of the population (estimates actually range from 0.5% to 8%), although almost all of it is preventable with proper treatment at about age 3.

TABLE 2.7—CHRONIC HANDICAPPING CONDITIONS IN 18-YEAR-OLDS, AND PROPORTIONS PREVENTABLE OR CORRECTABLE BY THERAPY

[In percent]

Diagnosis	Proportion of 18-year-olds chronically handicapped [1]	Proportion preventable or correctable through comprehensive health care [2]		Proportion preventable or correctable through case-finding and treatment at ages 0, 1, 3, 5, and 9 [2]
		Up to age 5	Up to age 15	
Orthopedic-musculoskeletal	2.38	15	45	25
Asthma	.81	40	75	20
Hernia	.66	27	81	45
Genito-urinary	.35	5	82	78
Rheumatic heart disease	.22	0	78	5
Congenital heart disease	.15	20	35	30
Epilepsy	.13	55	79	66
Diabetes	.11	8	64	5
Avitaminosis	.10	30	54	15
Dental	.09	28	72	(3)
Tuberculosis	.04	45	81	76
Subtotal for diagnoses shown	5.04	20	60	30
Total for all diagnoses (except vision, hearing, and failure to meet anthropometric standards) [4]	12.23	----------	----------	----------
Eye problems	.78	76	85	75
Ear and mastoid	.72	47	85	20
Hearing acuity	.69	27	50	25
Visual acuity	.56	27	29	20
Total for diagnoses shown	7.78	30	62	33
Total for all diagnoses (except failure to meet anthropometric standards) [4]	15.27	----------	----------	----------

[1] Preliminary data based on rejection rates in special selective service examinations of 18-year-old non-college-bound youth (July 1964–December 1965) under the conservation of manpower program. Source: Dr. Bernard Karpinos, Office of the Surgeon General, Department of the Army.
[2] Rough estimates of the effects of good health care, based on a survey of the medical literature on these leading handicapping conditions. Conditions corrected are conditions not handicapping in civilian life.
[3] Not available.
[4] Failure to meet anthropometric standards (underheight, underweight, excluding malnutrition, overheight, overweight) accounted for rejection of an additional 3.17 percent of these 18-year-olds.

3. Unmet dental needs

By age 5–6, almost all children (97%) require some dental care. By age 13, the average child has 11–12 decayed, missing, or filled teeth. Almost all children require some dental care each year, to clean and fill teeth and for necessary care for gums. The percentages presented in Table 2.8 therefore represent conservative estimates of the numbers of children not getting needed dental care: more than 60% of children in the South, more than 65% of children in low-income families, and more than 70% of nonwhite children are receiving inadequate (or no) dental care.

TABLE 2.8.—*Percent of children 5–14 with no visit to dentist within the year June 1963–June 1964*

	Percent
Total (all races)	45.1
White	40.4
Nonwhite	73.9
Total (all family incomes)	45.1
Under $2000 a year	78.7
$2000 to $3999	65.2
$4000 to $6999	47.8
$7000 to $9999	34.0
Over $10,000	20.1
Total (all regions)	45.1
Northeast	33.9
North Central	39.0
South	59.7
West	44.4

Source: National Health Survey.

III. COSTS AND EFFECTIVENESS OF MATERNAL AND CHILD HEALTH CARE PROGRAMS

The interrelationships among the effects of environment, education, and medical care make it very difficult to predict the improvements in health which would result from improvements in the delivery of health care. Results of health programs are usually not ascertainable for some years. This analysis estimates, however, that health care can significantly improve the health of children in health-depressed areas, reducing both mortality and chronic handicapping conditions.[1]

This chapter discusses the organization, estimated total costs, manpower requirements, and estimated effects of 14 possible child health care programs, grouped under seven major headings: (1) comprehensive maternal and child health care programs, (2) programs to provide early case-finding and treatment of congenital and other chronic disorders, (3) a program to provide early case-finding and treatment of vision and hearing defects, (4) programs to reduce unmet dental needs, (5) intensive care units for high-risk premature and other infants, (6) a program to provide treatment for Selective Service medical rejectees, and (7) a program of support for expanded family planning services. To allow meaningful comparison of program costs and effects, whenever possible, the projected impact of the programs is examined in a health-depressed urban or rural community of 50,000 persons, including 1,000 expectant mothers, 1,000 infants, 1,000 one-year olds, . . ., and 1,000 18-year-olds.

The next chapter compares the costs, manpower requirements, and estimated effects of these proposed programs on a health-depressed community of 50,000 persons and then compares the cost-effectiveness of the program in accomplishing each of the objectives outlined in Chapter II. All of the estimates of program effectiveness were made on the bases of imperfect knowledge (often only informed estimates) of the proportion of the population needing care, the proportion of the population not getting adequate care, and the effects of adequate care on

[1] *Health-depressed* areas have been defined as areas in which infant mortality is high (see Chapter II).

health (in particular, the effects on infant mortality and on handicapping conditions).

1. Comprehensive Maternal and Child Health Care Programs

This section examines the costs, manpower requirements, and anticipated benefits of experimental comprehensive maternal and child health centers. These centers would have an aim different from that of existing Children's Bureau and Office of Economic Opportunity projects: these centers would have as their primary purpose the exploration and demonstration of new and more efficient ways of delivering comprehensive health services to mothers and children.

Given the prospect of continued shortages of physicians, comprehensive child health care will not be feasible on a wide scale unless far more efficient use of physicians is achieved. Most promising of the ways to improve physician productivity is the use of new categories of health personnel, in particular, pediatric assistants and obstetric assistants.

(a) Program Description

This section discusses the organization of a comprehensive maternal and child health center serving (say) the 1,000 expectant mothers and 18,000 children under age 18 in a health-depressed community of 50,000 people. (As an alternative, a center serving 1,000 mothers-to-be and 5,000 children under age 5 is also discussed.) Such centers, in providing health care, would be the vehicles for experimentation and demonstration of the effectiveness of new health teams in providing needed health care, in particular, for experimentation with the use of varying numbers and types of physician assistants and neighborhood health aides in serving a health-depressed community. It is anticipated that most of the physician assistants and health aides would be drawn from the community to be served.[1]

In these maternal and child health centers, under supervision, obstetric assistants would provide almost all of the maternity care for the (say) 75% of women with uncomplicated pregnancies, pediatric assistants would provide much of the routine child health services traditionally provided by physicians (including well-child care and care of minor illnesses),[2] dental auxiliaries would clean and fill (but not drill) teeth,[3] and indigenous health aides, public health nurses, and social workers would "reach out" into the community, to attract and serve the 40–60% of mothers and children not served (or not served adequately) by present programs. Mental health services would be included as part of the comprehensive health care package.

The centers would be financed totally or in part by project grants renewable for at least five years and would be operated under the auspices of medical schools or groups of physicians, or possibly by community hospitals, local health departments, or civic organizations. The centers would serve all expectant mothers and all children up to a specified age in the community, taking full advantage of funds and services available from third party payers, Crippled Children's programs, public health funds, and Title XIX. To the extent that the physicians were not adequately compensated for their services from these sources, the project would pay them. If the State in which an experimental project is located has a Title XIX program, payments under that program would provide an important source of support for the centers.[4]

Full outpatient and inpatient preventive, curative, and rehabilitative services would be available to mothers and children. Family planning, an important element in the prevention of unwanted pregnancies, prematurity, and infant mortality in multiparous mothers, would be an integral part of maternal service, with counseling offered at postnatal visits. Individual and group counseling would cover nutritional problems, infant care, and health education. Dental care, psychological and social services, prescription drugs, and vitamin and protein supplements would be available to mothers and children.

Where necessary, arrangements would be made with regional institutions with professional competencies to provide back-up referral and consultative services for patients who present unusual diagnostic or highly specialized problems and to provide consultation and technical assistance in program planning and in appropriate utilization of existing and new categories of health personnel.

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[1] Estimates by N. J. Eastman, Johns Hopkins University Hospital, and H. Jacobson, University of California Hospital.

[2] Cf. R. W. Deisher, in Pediatrics, 25:711 (1960). Pediatric assistants could for example take histories (using check lists), give shots, screen for vision and hearing problems, give advice on well-baby care, make home visits, and provide care for minor illnesses.

[3] Dentists can perform 3,000 services yearly and triple that with addition of four trained auxiliaries (estimates by V. Diefenbach, Chief, Division of Dental Health, U.S. Public Health Service).

[4] Title XIX might meet (say) 40% of the cost of the maternal and child health centers. Firm estimates can be made only after adoption and implementation of Title XIX plans in the majority of States.

In accordance with evaluation guidelines drawn up by the Department, the project would provide for regular review and evaluation of the quality of services offered, the utilization of services and personnel, and the effectiveness of the program in meeting the needs of the population served. In particular, the project would provide for evaluation of the effectiveness of new types of health personnel and the impact of the program on the health status of the group served.

(*b*) *Costs and Manpower Requirements*

It is expected that the size of maternal and child health care centers would vary. To illustrate the impact of new types of health personnel on the need for obstetricians, pediatricians, and dentists, we have contrasted the personnel needs of two alternative programs with and without the utilization of these new professional assistants:

1.1 Comprehensive care for 1,000 mothers and 18,000 children under 18, with maximum use of new categories of health personnel (obsetric assistants, pediatric assistants, and dental auxiliaries),

1.2 Comprehensive care for 1,000 mothers and 18,000 children under 18, using only traditional health personnel,

1.3 Comprehensive health care for 1,000 mothers and 5,000 children under 5, with maximum use of new categories of health personnel (as in 1.1), and

1.4 Comprehensive care for 1,000 mothers and 5,000 children under 5, using only traditional health personnel.

The cost estimates and manpower requirements presented in Tables 3.1 and 3.2 have been prepared on the bases of information on existing Children's Bureau comprehensive health care projects and the judgments of leading professionals within and outside DHEW. If funds were available under Title XIX or from third party payers, the program costs would be reduced accordingly.

Comprehensive maternity care would cost approximately $560 per mother, including prenatal care, an average of four days hospital care at $50 per day, postnatal care, and full evaluation and treatment of any medical or emotional problems. Comprehensive child health care would cost $130–$140 per year per child, including dental and psychological services. (Costs for preschool children would be higher: approximately $250 per infant, including routing newborn services, and approximately $160 per child aged 1–5.) These costs are higher than in most current programs because they include costs for any necessary hospitalization ($25–$30 per child per year) and substantial costs for reaching out into the community through social workers, public health nurses, health aides, and homemakers ($20–$25 per child per year).[1]

(*c*) *Note on Training Costs*

None of the cost estimates above included training costs. Such costs are considered here.

Medical schools and others administering maternal and child health centers would be expected to provide for the recruitment and one to two years of specialized training for the new types of personnel to be used in providing improved care: obstetric assistants, pediatric assistants, and dental auxiliaries. Obstetric and pediatric assistants would receive their training under medical school auspices, most probably after two to four years of college; dental auxiliaries would require less academic preparation.

Operation of 10 centers would require training of 60 obstetric assistants, 90 pediatric assistants, and 200 dental auxiliaries or (allowing for 25% attrition) 80 obstetric assistants, 120 pediatric assistants, and 270 dental auxiliaries. Costs of training such assistants would be roughly $5,000–$6,000 per assistant trained.[2] Total training costs for the 350–470 assistants for ten centers would be $1.75–$2.8 million.

Short-term courses in public health administration and management would also be valuable for the professional personnel who will staff the centers.

(*d*) *Effects of Comprehensive Health Care on Infant Mortality and Mental Retardation*

Comprehensive maternity care from a time early in pregnancy may be expected to reduce prematurity rates by at least 20% in the maternity patients served

[1] For comparison, per capita costs for the second year of operation of three representative neighborhood health centers supported by the Office of Economic Opportunity are $100, $119, and $135. Services included vary a good deal: the first and second figures exclude hospitalization; the first and third exclude dental care.

[2] The average per student cost of training for the standard eight months course in professional midwifery is approximately $5,500. The Division of Dental Health, U.S. Public Health Service, estimates costs of training dental auxiliaries as approximately $3,300 per year, exclusive of construction costs.

TABLE 3.1—ESTIMATED PERSONNEL REQUIREMENTS FOR COMPREHENSIVE HEALTH CARE PROGRAMS

Program	Numbers served		Obstetric		Pediatric		Dental		Psychiatric						
	Mothers	Children	M.D.	Assistant	M.D.	Assistant	D.D.S.	Auxiliary	M.D.	Psychologist	Social worker and R.N.	R.N.	Social worker	Clerical	Aide [1]
1.1 Comprehensive health care to age 18, using new types of health personnel	1,000	18,000	3	6	[2] 8.7	9	4	20	2	2	3	18	11	30	26
1.2 As above, using only traditional health personnel	1,000	18,000	5	0	17.5	0	11	11	2	2	3	18	11	30	26
1.3 Comprehensive health care to age 5, using new types of health personnel	1,000	5,000	3	6	[2] 3.8	4	1	3	0	0	0	9	4	14	14
1.4 As above, using only traditional health personnel	1,000	5,000	5	0	7.6	0	2	2	0	0	0	9	4	14	14

[1] Nurses aides, health aides, homemakers (largely hired from the community to be served).
[2] It is estimated that, with the use of 1 or more pediatric assistants, each pediatrician could care for perhaps 2 to 5 times the number of children he would care for today. In the absence of much experience, the most conservative estimate is used here.

TABLE 3.2—ESTIMATED COSTS FOR COMPREHENSIVE HEALTH-CARE PROGRAMS

Program	Numbers served	Estimated yearly costs [1]	
		Total	Per person served
1.1 Comprehensive health care to age 18, using new types of health personnel	[2] 1,000	$561,000	$561
	[3] 18,000	2,335,000	130
Total	19,000	2,896,000	
1.2 As in 1.1, using only traditional health personnel	[2] 1,000	561,000	561
	[3] 18,000	2,493,000	139
Total	19,000	3,054,000	
1.3 Comprehensive health care to age 5, using new types of health personnel	[2] 1,000	561,000	561
	[3] 5,000	868,000	174
Total	6,000	1,429,000	
1.4 As in 1.3, using only traditional health personnel	[2] 1,000	561,000	561
	[3] 5,000	907,000	181
Total	6,000	1,468,000	

[1] These costs are higher than in most current programs because they include costs for any necessary hospitalization ($25 to $30 per child per year) and substantial costs for reaching out into the community through social workers, public health nurses, health aides, and homemakers ($20 to $25 per child per year).
[2] Mothers.
[3] Children.

(e.g., reducing low birth weight infants from 14% to 11% of the total). As a result, a reduction of at least 4/1,000 would be expected in numbers of neonatal deaths (deaths within 28 days after birth) and a reduction of at least 1/1,000 would be expected in numbers of infants born mentally retarded.[1] On the other hand, if prematurity rates can be reduced to 6–8%, one would expect reductions of approximately 9/1,000 in neonatal deaths and approximately 2/1,000 in numbers born mentally retarded.[2]

In addition, comprehensive health care in postneonatal period (ages 1–11 months) might be expected to reduce infant mortality rates by another 8.5/1,000 in health-depressed areas.

TABLE 3.3—ESTIMATED EFFECTIVENESS OF COMPREHENSIVE MATERNITY AND INFANT CARE IN HEALTH-DEPRESSED AREAS

Program	Births	Maternal deaths	Premature infants	Infant deaths	Mentally retarded (at age 1)
0. Baseline (no new program)	1,000	[1] 0.9	[1] 139	[1] 41	[2] 20.6
1.1 or 1.2 Comprehensive health care (mothers, and children up to age 18)	[3] 1,000	[4] 0.45	[5] 70–111	[6] 24–29	[6] 18.8–19.8
1.3 or 1.4 Comprehensive health care (mothers, and children up to age 5)	[3] 1,000	[4] 0.45	[5] 70–111	[6] 24–29	[6] 18.8–19.8

[1] Negro rates have been used as conservative estimates of death rates in "health-depressed" areas.
[2] See "Note on Methodology."
[3] Effects of family planning program are ignored here.
[4] Estimates of proporition of maternal deaths that are preventable range from 31 to 81 percent. The national average is 0.33 maternal deaths per 1,000 live births.
[5] Estimated reductions are based on assumed reductions in prematurity rates of 20 to 55 percent among the maternity patients served.
[6] These estimates are based on reduced neonatal mortality resulting from an assumed 20- to 50- percent reduction in prematurity rate and on an assumed reduction in postneonatal mortality resulting from comprehensive infant care (see "Note on Methodology").

(e) *Note on Methodology*

Neonatal Mortality.—Calculations of lowered neonatal mortality rates (deaths in the first 28 days) are based on the assumption that the neonatal mortality rate is 151/1,000 for low birth weight infants and 7/1,000 for normal weight infants. These are consistent with both white and non-white overal neonatal mortality rates for 1964. Neonatal mortality rates for 1950 (best data available) were 175.8

[1] See "Note on Methodology," page 14.
[2] S. H. Clifford has estimated that if present knowledge and methods are applied to identification and management of high-risk pregnancies, premature births *in this group* can be reduced to 6–8%. (New England Journal of Medicine, July 1964, pp. 243–249).

and 164.7 for low birth weight white and non-white infants, respectively, and 7.1 and 11.9 for normal birth weight whites and non-whites.

Postneonatal Mortality.—Calculations of lowered postneonatal mortality rates (deaths at ages 1–11 months) are based on the unproven but reasonable assumption that, with comprehensive child health care, the postneonatal mortality rate can be reduced from an assumed rate of 14.6/1,000 (the Negro rate) to 6.1/1,000. (The latter rate was obtained by combining the Negro rate for postneonatal accidental deaths, 1.3/1,000, with the white rate for all other postneonatal deaths.) Here, as elsewhere, Negro rates have been used as conservative estimates of rates for "health-depressed" areas.

Mental Retardation.—Calculations of lowered rates of mental retardation are based on the estimate that the rate of mental retardation is 4.3% for low birth weight infants and 1.7% for normal birth weight infants. These unpublished rates are from an on-going collaborative study of the Perinatal Research Branch, National Institute of Neurological Diseases and Blindness.

(f) *Effects of Family Planning*

As was mentioned above, family planning would be an integral part of the services offered in the maternal and child health programs under consideration here. The costs and predicted effects of family planning services are discussed in Section 7 below.

(g) *Effects of Comprehensive Health Care on Chronic Handicapping Conditions*

Table 2.7 presented rates of prevalence of chronic handicapping conditions severe enough to cause Selective Service rejections of 18-year-old non-college-bound youth, together with rough estimates of the proportions of those conditions that could be prevented or corrected by comprehensive health care up to age 5 or to age 15. Approximately 15% of these 18-year-olds had chronic handicapping conditions severe enough for rejection.

Based on a survey of the medical literature on the leading handicapping conditions, it was estimated in Table 2.7 that approximately 20 to 30% of chronic handicapping conditions could be prevented or corrected (for civilian life) by comprehensive care up to age 5 and that approximately 60% of such conditions could be prevented or corrected by such care up to age 15.

Table 3.4 presents the estimated effects of comprehensive child health care up to age 18 (programs 1.1 and 1.2): uncorrected vision problems would be reduced by more than 80% below their assumed prevalence under present conditions, uncorrected hearing problems by more than 50%, other chronic hnadicapping conditions by more than 50%, and unmet dental needs by 100%. Amblyopia (blindness in one eye) would be prevented in 17 out of every 1,000 18-year-olds; binaural hearing loss (partial or total deafness) in two out of every 1,000 18-year-olds.

TABLE 3.4—ESTIMATED EFFECTS OF COMPREHENSIVE CHILD HEALTH CARE ON EACH 1,000 18-YEAR-OLDS IN A HEALTH-DEPRESSED COMMUNITY

Program	Prevalence of chronic handicapping conditions among 18-year-olds					Unmet dental needs [1]
	Uncorrected vision problems		Hearing loss		Other physical handicaps	
	All	Amblyopia	All	Binaural		
0 Baseline (no new program)	[2] 120	20	40	4.6	[3] 107	650
1.1 or 1.2 Comprehensive health care (up to age 18)	[4] 20	3	15	2.5	[5] 49	0
1.3 or 1.4 Comprehensive health care (up to age 5)	[6] 92	3	30	3.9	[7] 98	650

[1] Number of 18-year-olds with decayed and unfilled teeth.

[2] Assumes that 20 percent of the 18-year-olds have vision problems and that 60 percent of vision and hearing problems go untreated in health-depressed areas, in the absence of new programs.

[3] Estimates are based on 12.2 percent rejection rates for medical reasons (excluding vision and hearing problems), in special Selective Service examinations of 18-year-old non-college-bound youth. (See table 2.7.) These totals are based on the assumption that only 40 percent of chronic conditions are now treated in health-depressed areas and that this treatment corrects 30 percent of conditions treated.

[4] Assumes that 20 percent of children up to age 18 receive treatment and that treatment prevents or corrects the vision problem in 90 percent of these cases.

[5] Assumes that program prevents or corrects 60 percent of handicapping conditions. (See table 2.7.)

[6] Assumes that (a) 8 percent of children up to age 5 receive treatment and that treatment prevents or corrects the vision problem in 75 percent of these cases, and (b) 40 percent of the remaining children receive (successful) treatment after age 5.

[7] Assumes that program prevents or corrects 30 percent of handicapping conditions. (See table 2.7.)

2. Programs to provide early case-finding and treatment of congenital and other chronic disorders in children

This section discusses a much lower-cost program, which examines children in health-depressed areas at specified ages and provides all required medical treatment, in particular, treatment for congenital and other chronic disorders. Such a program could be organized as an extension of the present Crippled Children's program. Funds for such a program could also come through the Title XIX "Medicaid" program for the medically indigent.

(a) Program Descriptions

These proposals provide for early detection, treatment and follow-up of congenital and other chronic disorders in children in health-depressed areas. With the dramatic successes in combating infectious diseases in the past 30 years, congenital disorders and visual, auditory, psychological, and other chronic conditions have become the major causes of childhood morbidity.

These case-finding and treatment programs would encompass comprehensive medical evaluation of children at certain specified ages and, as indicated, follow-up, further diagnostic investigation, and definitive treatment. Sufficient funds would be available to pay for treatment of all children in whom abnormalities were detected. Three alternatives, differing in the groups of children to be covered, have been proposed. The first program (Alternative 2.1) would provide screening, follow-up, and treatment of newborn infants in health-depressed areas. Since many newborns do not currently receive a thorough pediatric evaluation, diagnosis and treatment of congenital and other disorders are delayed, occasionally until a life-threatening situation exists. Newborns could be examined prior to hospital discharge, preferably at age 3–5 days.

The second program (Alternative 2.2, the major alternative) would be a case-finding and treatment program for children in health-depressed areas at specified ages; for example, 4 days, 1 year, 3 years, 5 or 6 years, and 9 years. (Screening every year would add considerably to the costs without changing the benefits appreciably.)

This program would require organization of State and local programs to assure that all children in health-depressed areas are screened at specified ages and that (acute and) chronic handicapping conditions discovered are actually treated. Screening of the newborn would be performed, as in Alternative 2.1, before the infant was discharged from the hospital. High participation in the 1 and 3 year old groups would be difficult but might be attained through cooperation of the local health department, well-baby clinics, local physicians, Head Start programs, day care centers, and community action programs. Screening at school age would be organized through the local school system, the main point of this new program being that follow-up and treatment would be provided for all medical defects discovered in the children screened.

In accordance with evaluation guidelines drawn up by the Department, techniques would be built in for regular review, evaluation, and adaptation of services with a view to maintaining high quality services and meeting the program's objectives.

Appropriate local public and voluntary health and welfare agencies, school health programs, and professional and community organizations would be involved from the planning phase on. Any existing child health care programs and services (in particular, Crippled Children's services) within the community would be involved to avoid duplication of efforts and to aid in securing care and services for children needing such. Title XIX could be amended to require that diagnostic examinations at specified ages and treatment of chronic and potentially handicapping conditions discovered must be included in any State Medical Assistance Plan.

The third program (Alternative 2.3) would screen and provide follow-up and treatment for all (and only) premature newborns, not only those in health-depressed areas. This group was singled out because of the 45% greater incidence of congenital malformations as well as an increased incidence of other disorders in low-birth-weight infants as compared with those of normal birth weight. In this alternative, treatment for handicapping conditions would be financed only for the medically indigent. Screening and diagnostic work, but not treatment, would be covered for infants from higher-income families.

(b) Costs

Cost estimates and manpower requirements for these screening and treatment programs are presented in Tables 3.5 and 3.6. In comparison with comprehensive

health care, early case-finding and treatment (Program 2.2) is relatively inexpensive, costing approximately $30 per child screened.

TABLE. 3.5—ESTIMATED COSTS FOR EARLY CASEFINDING AND TREATMENT OF CONGENITAL AND OTHER CHRONIC DISORDERS

Program	Number of children served	Estimated yearly costs	
		Total	Per person screened
2.1 All newborn infants in health-depressed areas	1,000,000	$29,700,000	$30
2.2 Children in health-depressed areas, aged 0, 1, 3, 5, and 9 [1]	[2] 5,000,000	[3] 149,700,000	[3] 30
2.3 All premature infants:			
Medically indigent	80,000	3,154,000	39
Other premature infants	24,000	[4] 2,175,100	[4] 9

[1] All 800,000 to 1,000,000 children in each age group would be screened each year; treatment would continue as long as necessary.

[2] Estimated numbers treated each year:

Vision	110,000
Hearing	20,000
Congenital malformations (another 204,000 would already be under treatment)	75,000
Other medical	306,000
Psychiatric	70,000
Total	581,000

[3] During the 1st 4 years, costs would be approximately 10 percent higher.

[4] Followup and treatment would be at private expense.

TABLE 3.6—ESTIMATED PERSONNEL REQUIREMENTS FOR CASE-FINDING AND TREATMENT

Program	Number of children served	M.D.'s required
2.1 All newborn infants in health-depressed areas	1,000,000	270
2.2 Children in health-depressed areas, aged 0, 1, 3, 5, and 9	5,000,000	[1] 1,900
2.3 All premature infants	320,000	86

[1] 700 pediatrician-years for case finding, 1,200 specialist-years for treatment of health problems discovered.

(c) *Effects of Early Case-Finding and Treatment on Chronic Handicapping Conditions*

Table 2.7 presented rates of prevalence of chronic handicapping conditions severe enough to cause Selective Service rejection in 18-year-old non-college-bound youth. Approximately 15% had chronic handicapping conditions severe enough for rejection. It was estimated in Table 2.7 that approximately 30% of chronic handicapping conditions could be prevented or corrected (for civilian life) by the major case-finding and treatment program under consideration here, Alternative 2.2. Section 3, below ("Program to Provide Early Case-Finding and Assured Treatment of Vision and Hearing Defects"), discusses the anticipated effects of the vision and hearing components of this program.

Tables 3.7 and 4.4 summarize the estimated effects of early case-finding and treatment programs: Under the major alternative 2.2, uncorrected vision problems would be reduced by 40% below their assumed prevalence under present conditions, uncorrected hearing problems by 40%, and other chronic handicapping conditions by 20%. Amblyopia would be prevented in 17 out of every 1,000 18-year-olds; binaural hearing loss in 1 out of every 1,000 18-year-olds.

3. Program to provide early case-finding and treatment of vision and hearing defects

This section examines the estimated costs and effects of a subprogram of program 2.2: early case-finding and treatment of vision and hearing defects.

Currently, approximately one-half of the 6 and 9-year-olds receive vision screening through school health programs, and hearing screening is received by one-half of the 6-year-olds and one-third of the 9-year-olds. Most of these programs do not have effective referral mechanisms, nor are funds available for paying for treatment. At the present time, 3-year-olds are virtually unreached. Undiscovered and untreated defects affecting communication skills can significantly retard the learning of the pupils so handicapped. Almost 10% of preschoolers have vision problems (most of them preventable or correctable); approximately 3% have hearing problems, half of them correctable or preventable.

TABLE 3.7—ESTIMATED EFFECTS OF CASE-FINDING AND TREATMENT PROGRAMS ON 1,000 CHILDREN AT AGES 1, 3, AND 18

Program	Untreated congenital malformations		Chronic handicapping conditions at age 18
	Age 1	Age 3	
0.0 Baseline (no new program)	45–75	24–75	[1] 107
2.1 Screening and treatment of all newborn infants	37	37	(?)
2.2 Screening and treatment at ages 0, 1, 3, 5 or 6, and 9	11	0	[2] 85
2.3 Screening and treatment of all premature infants	[3] 54	[3] 54	(?)

[1] Assumes that 12.2 percent (see table 2.7) have handicapping conditions (exclusive of vision and hearing problems) only 40 percent of which have received proper treatment. Further assumes that proper treatment corrects 30 percent of conditions treated.
[2] Assumes that program prevents or corrects 30 percent of handicapping conditions (see table 2.7).
[3] Assumes 108 congenital malformations/1,000 premature infants (incidence 45 percent above national average).

(*a*) *Program Description*

Under this proposal, State and local programs of vision and hearing screening would be developed or expanded to include referral and correction of defects, in order that as many vision and hearing defects as possible be detected and treated at ages 3, 5 or 6, and 9. For school age children, the screening and follow-up would be part of the school health program. At age 3, children could be reached in nursery schools, day care centers, Headstart projects, health department clinics, or other clinics set up for screening. Procedures would be developed for referring children with abnormal findings to appropriate health care resources for further diagnostic evaluation, definitive treatment, and rehabilitation. While the focal point of this program locally most probably would be in the school health program, it would be imperative, because of the new program emphasis on evaluation and treatment of all children in whom problems are identified, that appropriate public and voluntary community health and welfare agencies, professional groups and parental organizations be involved from the planning phase on. Any existing child health care programs and services should be involved to avoid duplication of efforts and to aid in funneling problems to the appropriate source of care.

Plans for evaluation of the program should be evident and include not only operational statistics but determination of the effectiveness of various screening techniques in uncovering hearing and vision problems and determination of the extent to which such problems are remedial and future seriously handicapping conditions are forestalled. The program should be responsive to the results of the evaluation, which might suggest a different methodology or the need for new community resources to handle visual and hearing problems.

(*b*) *Costs*

Table 3.8 presents a summary of the costs and services provided by this program of screening and treatment of vision and hearing defects, in a community of 50,000. These programs can be expected to prevent or correct the majority of vision and hearing defects in young children at an average total cost of $6.86 per person screened, or $158 per person treated.

Teachers, school nurses, and laymen can be trained to perform vision screening at little expense. Screening of 3,000 children in the age groups under consideration would require only ½ man-year of technicians' time, and a total of 1½ man-weeks of audiologists' time. Treatment of vision and hearing problems discovered would require from 3.5 to 6.5 man-weeks of specialists' time.

(*c*) *Effectiveness*

Vision.—The great majority of vision impairments are refractive errors, almost all of which are correctable, and coordination problems, half of which are correctable. Amblyopia ex anopsia, which constitutes 90% of amblyopia (blindness in one eye) can be prevented by screening and proper treatment at age 3 but would not be affected by any program which reached children only upon entry to school.

Without such a program of screening, follow-up and treatment, it can be estimated that (say) 60% of vision handicaps go uncorrected in "health-depressed" areas (unproven but reasonable assumption). Each year the program would treat new vision handicaps in 3% of 3-year-olds, 5% or children entering school (additional cases), and 3% of 9-year-olds (additional cases). After the program had been in operation for three years, almost all refractive errors in children under 9 would have been corrected; uncorrected coordination problems would have been re-

TABLE 3.8—ESTIMATED COSTS AND SERVICES PROVIDED: EARLY CASEFINDING AND TREATMENT OF VISION AND HEARING DEFECTS

Program	Numbers served								Estimated yearly costs
		Need followup			Treated [1]				
	Screened [2]	Total	Hearing	Vision	Total	Hearing	Eye surgery	Other vision treatments (including glasses)	
3.1 Early casefinding and assured treatment:									
Age 3	1,000	45	15	30	37.5	7.5	14	16	----------
Age 5 or 6	1,000	85	15	60–80	57.5	7.5	----	50	----------
Age 9	1,000	50	10	40	35.0	5.0	----	30	----------
Total [3]	3,000	180	40	140	130.0	20.0	14	96	[4] $20,570

[1] New cases only (totals would be higher in the first 4 years of the program).
[2] All 1,000 children/age group would be screened each year; treatment would continue as long as necessary.
[3] Total per person screened, $6.86; per person treated, $158.
[4] During the first 4 years, costs would be approximately 15 percent higher.

duced by approximately 50%; and amblyopia would have been reduced by perhaps 50% (after three more years, amblyopia would have been reduced by 85%).

It can be anticipated that improvement in the child's general outlook and learning ability will follow when his vision handicaps are corrected.

Hearing.—It is commonly estimated that 50% of hearing loss is correctable or can be significantly improved. (The Michigan Hearing Conservation Program findings support this as a conservative figure: 75% of children who receive medical attention (as well as 25% of those not receiving medical attention) show improvement or return to normal.) Based on analysis of several studies, it is estimated that the screening and treatment programs under consideration here would reduce hearing loss among preschool children in "health-depressed" areas from 1.2–1.5% (in absence of the program) to 0.9%; among children 5–11, hearing loss would be reduced from 4% to 2.5%.

4. Program to reduce unmet dental needs

Up to this time, because of failures in organization or in follow-up treatment, dental programs for indigent children have not had significant lasting dental benefits.

Comprehensive dental care programs for school children have received increasing attention and support. This analysis reveals that the costs of any such dental care program can be dramatically reduced by prior fluoridation of those community water supplies that still remain unfluoridated.

(a) Program Descriptions

Only a small proportion of the people in the United States receive anything close to complete dental care, and most people postpone treatment until pain forces them to visit the dentist. Most of the dental ills in adults are traceable to childhood neglect. This section describes three dental programs: a fluoridation program, a dental care program organized through the school systems, and a program combining these two.

The first program (Alternative 4.1) is a program of Federal grants for the installation of fluoridation equipment for community water supplies, plus annual financial "bonuses" to help meet the cost of operating and maintaining fluoridation programs.

At present, 4,046 communities with a combined population of approximately 70 million persons are drinking naturally fluoridated water or water with adjusted fluoride content. Ten million people drink naturally fluoridated water; 60 million artificially fluoridated water. Forty-six percent of the people using community water supplies drink fluoridated water.

The adjustment of fluoride ion in community water supplies to an optimal level has been determined to be a safe and effective method of reducing dental decay by more than 50%. Initially this improvement is observed only among children, since the consumption of fluoridated water affects the structure of teeth during the stage of enamel formation (during the first 12 years of life). Once the tooth

structure has been thus modified, however, increased resistance to dental casier becomes a life-long asset. Consequently, with the passage of time and continued fluoridation, the entire population can ultimately benefit.

The second dental program (Alternative 4.2) is a program to provide comprehensive dental care to school children from the first to the twelfth grade. Care would be provided on an incremental basis: in the initial year, coverage will include first graders only; in the second year, first and second graders; in the third year, first, second, and third graders. The annual one-grade increment would continue until all of the children in both primary and secondary schools were included. Dental services would include diagnosis, prophylaxis, fillings, extractions, topical fluoride applications where necessary, and tooth-space maintainers.

There are two reasons for directing such a dental care program exclusively to school age children: first, the child's entering into school usually coincides with the appearance of the first permanent teeth and marks the beginning of the critical period of oral health. Second, the schools themselves provide the setting in which continuous access to the largest number of children is assured and most productive use of dental manpower is achieved.

The program would provide basic preventive dental care for all children enrolled, including diagnostic services, continuing emergency care, and preventive and restorative services. Specialty services, such as orthodontics, would be included only in selected programs, to gain actuarial experience. Dental treatment would be provided by private dentists and dentists employed by public agencies.[1] The dental programs would be operated in close cooperation with local school systems, although overall program guidance would be furnished by a local health agency or local dental society.

The program would require the expansion, renovation, and equipping of dental treatment centers, with special incentives for the establishment of school clinics, group practice clinics, and the optimum utilization of publicly supported facilities. Mobile clinics for isolated areas and systems for transporting children from outlying areas to established care centers would be provided where necessary.

The third dental care program (Alternative 4.3) is simply a combination of the first two, combining fluoridation and dental care for schoolchildren and costing far less than comprehensive dental care in the absence of fluoridation.

(*b*) *Costs*

Tables 3.9 and 3.10 present estimated costs and manpower requirements for the three dental health programs. The fluoridation program costs approximately $0.71 per year per child served; comprehensive dental care costs approximately $30 per child per year in a community without fluoridated water, but only $13 per year in a community which has had a fluoridated water supply during the period in which the "teeth served" were being formed.

TABLE 3.9—ESTIMATED COSTS FOR DENTAL HEALTH PROGRAMS IN A COMMUNITY OF 50,000 PEOPLE

	Program	Number of children served	Estimated yearly costs	
			Total [1]	Per child served
4.1	Fluoridation of community water supples	[2] 12,000	[1] $5,800–$8,500	$0.71
4.2	Comprehensive dental care without fluoridation	[3] 9,000	270,000	30.00
4.3	Comprehensive dental care with fluordiation	[3] 15,000	117,000	[4] 13.00
	Cost of fluoridation		+8,500	+.71

[1] The Division of Dental Health estimates that it would cost $20,000,000 for installation of equipment to fluoridate the 12,868 nonfluoridated (mostly small) community water supplies, serving 82,000,000 people. Annual maintenance and chemical costs are approximately $0.12 per capita. If the $20,000,000 were prorated over (say) 5 years, equipment costs would be 5 cents per capita per year. Hence total fluoridation costs can be calculated to be $0.17 per capita, or roughly $0.71 per child (under 12) served.

In Charlotte, N.C. (for 50,000 people), installation costs for fluoridation equipment was approximately $2,500 and annual maintenance and chemical costs are $5,300; in Miami, Fla. (for 500,000), installation costs were $16,000 and annual costs are $51,500.

[2] Ages 0–12.

[3] Assumes 75 percent participation of school-age children.

[4] Costs would be higher if orthodontic work were added.

[1] The Division of Dental Health estimates that if dentists who wanted more patients were distributed geographically in the same way as are the children without dental care, the dentist supply for a national program for children would probably be adequate, even if every child were covered under the plan. With the existing distribution of dentists, however, the South and some Northern communities would be seriously short of dentist resources needed. The Division of Dental Health has therefore also recommended a program of training dental auxiliaries for work under supervision of dentists in a national dental care program for children.

TABLE 3.10—ESTIMATED PERSONNEL REQUIREMENTS FOR DENTAL HEALTH PROGRAMS IN A COMMUNITY OF 50,000 PERSONS

Program	Number of children served	Personnel required	
		DDS	Dental auxiliary
4.1 Fluoridation of community water supplies	12,000	0	0
4.2 Comprehensive dental care (no fluoridation)	9,000	2.5	12.5
4.3 Comprehensive dental care (plus fluoridation)	9,000	1.1	5.5

(c) *Effectiveness*

As Tables 3.9 and 3.10 indicated, fluoridation will bring about major reductions in tooth decay, reduce the number of treatment hours needed per child, and (over time) dramatically lower dental needs and hence lower the per capita cost of dental care. Table 3.11 indicates the estimated effects of the three dental health programs, based on experiences in a number of communities throughout the country. Numbers of decayed, missing, and filled teeth are 50–60 lower in communities with fluoridated water supplies.

TABLE 3.11—ESTIMATED EFFECTS OF DENTAL HEALTH PROGRAMS

Program	Dental status			
	Age 13		Age 20 to 44	
	DMF teeth [1]	Missing teeth	DMF teeth [1]	Missing teeth
0 Baseline (no fluoridation)	[2] 12	[2] 1.15–1.5	[3] 17.2	[3] 4.4
4.1 Fluoridation	[4] 7	[4] 3	[5] 7.5	[5] 1.6
4.2 Comprehensive dental care, no fluoridation	[3] 11.4	[3] 5	----------	----------
4.3 Comprehensive dental care, fluoridation	[4] 5.7	[4] 1	----------	----------

[1] Decayed, missing, or filled teeth.
[2] Woonsocket, R.I.
[3] Boulder, Colo. (average care).
[4] Gainesville, Fla.
[5] Colorado Springs, Colo. (average care).

5. *Intensive care units for high-risk premature and other infants*

Intensive care units for high-risk premature and other newborns have been proposed as a direct attack on the problem of infant mortality.

(a) *Program Description*

This proposal would facilitate the development of intensive care centers for high-risk premature and other newborns. Limited experience in the United States and more extensive experience abroad have shown such centers to be of considerable benefit in lowering mortailty among the infants served. This program would assist in the establishment of special care centers for premature and other newborn infants with medical complications (such as respiratory distress, serious congenital malformations, hemolytic disease of the newborn), who need greater medical and nursing supervision than is provided in premature and regular newborn nurseries, care by specially trained personnel, and occasional electronic and other monitoring. Preference would be given to hospitals with teaching programs in pediatrics. Staffing, transportation of infants to the center, and renovation and equipment prorated over ten years are provided for. A regional unit sufficient to serve a geographical area with a population of 500,000 is envisioned, though considerable variation is possible within the limits of effective deployment of specialized manpower and equipment. Assurance should be given that the staff has received or will concurrently be receiving special training in the care and treatment of cardiopulmonary failure and respiratory distress in newborn infants. Procedures for use of the center and transportation of infants should be well developed.

Plans for evaluation would focus on the effectiveness of the center in reducing infant mortality and morbidity. Alternative staffing patterns and realignment of responsibilities to provide optimum care and utilize personnel most effectively should be explored.

84-449 O—67——3

(*b*) *Costs*

The cost estimates and manpower requirements presented in Table 3.12 have been prepared on the basis of estimates that approximately 5% of newborns need intensive care. Nurse- and aide-requirements per shift have been multiplied by 5 to assure 24-hour, 52-week coverage.

TABLE 3.12—ESTIMATED COSTS AND PERSONNEL REQUIREMENTS FOR AN INTENSIVE-CARE UNIT SERVING A COMMUNITY OF 500,000 PEOPLE

Infants served per year	Estimated Yearly costs		Personnel required			
	Total	Per infant	MD	RN	LPN	Aide
525	$491,000	$935	2	21	20	15

(*c*) *Effectiveness*

A large number of studies in this country and others have shown the effectiveness of special hospital units for "high-risk" infants.[1] Based on the experience in the special "Premature Centers" in New York City,[2] one can estimate that these centers would cut the neonatal mortality rate among premature infants from approximately 160 per 1,000 to approximately 125 per 1,000. In an area in which prematurity rates were high, intensive care units could have a substantial effect on over-all infant mortality rates.

6. Program to Provide Treatment for Selective Service Medical Rejectees

A health referral program for armed forces medical rejectees was initiated by the Public Health Service in 1964 under the authority contained in Section 301 of the Public Health Service Act. Contracts have been negotiated with State health departments, State vocational rehabilitation agencies, and, in one State, a State welfare department to provide health counseling and referral services at 75 military examining stations in the nation. The average age of the rejectees is 19, with a range from 17 to 27 years of age. Program experience has indicated that, of the medical rejectees, approximately 40% are already under treatment and 30% have conditions which do not necessitate referral (e.g., failure to meet anthropometric standards). It has been established by the Public Health Service that the Selective Service medical examination gives a good indication of conditions that are handicapping even in civilian life.

For the 30% of medical rejectees (currently roughly 120,000) needing but not under treatment, no funds for treatment are available through the program for those who do not have adequate personal resources or qualify for other public programs. On the basis of program experience, it is estimated that 12% of the medical rejectees (roughly 48,000 young men) need treatment but fail to receive it because they do not have adequate financial resources nor do they qualify for other public programs. Often the conditions requiring the most expensive treatment (e.g., heart surgery) are covered by other programs. Though a detailed cost analysis has not been done, it is estimated that $5,000,000 annually would go far towards meeting the needs of the 48,000 men who fail to receive treatment for financial reasons (and lack of eligibility for other public programs).

TABLE 3.13—ESTIMATED COSTS FOR TREATMENT OF SELECTIVE SERVICE MEDICAL REJECTEES

Program	Number served	Estimated yearly costs	
		Total	Per person treated
Treatment of medical rejectees (not otherwise receiving treatment for financial reasons)	48,000	$5,000,000	$104

7. Expanded Family Planning Services

There is substantial evidence that many individuals in the U.S. who would like to receive family planning services are not now receiving these services.

[1] Craig, Brit. Med. J., 5378:266-72. Karlstrom, Acta Ped., 51 (suppl 135): 130-6, 1962. Baumgartner, et al., J. Ped., *54*:725-740, 1959. Vignec, A. J., New York J. Med., *59*:2785, 1953. Taylor, E. S. and Walker, L., Obst. and Gynec., 135:555-62, 1959.

[2] Baumgartner, op cit.

These are often persons who for economic or social reasons most need family planning services. Where these services are presently offered in maternity and infant care projects administered by the Children's Bureau, their utilization has been high (approximately 80%) and the proportion of women persisting in the service has remained high.

Family planning services are, moreover, an important component of any program that seeks to reduce infant mortality rates and future handicapping conditions. This section therefore examines the costs and estimated effects of expanded family planning services.

(*a*) *Program Description*

Studies undertaken by Planned Parenthood affiliates indicate that there are at any given time in this country, approximately 5,000,000 medically indigent women who potentially desire family planning assistance. About one-half million indigent women now receive such aid from public or private sources. The Department of Health, Education, and Welfare has offered support for family planning services mainly through Children's Bureau maternal and child health programs. Federal financial support for these programs is estimated to have been $3 million in fiscal year 1966 and more than $5 million in fiscal year 1967.

This proposal provides for voluntary family planning programs available to those who would not otherwise have access to such services. Project grants would be awarded to public or private non-profit agencies to develop or improve family planning programs which are an integral part of maternal or other health services for women in "health-depressed" areas. Such programs would include dissemination of family planning information service and supplies to any woman seeking such services.

The programs conducted should guarantee freedom from coercion or pressures of mind or conscience. There would be freedom of choice so that all women in these "health-depressed" areas could choose in accordance with the dictates of their conscience.

(*b*) *Costs*

Based on experience with family planning programs to date, costs of providing family planning services should be less than $20 per woman served. When family planning services are provided in conjunction with prenatal, obstetric, and postnatal care, costs are reduced to $10–$15 per woman per year.

To serve up to 4.5 million additional low-income women not now having access to family planning services, expenditures ultimately as high as $90 million could ultimately be justified.

(*c*) *Effects*

Table 3.14 displays relevant experience in family planning programs in North Carolina and Chicago. On the basis of these figures, assuming that the birth rate among continued users of family planning services (mainly the pill and the IUD) to be neglibible, we estimate that, for every group of women receiving family planning services, at least 70% will continue to take advantage of the services and hence the birth rate will be reduced by at least 70%.

TABLE 3.14—PROPORTION OF WOMEN CONTINUING TO USE FAMILY PLANNING SERVICES

[In percent]

	After 12 months	After 24 months
Mecklenburg County, N.C.	74%	66%
Chicago	77+	72+

Source: Corkey, J., of Marriage and the Family, 26:478 (cited in Population Crisis, hearings on S. 1676, p. 986).

Family planning programs would presumably also lead to considerable decreases in numbers of illegal abortions, hence also to considerable decreases in maternal morbidity and mortality. Estimates of the numbers of illegal abortions range up to a million (or even more) each year, i.e., up to 1 abortion for every 4 live births.

Family planning can also have an important effect on infant mortality rates: both infant mortality rates and mental retardation rates are, for example, sub-

stantially higher than average among fourth and subsequent live births.[1] These infants account for only 29% of all live births but approximately 45% of all yearly infant deaths and a larger proportion of infants born mentally retarded. Among nonwhites, fourth and subsequent live births account for 41% of all live births.

The following calculations illustrate the effects that could be achieved through operations in health-depressed areas: It is assumed, for illustrative purposes, that a family planning program serves women with three or more children, that (as in the current Children's Bureau projects) 80% of these women participate, and that the family planning program reduces the number of births by 75% in the *participating group* (an unproven but reasonable assumption, based on the theoretical effectiveness of current family planning methods). Under these assumptions, the overall non-white infant mortality rate would be reduced from 41.1 to 30.2. A national program for all women with three or more children would, under the same assumptions of 80% participation and 75% effectiveness, reduce the national infant mortality rate from 24.8 to 22.0.

Under similar assumptions, family planning programs could reduce the incidence of mental retardation from (say) 21 per 1,000 to 15 per 1,000 infants.

IV. Costs of Achieving Proposed Objectives

This chapter compares the costs and manpower requirements of the above maternal and child health care programs, then compares the cost-effectiveness of these programs in accomplishing each of the child health objectives.

A. COSTS AND MANPOWER REQUIREMENTS

Table 4.1 summarizes costs and personnel requirements of the alternative child health care programs examined, for a health-depressed community of 50,000 people. Comprehensive maternity care (in programs 1.1–1.4) would cost approximately $560 per mother, including prenatal care, an average of four days hospital care at $50 per day, postnatal care, and full evaluation and treatment of any medical or emotional problems. Comprehensive child health care would cost $130–$140 per year per child (in programs 1.1 and 1.2), including dental and psychological services.[2] [3]

The program of early case-finding and treatment (program 2.2) would cost approximately $30 per year per child screened ($188 per child treated).

Fluoridation (program 4.1) would cost approximately $0.71 per year per child served; comprehensive dental care (programs 4.2 and 4.3) would cost approximately $30 per year per child served (or $13 per year for children whose water supply had been fluoridated since their births).

Family planning services (program 7.1) would cost at most $20 per year per woman served.

For a health-depressed community of 50,000 people, costs of the programs considered would range from $8,500, for fluoridation (program 4.1) to approximately $3,000,000, for comprehensive health care for mothers and children (programs 1.1 and 1.2). Table 4.2 ranks the programs considered by total estimated yearly costs.

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[1] The report of the British Perinatal Survey states that the mortality rates for 4th, 5th, 6th-7th, and 8th live births are 1.38, 1.41, 1.74, and 1.8 (est.) times those for all live births. Whether this increased infant risk is due to parity (the number of previous babies) or to concomitant conditions—maternal age, spacing of pregnancies, prior pregnancy or lying-in complications, age of the father, socio-economic factors, etc.—cannot be perfectly explained. It is important to recognize, however, the increased risk which accompanies increasing maternal age and parity in every socio-economic stratum as a strong rationale for family planning.

[2] These costs are higher than in most current programs because they include costs for any necessary hospitalization ($25–$30 per child per year) and substantial costs for reaching out into the community through social workers, public health nurses, neighborhood health aides, and homemakers ($20–$25 per child per year).

[3] Costs for comprehensive infant care would be approximately $250 for the year of infancy, including routine newborn services.

TABLE 4.1.—SUMMARY OF YEARLY ESTIMATED COSTS AND PERSONNEL REQUIREMENTS FOR ALTERNATIVE CHILD HEALTH CARE PROGRAMS SERVING A HEALTH-DEPRESSED COMMUNITY OF 50,000 PEOPLE

	Program	Numbers served		Numbers treated	Personnel requirements		Estimated yearly costs				
							Per community	Per person served		Per person treated	
		Mothers	Children		Doctor	Dentist		Mother	Child	Mother	Child
0	Baseline (no new program)	0	0	----------	----------	----------	----------	----------	----------	----------	----------
1.1	Comprehensive health care (mothers, and children up to age 18)	1,000	18,000.0	19,000.0	11.7	4.0	$2,896,000	$561	$130.00	$561	$130.00
1.2	Comprehensive health care (mothers, and children up to age 18)	1,000	18,000.0	19,000.0	22.5	11.0	3,054,000	561	139.00	561	139.00
1.3	Comprehensive health care (mothers, and children up to age 5)	1,000	5,000.0	6,000.0	6.8	1.0	1,429,000	561	174.00	561	174.00
1.4	omprehensive health care (mothers, and children up to age 5)	1,000	5,000.0	6,000.0	12.6	2.0	1,468,000	561	181.00	561	181.00
2.1	Casefinding and treatment (newborns only)	----------	1,000.0	37.0	.22	----------	29,700	----------	30.00	----------	803.00
2.2	Casefinding and treatment (ages 0, 1, 3, 5, and 9)	----------	5,000.0	581.0	1.3	----------	149,700	----------	30.00	----------	258.00
3.1	Vision and hearing Casefinding and treatment	----------	3,000.0	130.0	.2	----------	20,570	----------	6.86	----------	158.00
4.1	Fluoridation	----------	12,000.0	----------	----------	----------	8,500	----------	.71	----------	----------
4.2	Comprehensive dental care (without fluoridation)	----------	[1] 9,000.0	9,000.0	----------	2.5	270,000	----------	30.00	----------	30.00
4.3	Comprehensive dental care (plus fluoridation)	----------	15,000.0	9,000.0	----------	1.3	125,500	----------	8.37	----------	13.94
5.1	Intensive care units for high-risk newborns	----------	52.5	52.5	.2	0	49,100	----------	935.00	----------	935.00
7.1	Expanded family planning services	[2] 1,600	----------	----------	----------	----------	32,000	20	----------	----------	----------

[1] Assumes 75 percent participation.
[2] Assumes that only women with at least 3 children participate in the program.

TABLE 4.2.—RANKING OF PROGRAMS BY ESTIMATED YEARLY COSTS IN A HEALTH-DEPRESSED COMMUNITY OF 50,000

Program	Estimated yearly costs			Physicians and dentists required	Persons served	Persons treated
	Total	Per person treated				
		Mother	Child			
4.1 Fluoridation	$8,500	.....	.....	0	12,000.0	0
3.1 Vision and hearing case-finding and treatment (ages 3, 5, and 9)	20,570	.....	.86	0.2	3,000.0	130.0
2.1 Case-finding and treatment (newborns)	29,700	.....	803	.22	1,000.0	37.0
7.1 Expanded family planning services	32,000	.....	.....	.....	1,600.0	0
5.1 Intensive care units for high-risk newborns	49,100	.....	935	.2	52.5	52.5
4.3 Comprehensive dental care (plus fluoridation)	125,500	.....	13.94	1.1	15,000.0	9,000.0
2.2 Case-finding and treatment (ages 0, 1, 3, 5, and 9)	149,700	.....	258	1.3	5,000.0	581.0
4.2 Comprehensive dental care (without fluoridation)	270,000	.....	30	2.5	9,000.0	9,000.0
1.3 Comprehensive health care (mothers, and children up to age 5)	1,429,000	561	174	7.8	6,000.0	6,000.0
1.4 Comprehensive health care (mothers, and children up to age 5)	1,468,000	561	181	14.6	6,000.0	6,000.0
1.1 Comprehensive health care (mothers, and children up to age 18)	2,896,000	561	130	15.7	19,000.0	19,000.0
1.2 Comprehensive health care (mothers, and children up to age 18)	3,054,000	561	139	33.5	19,000.0	19,000.0

The above costs can be used to provide rough estimates of the costs of providing health care to *all* the mothers and children living in poverty. Table 4.3 presents the costs of providing health care to all such mothers and children: If sufficient personnel were available to provide care at the estimated costs, comprehensive maternity care for the 800,000 to 1,000,000 low-income mothers would cost approximately $450–$560 million per year; comprehensive health care for the 15 million poor children under age 18 would cost approximately $2 billion per year. Early case-finding and treatment programs serving each year the 4 to 5 million poor children aged approximately 0, 1, 3, 5, and 9 would cost $120–$150 million per year. Comprehensive dental care for the 10 million poor children of school age would cost $300 million per year (or $130 million per year if their water supplies had been fluoridated since their births).

Comprehensive maternity care for 800,000 mothers would require services of more than 4,000 obstetricians (or 2,400 obstetricians if obstetric assistants were employed).[1] Comprehensive health care for 15 million children would require services of 14,600 physicians (less than 7,300 physicians if pediatric assistants were used).[2] Comprehensive dental care for 10 million children would require services of 7,800 dentists (or 2,800 if trained auxiliaries were used, and less than half as many in each case if water supplies had been fluoridated for suitable periods of time).[3] Early casefinding and treatment programs serving 5 million children per year would require approximately 1,900 doctors.

B. COST-EFFECTIVENESS OF MATERNAL AND CHILD HEALTH PROGRAMS

This section compares the cost-effectiveness of the programs considered in meeting the objectives proposed in Chapter II: providing needed child health care, preventing or correcting chronic handicapping conditions, reducing infant mortality, and reducing unmet dental needs. Table 4.5 compares the estimated effects of these programs, for each $10 million expended. The bases for this comparison are Tables 4.1 and 4.4, which summarize the estimated costs and effects of these programs.

1. Providing needed child health care

According to Table 4.5, for every $10 million expended, the program of early case-finding and treatment would provide examinations each year for 334,000 children and would provide medical care for the 39,000 needing treatment. Each child would be examined five times in his first 10 years, treatment being provided for any chronic (or acute) conditions discovered.

[1] Total number of full-time non-Federal obstetricians in the United States is approximately 15,000 (approximately one obstetrician for every 270 live births).

[2] Total number of full-time non-Federal pediatricians in the United States is approximately 14,000 (one pediatrician for every 4,000 children under age 15).

[3] Total number of active non-Federal dentists in the United States is approximately 86,000.

TABLE 4.3—COSTS OF PROVIDING HEALTH CARE TO ALL MOTHERS AND CHILDREN IN POVERTY

	Program	Number of low-income people needing care	Yearly costs of program	Approximate manpower requirements		Existing manpower
				Without physician assistants	With use of physician assistants	
1.1–1.4	Comprenensive maternity care	800,000–1,000,000 mothers.	$450,000,000–$560,000,000	4,000–5,000 obstetricians.	2,400–3,000 obstetricians.	15,000 obstetricians.[1]
1.1–1.2	Comprehensive child health care	15,000,000 children under 18.	$2,000,000,000	14,600 physicians	7,300 physicians	14,000 pediatricians.[1]
2.2	Early casefinding and treatment	4,000,000 to 5,000,000 children per year.	$120,000,000–$150,000,000	(2)	(2)	
4.2–4.3	Comprehensive dental care	10,000,000 children of school age.	$130,000,000 with flouridation.		1,200 dentists	86,000 dentists.
			$300,000,000 without flouridation.	7,800 dentists	2,800 dentists	

[1] Non-Federal, full-time obstetricians and pediatricians. General practitioners add to this total, but the supply of general practitioners is falling rapidly.

[2] 1,500–1,900 physicians.

TABLE 4.4—SUMMARY OF ESTIMATED YEARLY EFFECTS OF ALTERNATIVE CHILD HEALTH CARE PROGRAMS IN A HEALTH-DEPRESSED COMMUNITY OF 50,000 PEOPLE (INCLUDING 1,000 INFANTS AND 1,000 18-YEAR-OLDS)

	Program	Number served	Number treated	Births	Maternal deaths	Premature births	Infant deaths	Mentally retarded [1]	Prevalence of chronic handicapping conditions: Uncorrected vision problems: All	Uncorrected vision problems: Amblyopia	All	Binaural [2]	Other physical handicaps	Unmet dental needs
0	Baseline (no new program)	--------	--------	1,000	0.9	139	41	21.0	120	[3] 20	40	4.6	[4] 107	[5] 650
1.1	or 1.2 Comprehensive health care (mothers, and children up to age 18)	19,000.0	19,000.0	[6] 1,000	.45	70–111	24–29	19–20.0	20	3	15	2.5	49	0
1.3	or 1.4 Comprehensive health care (mothers, and children up to age 5)	6,000.0	6,000.0	[6] 1,000	.45	70–111	24–29	19–20.0	92	3	30	3.9	98	650
2.1	Casefinding and treatment (newborns)	1,000.0	37.0	1,000	--------	--------	(7)	(7)	--------	--------	--------	--------	(7)	--------
2.2	Casefinding and treatment (ages 0, 1, 3, 5, and 9)	5,000.0	581.0	--------	--------	--------	(7)	(7)	66	3	25	3.7	85	--------
3.1	Vision and hearing casefinding and treatment (ages 3, 5, and 9)	3,000.0	130.0	--------	--------	--------	--------	--------	66	3	25	3.7	--------	--------
4.1	Fluoridation	12,000.0	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	[8] 500
4.2	Comprehensive dental care (without fluoridation)	[9] 9,000.0	[9] 9,000.0	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	[9] 250
4.3	Comprehensive dental care and flouridation	15,000.0	[9] 9,000.0	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	[9] 187
5.1	Intensive care units for high-risk newborns	52.5	52.5	1,000	--------	139	36	(7)	--------	--------	--------	--------	--------	--------
7.1	Expanded family planning services	[10] 1,600.0	--------	830	.8	(7)	[11] 25	[12] 12.5	--------	--------	--------	--------	--------	--------

[1] At age 1.
[2] Can hear and understand at most a few words.
[3] Studies range from 5 per 1,000 to 80 per 1,000.
[4] Assumes that 153 have handicapping conditions (see table 2.7), that only 40 percent of these have received proper treatment, and that 30 percent of the conditions treated properly are no longer handicapping in civilian life.
[5] Number of 18-year-olds with decayed and unfilled teeth (assumption).
[6] Excludes effects of family planning services.
[7] Some improvements are anticipated; no quantitative estimates were made.
[8] Assumes that 25 percent of 18-year-olds are free of cavities and that 33 percent of these with cavities would receive dental care in any case.
[9] Assumes 75-percent participation.
[10] Assumes, for illustrative purposes, that only women with at least 3 children participate in the program.
[11] Assumes that family planning programs can reduce infant mortality rates from 41 per 1,000 to 30 per 1,000 by reducing births in high-risk groups.
[12] Assumes that family planning programs can reduce incidence of mental retardation from 21 per 1,000 to 15 per 1,000 by reducing births in high-risk groups.

TABLE 4.5—SUMMARY OF ESTIMATED YEARLY EFFECTS OF ALTERNATIVE CHILD HEALTH CARE PROGRAMS, PER $10,000,000 EXPENDED IN HEALTH-DEPRESSED AREAS

Program	Number served	Births prevented	Maternal deaths prevented	Premature births prevented	Infant deaths prevented	Mental retardation prevented	Chronic handicapping conditions prevented or corrected by age 18					Unmet dental needs [2]
							Vision problems		Hearing loss		Other physical handicaps	
							All	Amblyopia	All	Binaural [1]		
1.1 Comprehensive health care (up to age 18)	3,500 mothers, 63,000 children.	[3] 0	1.6	98–247	42–60	[4] 4.5–7	345	59	86	7.2	200	2,240
1.3 Comprehensive health care (up to age 5)	6,880 mothers, 34,400 children.	[3] 0	3.0	196–483	84–119	7–14	196	119	70	4.9	63	0
2.1 Case finding and treatment (newborns)	337,000 screened	--------	--------	--------	([5])	([5])	--------	--------	--------	--------	([5])	--------
2.2 Case finding and treatment (ages 0, 1, 3, 5, and 9).	334,000 screened (39,000 treated).	--------	--------	--------	([5])	([5])	3,610	1,140	1,000	60.0	1,470	--------
3.1 Vision and hearing case finding and treatment	1,458,000 screened (63,000 treated).	--------	--------	--------	--------	--------	26,250	8,260	4,370	437.0	--------	--------
4.1 Fluoridation	14,112,000 [6] age 0 to 12.	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	[7] 294,000
4.2 Comprehensive dental care (with fluoridation)	333,000, to aged 6–18	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	18,000
4.3 Comprehensive dental care and fluoridation	1,200,000, to aged 0–18	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	44,000
5.1 Intensive care units for high-risk newborns	10,710 [6]	--------	--------	--------	367	([5])	--------	--------	--------	--------	--------	--------
7.1 Expanded family planning services	500,000	[8] 49,000	[9] 44.0	([5])	[10] 2,000	[11] 1,000	--------	--------	--------	--------	--------	--------

[1] Those afflicted can hear and understand at most a few words.
[2] Reduction in number of 18-year-olds with decayed and unfilled teeth.
[3] Does not include effects of family planning programs.
[4] Infants.
[5] Some effects are anticipated; no quantitative estimates were made.
[6] This program would serve children in all areas, not only in health-depressed areas.
[7] Fluoridation would prevent cavities (completely) in approximately 25 percent of 18-year-olds (431,000 each year). In addition, fluoridation would reduce cavities in the remaining 18-year-olds by more than 50 percent.
[8] Assumes a reduction of the fertility rate from 141.5/1000 to only 30 percent of that figure among the women using family planning services (see p. III.44).
[9] Assumes that the maternal mortality rate would have been 0.9 per 1,000 live births.
[10] Assumes that the infant mortality rate would have been at least 41 per 1,000.
[11] Assumes that the incidence of metnal retardation would have been at least 21 per 1,000.

On the other hand, $10 million worth of comprehensive child health care programs would provide care for approximately 77,000 children, at $130 per child.

2. Preventing or correcting chronic handicapping conditions

According to Table 4.5, the program of early case-finding and treatment would be by far the most cost-effective in preventing or correcting chronic handicapping conditions: for every $10 million expended per year, it is estimated that this program will correct or prevent vision problems in 3,600, hearing problems in 1,000, and other chronic handicapping conditions in 1,470 18-year-olds; will prevent 1,140 cases of amblyopia (blindness in one eye); and will prevent 60 cases of binaural hearing loss (essentially equivalent to deafness).

3. Reducing infant mortality

For every $10 million expended, it is estimated in Table 4.5 that intensive care units would prevent approximately 370 infant deaths. The same expenditure on comprehensive maternity and infant care would serve 12,000 mothers and infants [1] and prevent 114–200 infant deaths (as well as five maternal deaths and 12–24 cases of mental retardation). Comprehensive maternity and infant care for mothers and their infants in health-depressed areas could be expected to reduce the infant mortality rates in these areas from (say) 41 per 1,000 to 24–29 per 1,000 live births.

It is estimated that, for every $10 million expended (up to at least $90 million per year), family planning services would prevent approximately 49,000 unwanted births and perhaps 2,000 infant deaths (as well as 48 maternal deaths). Family planning services for low-income women would reduce overall infant mortality rates by reducing numbers of births to women in higher-risk groups.

4. Reducing unmet dental needs

Fluoridation is by far the most cost-effective means of reducing dental needs, in particular, decayed and missing teeth. As a corollary, it is also clear that comprehensive dental care and fluoridation is far more effective (less costly) than comprehensive dental care along in reducing unmet dental needs.

V. Conclusions

This report has proposed specific objectives and reviewed national needs in child health, described major ongoing maternal and child health care programs, and estimated the costs and effects of maternal and child health programs designed to meet the proposed objectives.

The nation is already committed to the goal that all children should have the health care they need to participate fully in the nation's work and its rewards. Total expenditures by Federal, State, and local governments for maternal and child health care were more than $480 million in fiscal year 1965 and have risen sharply since then. Federal expenditures for maternal and child health care were more than $150 million in fiscal year 1965 and have risen to more than $400 million (estimated) for fiscal year 1967, the bulk of the Federal increases being due to Title XIX (Medicaid) vendor payments and to Children's Bureau, Office of Economic Opportunity, and Office of Education project grants for health care.

While most of these programs are aimed at poor children, they are insufficient to provide adequate medical care even for the 15 million children who live in poverty. Today, most poor children go without adequate preventive or remedial health care. In low-income areas, between 10 and 25% of children suffer from one or more *untreated* chronic conditions, including orthopedic, neurological, mental and emotional, and vision and hearing disorders.

The report proposed three specific objectives for the health of children: prevention or correction of chronic handicapping conditions, reduction of infant mortality, and reduction of unmet dental needs. In each case, it was suggested that priority in accomplishing the objective be given to children in low-income, health-depressed areas, where unmet needs are greatest.

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[1] Comprehensive maternity care would cost $560; comprehensive infant care, approximately $250.

A. PROVISION OF NEEDED MATERNAL AND CHILD HEALTH CARE

1. Comprehensive maternity care for the 800,000 to 1,000,000 low-income mothers would cost $450 to $560 million per year. If sufficient personnel were available, comprehensive health care for the 15 million poor children could be provided at a cost of approximately $2 billion per year. In both cases, these costs include psychological and dental services, any necessary hospitalization, and approximately $20 to $25 per person per year for social services.

2. With current methods of delivery of health care, comprehensive health care for 15 million poor children would require the services of more doctors than the total number of pediatricians practicing in the country today. With existing, or anticipated, numbers of physicians, comprehensive child health care will not be feasible on a wide scale unless far more efficient use of physicians is achieved.

3. The use of pediatric assistants promises to increase the production of pediatricians by at least 100%, and perhaps as much as 400%. The use of obstetric assistants promises to increase the productivity of obstetricians, though to a smaller extent. As experiments in more efficient use of physicians, therefore, a number of comprehensive maternal and child health care pilot projects ought to be established, to test the feasibility, costs, and effectiveness of new ways of providing children with comprehensive health services and new ways of training and using skilled physician assistants. These projects would be established under the auspices of university pediatric and obstetric departments, groups of physicians, or local health departments. If the pilot projects were successful, larger numbers of maternal and child health care projects could be established in subsequent years, presumably as part of neighborhood health centers serving all of the population in a given area and serving middle-income as well as low-income residents.

4. Public and private family planning programs are currently serving approximately 500,000 women, approximately 10% of those who could be considered potential recipients of subsidized family planning services. At a cost of up to $90 million per year ($20 per woman served), publicly supported family planning services could be extended to at least an additional 4.5 million low-income woman neither pregnant nor desiring pregnancy at a given time.

B. PREVENTING OR CORRECTING CHRONIC HANDICAPPING CONDITIONS

1. While experimentation is needed to discover how our doctors could provide comprehensive health care to more children, the nation already has the resources needed to find and care for the many children who suffer handicaps which could be prevented, corrected, or ameliorated by timely treatment. A program of periodic screening, follow-up, and treatment is the most cost-effective program for prevention and correction of chronic handicapping conditions. It is estimated that a program that screened children at ages 4 days, 1 year, and 3, 5, and 9 years, and provided appropriate follow-up and treatment, could prevent or correct 40% of vision and hearing defects and 20% of other chronic handicapping conditions.

2. Case-finding and follow-up services could be organized through the Crippled Children's program, school health programs, and other public health programs; money for treatment could be provided through the same sources and especially through amendments to Title XIX requiring that diagnostic services and required treatment be furnished to those children who are eligible for the "Medicaid" program. At a total cost of approximately $120 to $150 million per year, including those costs chargeable to public programs such as Medicaid, a program of early case-finding and treatment could each year screen essentially all the 4 to 5 million poor children at five specified ages (e.g., 0, 1, 3, 5, and 9) and pay for necessary treatment of the 450,000 to 600,000 who would require such treatment.

Such a program would go far toward remedying the oft-present defect in school health services, which provide for screening but usually not for treatment; the effort directed at preschoolers could have even greater benefits.

3. The Selective Service examination can also be used as a screening device, since the Public Health Service has established that the medical examination gives a good indication of conditions that are handicapping even in civilian life. The existing Public Health Service referral program for medical rejectees could be supplemented by funds for treatment of those who need it but would fail to receive it because they do not have adequate financial resources nor do they qualify for other public programs.

C. REDUCING INFANT MORTALITY

1. It is estimated that intensive care units for high-risk premature and other newborn infants would prevent 1 infant death for every $27,000 expended. Comprehensive maternity and infant care, which would have a great many additional benefits, could prevent 1 to 2 infant deaths per $100,000 expended, Family planning services would, while reducing unwanted births and presumably also reducing illegal abortions and numbers of illegitimate births, also reduce overall infant mortality rates by reducing numbers of births to women in higher-risk groups.

D. REDUCING UNMET DENTAL NEEDS

1. Fluoridation is by far the most cost-effective means of reducing dental needs. A program of fluoridation of community water supplies would ultimately reduce dental disease by more than 50% at minimum annual expense ($0.12 per capita, or $0.71 per child served), thus reducing either unmet dental needs or costs of dental treatment.

2. Fluoridation of water supplies could cut the approximate ultimate annual costs of comprehensive dental care for children from $30 to $13 per child. Fluoridation of the community's water supply might therefore be considered as a prerequisite to Federal support of any comprehensive dental care program is a given community.

E. REQUIREMENT FOR PROGRAM EVALUATION

1. The interrelationships among the effects of environment, education, and medical care make it extremely difficult either to predict the improvements in health which would result from improvements in the delivery of services or to predict the human or economic benefits that would result from improvements in health. Data are lacking, moreover, on the effectiveness of past programs in reducing mortality or in preventing disability.

2. Future maternal and child health care programs ought to include funds for evaluation of program effectiveness in delivering health services and in improving the health of the target population. Such evaluation would typically be conducted by an organization different from the organization administering a given program.

APPENDIX

MAJOR ONGOING MATERNAL AND CHILD HEALTH CARE PROGRAMS

The Nation is already deeply committed to programs which provide a start toward the objectives proposed in Chapter II. This Appendix discusses major ongoing maternal and child health care programs; Federal, State, and local costs of these programs for fiscal years 1965, 1966, and 1967 (as available); and numbers of children reached.

Tables A-1 and A-2 summarize the costs and the maternal and child health care services provided by Children's Bureau Maternal and Child Health programs, special project grants for maternity and infant care, special project grants for health of school or preschool children, and Crippled Children's services; by Welfare Administration vendor medical payments under Titles IV and XIX of the Social Security Act; by school health programs; by the Office of Economic Opportunity health programs under project Head Start and in neighborhood health centers; and by the Public Health Service and the Vocational Rehabilitation Administration.

Total expenditures by Federal, State, and local governments for maternal and child health care are estimated to be more than $480 million for fiscal year 1965, with Federal expenditures more than $150 million in 1965, more than $250 million in 1966, and more than $400 million in 1967, the bulk of the Federal increases being due to Welfare Administration Medical Assistance Program (Title XIX) payments and to Children's Bureau, Office of Economic Opportunity, and Office of Education project grants for health care.

Taken together, present programs fall short of providing adequate health care for those mothers and children who live in poverty or for those children who are physically handicapped: the majority of low-income mothers fail to receive adequate maternity care; most children of low-income families go without adequate preventive or remedial health care (even after handicapping conditions have been identified in screening programs).

Although problems of State matching funds and of health manpower remain, Title XIX provides substantial funds for purchase of medical care for some medically indigent children and adults.

Past and present maternal and child health care programs have lacked systematic procedures for evaluation of effectiveness. Data are lacking, for example, on the effectiveness of these programs in reducing mortality and in preventing disability.

TABLE A-1.—MAJOR ONGOING MATERNAL AND CHILD HEALTH CARE PROGRAMS

Program	Authority	Funded by	Administrative structure	Estimated child health expenditures (millions of dollars)					
				Federal			Total (Federal) State, and local,		
				1965	1966	1967	1965	1966	1967
Total				154+	268+	423+	482+	----	-----
I. Maternal and child-health care:									
(a) Maternal and child-health programs	Title V, Social Security Act	Children's Bureau, Welfare Administration.	Mainly formula grants to States	34	45	[1] 50	135	----	-----
(b) Special project grants for maternity and infant care.	Title V, Social Security Act (1963 amendments).	do	Project grants to State and local health departments. Federal matching up to 75 percent.	10	30	[1] 30	13	40	40
(c) Special project grants for health of school or preschool children.	Title V, Social Security Act (1965 amendments).	do	Project grants to State and local health agencies, State crippled children's agencies, medical schools and affiliated teaching hospitals. Federal matching up to 75 percent.	0	15	35	0	21	43
(d) Medical assistance program (title XIX).	Title XIX, Social Security Act	Welfare Administration	Federal matching (50 to 83 percent), in accordance with approved State plans.	0	[2] 21	[2] 123	0	----	-----
(e) Aid to families with dependent children (vendor medical payments).	Title IV, Social Security Act	do	Federal matching, in accordance with approved State plans.	[3] 32	----	[3] 61	----		
(f) School health programs		State and local governments		0	----	----	133	----	-----
(g) Elementary and secondary school program (health care).	Title I, Elementary and Secondary Education Act.	Office of Education	Formula grants to States, to be used for grants to local educational agencies.	0	[4] 30+	----	0	[4] 30+	-----

(h) Head Start health programs	Economic Opportunity Act	Office of Economic Opportunity	Project grants to community action agencies and to State and local health and educational agencies. Federal matching up to 90 percent.	[4]	----	----	4+			
(i) Neighborhood health centers	----do	----do	Project grants to community action agencies, medical schools, hospitals, State and local health departments. Federal matching up to 90 percent.	0	[5] 36	[5] 84	0	36+	84+	
(j) Indian Health Services	Public Law 83–568	Public Health Service	Direct operations	31	33	37	31	33	37	
(k) Immunization program	Title III, Public Health Service Act.	----do	Project grants. No matching required	0	8	9	0	8	9	
(l) Migrant health program		----do	Project grants and direct Federal operations.	(7)	(7)	(7)	(7)	(7)	(7)	
(m) Chronic disease control programs		----do		(8)	(8)	(8)	(8)	(8)	(8)	
II. Services for handicapped children:										
(n) Crippled children's services	Title V, Social Security Act	Children's Bureau, Welfare Administration.	Mainly formula grants to States	35	45	50	97	----	----	
(o) Vocational rehabilitation medical services.	Public Law 89–333	Vocational Rehabilitation Administration.	Formula and project grants	4	----	----	4+	----	----	
(p) Health referral program for selective service medical rejectees.		Public Health Service	Federal contracts with State agencies	4	5	5	4	5	5	

Notes on major maternal and child-health-care programs:

[1] Approximately $5,000,000 of maternal and child health funds are being used in fiscal year 1967 specifically for family planning services. Almost all maternity and infant care projects provide family planning services.

[2] Estimated expenditures on medical assistance, including medicaid, for children and youth (0 to 21) Special Analyses, Budget of the United States, 1968, p. 118. For 1968, the corresponding estimate is $221,000,000: total estimated Federal expenditures for medical assistance are estimated to be $770,000,000, $1,038,000,000, and $1,183,000,000 for fiscal years 1966, 1967, and 1968, respectively.

[3] Rough estimate, equals 40 percent of the total AFDC expenditures for medical payments for children and needy parents. (The 40-percent figure is based on the experience of the minority of States which keep separate records for adults and for children. Children make up 75 percent of the recipients of AFDC vendor medical payments.)

[4] Estimate by the Office of Education, on the basis of a 1-percent sample of the 22,000 projects funded under title 1. Federal funds were used for health services in nearly one-third of the projects.

[5] Estimated expenditures on health care of children and youth (0 to 21), Special Analyses, Budget of the United States, 1968, p. 118. For 1968, the corresponding estimate is $100,000,000: total estimated OEO expenditures on health care are estimated to be $48,000,000, $120,000,000, and $140,000,000 for fiscal years 1966, 1967, and 1968, respectively.

[6] Estimate by the Public Health Service, equals approximately 45 percent of the nonconstruction budget. Over 50 percent of the population served are under 21 years of age.

[7] Breakdown of expenditures for children not available. Total costs equal $2,800,000, $3,500,000, and $8,000,000 for 1965, 1966, and 1967, respectively.

[8] Breakdown of expenditures for children not available. Total costs for these programs, except those specifically for the aged, have been estimated by the Public Health Service as $49,000,000, $70,000,000, and $76,000,000 for 1965, 1966, and 1967, respectively.

TABLE A-2.—SERVICES PROVIDED BY MAJOR MATERNAL AND CHILD HEALTH CARE PROGRAMS

Program	Services provided	Population served [1]		Approximate yearly expenditures (Federal, State, and local)	Remarks
		Estimated number	Percent		
I. MATERNAL AND CHILD HEALTH CARE					
A. Maternal and child health care programs [2]	1. Maternity clinics	287,000	6.9 percent of mothers	Yearly expenditures are approximately $2 per child under 18; approximately $10 per poor child under 18.	
	2. Maternity nursing services	547,000	13.6 percent of mothers		
	3. Well-child conferences	1,507,000	14.7 percent of infants under 1, 4 percent of children 1 to 4.		
	4. Public health nursing services.	2,862,000	18 percent of infants under 1, 3.5 percent of children 0 to 20.		
	5. Physical examinations	2,437,000	4.9 percent of children 5 to 17.		In 1963, 19 percent of those examined were referred for further examination or treatment but only 8 percent of those examined completed referral.
	6. Vision screening	8,284,000 [2]	17 percent of children 5 to 17.[2]		In 1963, 9.4 percent of those screened were referred, but only 5.5 percent completed referral.
	7. Audiometer testing	5,332,000	9 percent of children 5 to to 17.		In 1963, 2.9 percent of those screened were referred, but only 1.3 percent completed referral.
B. Special project grants for maternity and infant care.[3]	Comprehensive maternity and infant care.	75,000 mothers; 75,000 infants.	2.5 percent of mothers and their infants under 1.	$267 per person served	
C. Special project grants for health of school or preschool children.[4]	Comprehensive health care for children of low-income families.	(4)	(4)		
D. Medical assistance program (title XIX) [5]	Inpatient and outpatient services, other laboratory and X-ray services, physicians services, and other services selected by the States.	5,936,000 (all ages)	8.5 percent of population of first 14 States with plans approved; presumably a higher proportion of the children in these States.	$162 per person served (all ages).	In many States, the proportion of the low-income population covered will remain small. In many health-depressed areas, a means for delivery of health services must still be provided.
E. Aid to families with dependent children, title IV (vendor medical payments).[6]	Vendor medical payments	3,358,000 children; 1,099,000 adults; 4,457,000 recipients.	4.8 percent of children under 18.	$18 per AFDC child [6]; $35 per recipient.	Federal sharing in the costs of vendor medical payments under AFDC (title IV) will cease on Dec. 31, 1969, or earlier upon adoption of a State program under title XIX.
F. School health programs [7]	Varied (see A.5, A.6, and A.7, under maternal and child health care programs above).			$3 State and local expenditures per child of school age.	Correction of physical or mental defects is usually left to family responsibility (see A.5, A.6, and A.7 under "Maternal and child health care programs" above).
G. Elementary and secondary school programs (health care).	Varied				
H. Head Start health programs [8]	Mainly physical examinations.	550,000 preschool children.			

I. Neighborhood health centers [9]	Comprehensive health care			$100, $119, $135 per capita.	
J. Indian health centers [10]	Comprehensive community health program.	383,000 (all ages)		$89 per capita	
K. Immunization program [10]	Immunizations, particularly of preschool children (to fill in gaps in other programs).	2,000,000	10 percent of children under 5.	$4 per child immunized	
L. Migrant health program	Clinics, hospital care, and special projects.				
M. Chronic disease control	Prevention and control of specific diseases.				
II. SERVICES FOR HANDICAPPED CHILDREN					
N. Crippled children services [11]	Casefinding, diagnosis, treatment, and after care for children who are "crippled" or who suffer from diseases which lead to "crippling." (The majority of children served suffer from nonorthopedic defects.)	420,000	0.53 percent of those under 21.	$200 per child "served"	Definition of "crippling condition" and services provided vary greatly from State to State. Assuming broad comparability in the different States for prevalence rates of crippling conditions and proportions of families needing assistance, the Children's Bureau estimates that more than twice as many children (say 1.2 percent) ought to be receiving services under this program. (The 1965 amendments require that the States make a satisfactory showing of progressive extension of services for crippled children with a view toward making these services available to children in all parts of the State by July 1, 1975.)
O. Vocational rehabilitation [12] medical services.	Medical services	28,778 children over age 14.			
P. Health referral program for Selective Service medical rejectees. [10]	Counseling and health referrals.	200,000 aged 17 to 27			Of the 30 percent of medical rejectees needing but not under treatment, the program is successful in placing one-half under medical care. (No funds are available through this program to provide for treatment.)

[1] Data are presented for the latest possible fiscal year, the year being stated in the following notes:
[2] The number of children screened each year by doctors, nurses, and teachers, is probably far above the reported total. Data are for 1964.
[3] Data are estimates for fiscal year 1967.
[4] The projects so far approved are just beginning.
[5] Title XIX pays for, but does not itself provide a system for delivery of health services.
[6] Estimated from the minority of States reporting expenditures separately for children and for adults. Data are for fiscal year 1966.
[7] Data are for fiscal year 1965.
[8] Data are for 1965.
[9] Data are the second year of operation of 3 representative neighborhood health centers. Services included vary a good deal (the 1st and 2d figures exclude hospitalization; the 1st and 3d exclude dental care).
[10] Data are for fiscal year 1966.
[11] Data are for fiscal year 1964.
[12] Data are for fiscal year 1965.

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Chairman PROXMIRE. Thank you very much, Mr. Gorham.

Our next witness is Mr. William Ross, Deputy Under Secretary for Policy Analysis and Program Evaluation, Department of Housing and Urban Development.

You may proceed, Mr. Ross.

STATEMENT OF WILLIAM B. ROSS, DEPUTY UNDER SECRETARY FOR POLICY ANALYSIS AND PROGRAM EVALUATION, DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

Mr. Ross. Thank you, Mr. Chairman. It is a pleasure to appear here today with other Federal witnesses to discuss our varied approaches to and experiences with the application of the Planning-Programing-Budgeting System to our respective civilian agency problems.

PPB in these settings can only be satisfactorily described in terms of its intended objective of improving "the basis for major program decisions." With an objective so laudable, it is all too easy to fall into an unfortunate trap of describing the preimproved past in strong purple terms to overdistinguish it from the rosy red of the perfect future and from the blue of the better-but-still improvable present.

In the case of HUD, at least, I find it is both more accurate and more productive to concentrate attention on the manner in which PPB offers a framework within which the continuing analytic efforts can be better focused to serve the needs of the Department.

In a world in which most public attention is directed to new legislative proposals to meet newly identified national needs, we sometimes fail to acknowledge fully the extent to which public management is dominated by "continuing" as distinguished from "new" business. Despite the numbers and significance of new programs, the bulk of public management time, attention, and money in any given year is applied to ongoing activities.

In its own time and its own way, each of these activities survived a rigorous series of legislative and executive tests. Each was approved and handled on the basis that it was considered—

To deal with a legitimate and pressing public problem,

To be an effective mechanism for dealing with that problem, and

To yield public benefits in an acceptable relationship to its public costs.

One of the great strengths of the modern legislative process, at least in the field in which I work, has been the extent to which the Congress has tended to rely upon selective specific limitations in combinations with broad administrative discretion. These unique combinations have permitted experimentation and adaptation within the framework of the legislative intent, thereby allowing significant experimentation and reorientation of programs to be accomplished by administrative adjustment or by relatively modest legislative amendments of the critical terms or conditions in the basic statutes.

This approach has had great virtue in facilitating the adaptation of programs to meet shifting conditions and even to new purposes. Consequently, the Congress has needed to give only intermittent attention to reexamination and restatement of the broad intent of the packages of programs it has authorized and continued to finance. This sequence requires that the executive branch fill in some of the missing

pieces in the articulation of the national strategy. If it fails to do so, it runs the risk, of course, that programs could be allowed to degenerate into obsolete or idle exercises, without understanding of the way in which they have failed to meet their original intents.

PPB as a system is intended to provide a disciplined and conscious effort by agency managements—

To express and improve the broad statements of national goals in their respective area of responsibility,

To clarify the role which specific activities are expected to serve in achieving the national goals, and

To identify inconsistencies or inadequacies for corrective action—by administrative action, if possible, or by legislative proposal, if necessary.

The individual products of this disciplined decisionmaking process are not distinguishable to the naked eye from those of less organized systems; they still must take the form of administrative regulations, budgetary requests, or legislative proposals. The distinctions are expected to show principally in a subtle but progressive improvement in consistency between related program decisions.

The "program structure" or "program category" concept is the principal mechanism which is expected to facilitate this particular function of PPB. It is also, I believe, one of the principal aspects of PPB which distinguishes it from mere mass cost-benefit analysis.

Program categories are the broad groupings of agency activities which serve common or closely related objectives and provide the framework for resolving major questions of mission and scale. In turn, the categories provide the framework for dependent and subsidiary issues of policy, practice, or scale of operations.

All such program structures currently in use are understood to be experimental and subject to change as they are tested by the criterion of how satisfactorily they contribute—and this will be an intuitive judgment—to orderly and perceptive identification and resolution of the major issues.

For the Department of Housing and Urban Development, the current tentative program category structure is derived—with liberal doses of selection, interpretation, and interpolation—from major congressional declarations of purpose in the Department of Housing and Urban Development Act of 1965, the Housing Act of 1949, and other major enactments where the Congress has provided a clear statutory statement of its intent.

In this respect, I think it is important to point out, Senator Jordan, that Housing and Urban Development is served better by broad statements of congressional purposes than other agencies because of the restatement we have had with the chartering of the Department. That event gave the Congress a chance to look in a much later setting at the broad series of programs that had been provided and to reconsider the broad statements rather than just continue a series of independent, individual programs with their own statements of purpose. But for illustrative purposes this morning, I will draw my specific example from the analysis work carried out within one of these major categories.

There are several explicit statements of purpose stressing the role of private activities in serving national housing goals. For example:

From the declaration of purpose in the Department of Housing and Urban Development Act:

. . . to encourage the maximum contributions that may be made by vigorous private homebuilding and mortgage lending industries to housing, urban development, and the national economy. . .

From the declaration of national housing policy in the Housing Act of 1949:

. . . the realization as soon as feasible of the goal of a decent home and a suitable living environment for every American family, . . . The policy to be followed in attaining the national housing objective hereby established shall be: (1) private enterprise shall be encouraged to serve as large a part of the total need as it can; (2) governmental assistance shall be utilized where feasible to enable private enterprise to serve more of the total need; . . . departments or agencies . . . shall exercise their powers, functions, and duties . . . in such manner as will encourage and assist . . . (2) the reduction of the costs of housing without sacrifice of . . . sound standards; . . . (5) the stabilization of the housing industry at a high annual volume of residential construction.

And from the Federal National Mortgage Association Charter Act, which authorized specific activities as—

Thereby improving the distribution of investment capital available for home mortgage financing . . . [and] . . . as a means of retarding or stopping a decline in mortgage lending and home building activities which threatens materially the stability of a high level national economy . . .

Based on these congressional statements, we have selected as one of our program categories "Decent Housing for All Americans Through Efficiently Functioning Private Markets."

For this broad mission of the Department, our first attempt at further defining the Federal role in private housing was a study of the history of the Federal-private relationships and a summarization of the then current status of the evolution of the private housing markets and the Federal activities which were involved. I will quote just briefly from pieces of that analytical report which provides the framework within which to do other studies:

"D. THE FEDERAL ROLE IN PRIVATE HOUSING MARKET

"*1. The nature of aggregate national need*

"The national need for Federal intervention (or facilitative support) in private housing markets is, in a practical sense measured by market demand—or more precisely, interstate differentials or disproportions between market demands and available investment capital to fulfill them. This continuing need is accompanied by the desirability of buffering the speed, duration, and intensity of cyclical swings to which the private housing construction and finance industries are vulnerable."

"While institutional lenders have been serving an increasing share of the national need for mortgage lending in recent years without seeking the protection of Federal underwriting, the geographical picture is far from even. The burgeoning deposits of the savings and loan industry have been largely responsible for this gradual but persistent decline in the FHA share of new construction lending. But because savings and loan associations and commercial banks are predominantly local in their lending, major regions of the Nation have been unable to obtain a supply of mortgage funds commensurate with local needs. Generally, these regions are those that are growing most rapidly and where total capital requirements are in excess of indigenous thrift. The Pacific coast, Southwest and parts of the South have mortgage

credit needs in excess of locally supplied funds even when augmented by mail-order S. & L. accounts.

"The fulfillment of these needs requires interstate mobility of funds from the capital-surplus areas of the East and Northeast where savings often exceed local investment, particularly by mutual savings banks and life insurance companies, who have been restrained by law, regulation, or policy except where Federal underwriting lf mortgage loans may be obtained. Thus, the availability of FHA mortgage insurance has been a basic ingredient in facilitating the interstate flow of funds needed to meet the national need unserved by local private lenders. These interstate flows are motivated by somewhat higher yields available in the shortage areas than in the surplus centers.

"But the supply of mortgage funds from private lenders using Federal underwriting has not been sufficient to meet the aggregate need of home financing in the capital-short areas of the Nation, even in periods of maximum monetary ease. These deficiencies are being overcome, at least in part, by the secondary market operations of FNMA. By selling its notes and short-term debentures in the general capital markets, FNMA increases the total supply of funds available for housing finance, since the investors who buy FNMA obligations would not have invested directly in home mortgages. And again, the underwriting of FHA and VA play a key role, since only those loans that have Federal endorsement are eligible for sale to FNMA. Working in concert, the FHA–FNMA activities are responsive to the voids that arise from place to place as well as from time to time in the aggregate national needs for housing finance as expressed by market demand.

"While the foregoing paragraphs are directly descriptive of the FHA–FNMA role in financing new construction, they are also pertinent to the sale of existing homes. For about a decade, one of the major sectors of demand for new construction has arisen from families who are trading up, moving, or seeking a different house for other reasons. Their mobility, however, is usually dependent on finding a buyer for the equity in their present house.

"During these past 10 years, the volume as well as the proportion of FHA activity related to the turnover of existing houses has risen, even though its direct participation in new construction has declined. Aggregate national needs for housing finance involve the utilization of the existing stock of housing, even more than financing current building activities, and the Board of Governors of the Federal Reserve System has estimated that sales of existing houses outnumber those of new by a ratio of about 2 to 1. Thus, in the shift of its insuring activities from new to existing homes, FHA has reflected the changes that have occurred in the housing market."

The statement goes on to explain that despite all of the very strong institutional growth of private housing finance—from the recovery of the depression of the early thirties and through the development of the very strong savings and loan, mutual savings bank, commercial bank, and insurance company housing investment systems—that there was a very significant residual need for providing the mechanism for helping financial institutions move funds across State lines into mortgage finance. Through insurance of mortgages directly, the FHA makes it possible for some of these institutions to invest bonds beyond the range from which they draw their savings. Through the mechanism of insured mortgages purchased by a Federal instrumentality (the

Federal National Mortgage Association) which are in turn financed by the sale of bond instruments, the FHA and the FNMA activities, in concert, work to provide a supplemental mechanism for the flow of funds from one group of savers into a type of investment which they could not otherwise effectively use. These devices have produced the basis for an effective supplement to the private housing and financial systems, and one which is both necessary and very critical in helping to minimize the cyclical swings to which housing is particularly vulnerable.

In the context of this appraisal of how the Federal-private role has evolved and its status as of 1966 and 1967, the Department prepared several special studies of contemporary mortgage market problems, which were provided to the Congress in the form of two special reports. The "Report on Mortgage Discounts" was made to both the Senate and House Banking and Currency Committees and a lengthy analysis of past and future sources of mortgage funds was submitted for the study of mortgage credit which was carried out by the Subcommittee on Housing and Urban Affairs of the Senate Committee on Banking and Currency.

Senator Proxmire is familiar with both of those in his role as a member of the Banking and Currency Committee.

These papers analyzed the sources of savings which were available for mortgage investments and the conditions which determined the relative attractiveness of mortgages in competition with alternative investment opportunities. Together they contributed to further understanding of the need for more effective mortgage instruments and more effective mechanisms for converting savings into investments in mortgages in order to avoid or minimize the unstabilizing effect of sudden changes in money market conditions on private housing. Not unexpectedly, we have not yet found final solutions to this difficult basic problem. As we indicated in the hearings on mortgage credit, however, the intensive search for new alternatives and new solutions to the mortgage market stability problem is one of the Department's highest priorities for further study and analysis.

On a less lofty—but highly significant—level, we also carried out a related special study which, while ostensibly dealing with a mere administrative procedure, was strongly conditioned by the overview of the Federal role in effective private mortgage markets. It also represents, I believe, a good example of the intricate interrelationships between national goals, program policies, and administrative practices.

As you may be aware, FHA has traditionally written its mortgage insurance contracts to provide that in event of default, FHA will pay off the insured mortgage and take title to the property thereby taking the responsibility for managing the property and reselling it to salvage the remaining value. This means that the FHA pays off the mortgage at the time it goes into default and makes, in effect, a very substantial investment in properties which it must then manage in order to make a recovery.

But the large and continuing volume of individual home mortgage claims in recent years has, among other effects, required a substantial increase in the numbers of FHA employees required for this direct operation as well as temporary investment of substantial amounts of FHA reserve funds in real property assets. The combination of

these disadvantages of the present claim settlement system prompted a review to determine if alternative settlement and salvage systems might be available which would be cheaper or more effective and still consistent with the role of the insurance program in meeting national objectives.

Senator JORDAN (presiding). Just at that point, what percentage of the loans, FHA loans, have defaulted? Do you have a figure on that?

Mr. ROSS. The figure is something between 1 and 2 percent, Senator Jordan. But the volume of these mortgages is so great that that 1 or 2 percent becomes 50,000 individual properties becoming the responsibility of FHA in a single year. The management, the resale, and refinancing of that volume of mortgages is a very substantial workload, even though it does represent a very modest share of total mortgages. But the concept of the FHA insurance program is that by a very small amount of leverage in direct Federal activity, we channel great volumes of private money into housing mortgages which can be traded freely across State lines and create the possibility of a true national mortgage market.

I think if the program had started out with a normal share of defaults, we would have gradually moved into this 50,000 defaults a year, and it might not have been quite the shock that it has been when it came about rather suddenly. We had had an artificially low share of defaults in the years in which FHA was growing, because capital values or used house prices inflated fairly consistently. So if someone got into trouble, he could sell his house, recover the balance of his mortgage, and not have to go through a default. But as prices stabilized, the normal turnover of people who were moving in relatively short periods of time was reflected in direct defaults. This happened comparatively suddenly, as housing supply was more fully met in the late fifties, after the two wartime shortages had been overcome.

I think this still represents a very good example of a practice that requires intermittent reexamination. This one got its attention because it became a problem rather suddenly, and that earmarked it for attention. The process of selecting what are the key issues this year, as you know, is affected by certain gratuitous examples—sudden change is one. The need to justify larger increases in personnel for a practice makes it necessary for us to be certain that that practice is, in fact, required and cannot be substituted for, to avoid the necessity for increases.

Senator JORDAN. Go ahead with your statement.

Mr. ROSS. All right, sir.

From a review of the causes and trends in foreclosures, we recognized that the default volume was likely to remain high. The consideration of administrative alternatives available without changing the basic insurance contract indicated that for any of them to have any prospect for reasonable success would require substantial increases in the net loss per case, which could not be absorbed by the insurance funds at current premium rates. Proceeding further, we examined the ownership of FHA mortgages by type of investor, to see what type of investors were involved and to see what the prospects were that those investors would be willing to accept more of the settlement activity.

The identification of existing investor groups made it possible to

identify also a number of institutional constraints which would influence investor attitudes toward whether they would be able to use FHA mortgages in the same degree if more risk or more administrative work were involved.

We concluded that these constraints were sufficiently strong to lead to a significant reduction in the flow of funds into FHA mortgages if the responsibility or risk for properties were not assumed by FHA. This conclusion has been further reinforced by the subsequent analyses of the future sources of mortgage funds. As the need grows to tap such sources of savings as pension and trust funds, the questions of improving liquidity and security and reducing administrative burden on the investor become even more important.

Thus, in the context of the overall national goal of achieving a strong private housing industry, and in the context of a departmental mission to facilitate such an industry by providing an investment medium attuned to bringing savers and borrowers together, our analyses can lead to decisions not to change certain elements of the status quo as well as decisions to make change. But even "no change" decisions are not the end of analysis.

From the conclusion that changes in present mortgage settlement procedures would not be productive, we can extend analysis with confidence in two directions—

Backward toward the possibilities for minimizing numbers of defaults while still serving program objectives; and

Forward toward reexamination of the efficiency and effectiveness of the direct property management and liquidation activities.

I think in summary, Senator Jordan, what I have been trying to say this morning is that my own experience in program analysis has indicated that analysis and rationality are not new concepts in Federal civilian programs;

2. That PPB does provide a highly useful framework for integrating and improving analysis and thereby improving the probabilities of more consistent program decisions.

3. That mission and purpose are most often defined primarily by legislative statements of intent supplemented and organized by the executive branch managers.

4. That the status quo is not always wrong—but reexamining it is always worth while and frequently leads on to other productive inquiries.

5. That the purpose and effect of the entire process is to improve the effectiveness and efficiency of programs in carrying out their intended purposes of serving the public welfare.

Senator JORDAN. Thank you, Mr. Ross.

We will proceed with hearing the third witness, Mr. Harry Shooshan, Deputy Under Secretary for Programs, Department of the Interior.

Proceed, Mr. Shooshan.

STATEMENT OF HARRY SHOOSHAN, DEPUTY UNDER SECRETARY FOR PROGRAMS, DEPARTMENT OF THE INTERIOR, ACCOMPANIED BY HARVEY B. MACK, ASSISTANT DIRECTOR FOR OFFICE OF PROGRAM ANALYSIS

Mr. SHOOSHAN. Mr. Chairman and members of the committee, we are extremely pleased to have the opportunity to meet with you and

discuss the application of the President's Planning-Programming-Budgeting System to the programs of the Department of the Interior.

As the principal Federal natural resources conservation agency, we are concerned with the management, conservation, and development of the Nation's water, energy, minerals, fish, wildlife, forests, and outdoor recreation resources. We also have major responsibilities for Indian and territorial affairs. Basically our mission is one of restoring and maintaining the proper balance between man and his use of these natural resources. Increasing awareness of the close relationship between man and his natural environment is bringing into sharp focus what must be done immediately to restore and preserve the quality of our environment to assure the well-being of present and future generations.

Over the past 350 years, development of the greatest Nation of the world was possible because of our abundance of natural resources. The early pioneers had no incentive for application of long-term conservation measures as these resources seemed to represent an endless supply, particularly when related to the state of social and economic development that then existed. Nature was more of a foe to be conquered; not a sensitively balanced force for the society's well-being.

The idea of conservation was born in the mid-19th century when man began to recognize that there was a need for wise use of these natural resources. A positive Federal program for conservation began to take shape under the administration of Theodore Roosevelt, but two World Wars and the depression years had heavy impacts on this Nation's resources and greatly retarded the conservation effort. It was not until the early sixties that the real magnitude of man's environment—and what had happened to it—focused national concern upon the need for the total conservation effort required to relate properly all of our natural resources into a complete ecological complex to restore, preserve, and develop the quality of our environment.

Massive problems of air and water pollution, waste disposal, loss of unique natural and historic recreation resources, resource availability to meet growing needs, and so forth, confront us. The task facing the American people is not a small one. Resource use and abuse continue at breakneck speed that does not wait for planning. These are not problems that can be solved by individual local, State, or Federal projects, or solely within the Federal Establishment by single bureau efforts or even by one major agency. Planning and action programs must be fully coordinated on a national basis which appropriately recognizes needs and establishes positive objectives and goals as a basis for timely, coordinated, effective Federal programs that assure maximum public benefit from the available financial and natural resources to encourage, complement, and support State, local, and private sector efforts.

The President's August 25, 1965, announcement of an integrated, governmentwide planning system was very timely, particularly for the Department of the Interior. For some time, there was a growing awareness of the need to plan our programs on the basis of the relationship of natural resources to meeting public need. Major program areas of water supply, energy, minerals, commercial fisheries, recreation, forestry, and even our Indian and territorial programs need to be developed on a national and total Federal effort basis if we are to most effectively meet national needs. Almost every bureau, office,

and program of this Department involves more than one of these major program categories. The following tabulation reflects the extent of this multiple involvement:

	Number of bureaus involved [1]		
	Direct	Indirect	Total
Water supply and control	7	7	14
Energy production, distribution, and supply	9	6	15
Minerals exploration, production, and supply	3	8	11
Land services, forage, and timber	3	4	7
Aquatic living resources	2	12	14
Recreation use and preservation	6	6	12
Earth-environmental study, measurement, and enhancement	11	5	16
Indians and territories	5	7	12

[1] Total of 18 included in this summary.

Similar relationships exist among major programs of other Federal agencies. For example, six agencies outside of the Department of the Interior have major programs that directly benefit Indian people. In fiscal year 1967, these agencies provided some $193 million for programs of education, nanpower training, housing, health, economic development, et cetera, which are an integral part of the total Interior effort for the social and economic development of these people. Similarly, major programs for water, energy, recreation, et cetera, have broad multiagency involvement that must be fully coordinated both on a governmentwide program basis and within each agency.

This planning-programing concept is not entirely new to Interior. In developing the preliminary budget estimates for fiscal year 1965, we made an initial effort toward planning our programs by major resources and program activities. Further refinements were made in subsequent years and the first program plan developed on this basis was presented to the Bureau of the Budget to begin the fiscal year 1967 budget cycle. While the concept still was not fully developed, it was obvious that a uniform planning/programing process was required whereby a systems analysis approach could be employed for every major resource area and for all programs that contribute to accomplishment of national, regional, and local objectives. Both existing and new program proposals need to be subjected to such analysis to evaluate their relative effectiveness, priorities, coordination of effort to best achieve overall objectives, et cetera.

For the Department of the Interior, the President's program did not involve a radical change as it was directly compatible with the planning process evolution that was underway. Its main effect was to accelerate the process and provide the means whereby major departmental program issues and proposals could be more effectively analyzed, presented and utilized as the basis for major legislative, program, and budgetary decisions. The advent of PPB was evolutionary rather than revolutionary for the Department of the Interior. It brought to a head efforts underway to rationalize our programs in the light of current and future needs, enabling us to allocate our resources to best achieve the purposes of our programs.

PPB is no magic potion or formula. It is not decisionmaking by computers. Basically, it is the application of logic and commonsense based upon reliable data and sound analysis. In Interior, we have carefully preserved and nurtured the line officer role and responsibility.

Within the departmental program structure and within the broad program and fiscal guidelines of the Secretary, bureau programs are developed, analyzed, and coordinated into a total departmental program which is presented to the Secretariat for review, evaluation, and display of alternative courses open to the decisionmaker. To the extent possible, program outputs and relative benefits are related to costs of proposed and alternative courses of action. Primary emphasis is directed at giving the decisionmakers (bureau heads, Assistant Secretaries, the Secretary, the Director of the Bureau of the Budget, the President, and the Congress) the best possible display of meaningful information, data, analysis alternative considerations, program costs, and so forth for use in the decision process.

Against this background, I should like to present to you a few specific cases where the Planning-Programing-Budgeting System has been applied in the Department of the Interior, which I understand is the specific focus and reason for our meeting with you today.

If I may be permitted to deviate from my text and, in a sense, deviate from highlighting at the moment, I think that organizationally we stand in sharp contrast, particularly to Secretary Ross' Department. As an old-line agency, established in 1849, many have characterized us as the dustbin of the executive branch. At the time we were created, we were a sort of department of miscellaneous affairs. After one took care of one's foreign affairs, Treasury, et cetera, there developed a need for a catchall department, and the interior of the country at that point meant west of the Mississippi. I say this by way of background, because the initial trauma of the announcement of PPB to an old-line agency on first blush might have appeared to be substantial. The fact was that PPB arrived at the right time for the Department of the Interior, on the crest of a conservation movement which had fits and starts since its momentum took effect under Theodore Roosevelt in the early 20th century.

The Department of the Interior struggled through two world wars and a great depression to give leadership to the Federal conservation effort. It was in process during the last 6 years of bringing this rationalization of its activities into sharp focus, particularly with the birth of other departments and agencies who picked up and got very explicit charters in areas that the Department of the Interior had responsibilities. We were groping for something like PPB when lo and behold, it came upon the scene. I stress this, for example, because as many know, the Office of Education at one point was in the Department of the Interior. Many residual functions of this kind kept the mission of a conservation of natural resources agency off balance.

Having said that, I think we are a good complement to the presentations you have been hearing this morning. As I have said, it so happened that when PPB came along, it gave us the framework we were looking for, and that framework, we are delighted to say, at least to ourselves, Senator, has given us a new opportunity to look at the present, and more particularly the future, and see the needs of the country; try, as PPB doctrine requires or suggests, to define those objectives in very specific terms to remove, if you will, the mother-love type of objective that has tended to be with conservation, and to get some very specific goals and objectives.

We are in our second year, but it is a matter of practical fact, and I do not say this by way of apology but simply in terms of reality,

the announcement of PPB came at a point in the cycle where we basically had, from an operating standpoint, about 6 months before the decisions for fiscal year 1968.

The tools of analysis, the tools associated with PPB, are well identified. However, the application to a department such as ours, and I suspect other civilian agencies, was not easy, not because of a lack of will or desire, but rather because it was not a shelf-goods item. You could not go to a store and pick it up to implement it. We could not go to the Department of Defense for the answers. We could, see the tools, but it was difficult to see the application.

For example, one of the first questions that my Secretary asked was "How much is the education of an Indian child worth as compared with a whooping crane?" Both programs of the Department.

When one starts thinking about tradeoffs, one's mind quickly gets to that kind of question.

Similarly, many thought that it was all decision by computers, and this it was not. Computers are one of the tools available to the programers, but they are not his master.

As we started with PPB, we consciously decided, and again as Secretary Gorham has pointed out, we started out trying to develop a process within the Department and a way of thinking for all levels. Planning is not the right, responsibility, privilege, however you might put it, of a few at the top of a department or the top of an agency or the top of a bureau. Rather, it is a full responsibility from the field on up. And with this, we were very conscious of avoiding having the program simply slip into the hands of programers or planners. Not that I have anything against programers or planners, but we were very conscious of keeping the decisionmaker very much in the mainstream of this whole effort—particularly since the initial effort was so clearly focused upon adapting PPB to the Department of the Interior and its programs and, in effect, not reinventing the wheel, but applying the tools available to the ongoing program.

The thing we had to guard against, as I am sure all others had to guard against, was the temptation to stop dead in our tracks because of either a lack of adequate analysis or the lack of the kinds of data needed to make the kinds of choices that the system contemplates. At any given moment of time, it is imperative to be able to apply the knowledge one has to the decision at hand and not to wait for perfection which, if it ever comes, may leave the basic problem or the decision in a worse shape than it was before. For example, water pollution gets worse with the passage of time.

I say this by way of background, because it explains a good deal of the effort that we have put in and how we have gone about it. But having said that, let me quickly rush to case histories, with this preface: What we attempted to do, then, in this process was to line ourselves up to look afresh at the natural resources problems of the Nation, not with any idea of having the Federal Government take on all the responsibilities of planning the natural resources development in the Nation, but rather, to identify the national goals and needs of the people and to see where the Federal Government fits in, where the Department of the Interior specifically fits in, and at the same time, look as much as possible on the role of other Federal departments and agencies.

In this process we did find some very significant things which I will just sketch out briefly, Senator. The items I have listed in my statement are the program categories that we are working with now.

Rather interesting, for example, in water supply and control, which I will go into in a moment, we have seven bureaus and offices that are directly in the water business, and seven that have what we call indirect relationships to water. Running down that list, one can see in our own Department the possibilities of reinventing the wheel by each bureau and office trying to set for themselves some kind of planning and program parameters within which they plan and carry out their assigned responsibility. This has caused us, in this process, to make a quartum jump forward, because we have put a large effort into setting up program and planning parameters so that we could identify the pieces that each of our own bureaus and offices could contribute to and, in turn, where we fit in with our sister agencies in the rest of the executive branch.

Turning specifically now to the first category of water supply and control, of all the natural resources, water is probably the most used and abused.

Water Supply and Control

Of all the natural resources, water is probably the most used and abused. Water supply ranges from excess to deficiency both geographically and by season. Nationally, there is an abundance of water but serious regional problems exist both as to quality and quantity. Unfortunately, the climate where people want to live, agriculture, industrial development, urban expansion, et cetera, often are not in balance with the water "bank account" for the region involved.

What this is saying is that on paper, one can figure out that for the Nation as a whole, we are not in a water shortage. But in specific regions, this is something different.

To meet current and future needs, planning and development of the water resources can no longer be on an individual project or single city basis. Planning must be by entire river systems and by their individual tributaries. All efforts—Federal, State, local government, and private—must be coordinated within river basin or subbasin plans.

The Department of the Interior, working closely with the Water Resources Council, the Corps of Engineers, and other agencies, plays a major role in the development of such plans.

As a part of our planning-programing effort, we are developing a "water situation profile" to be used for each planning area. These profiles will set forth major planning data for each region including economic indexes, water needs, and water supply. From this data, regional water problems will be identified and alternative courses of action developed and evaluated.

Basically, what this water situation profile will tell us is the demand-supply situation. It brings into sharp focus, as shown at the bottom third of the table, for example, all the possible sources of supply and each of our program efforts which contribute to it that we can forcefully identify. We can try to put together a cost-benefit analysis to determine what sort of mix of these various sources of supply can take place at what kind of cost to meet the identified needs.

Now the whole country has not yet been profiled this way, but this is the way we are moving very rigorously and working very closely

with the Water Resources Council and with our friends from the other departments and agencies who are in this business as well.

Water needs of any area can be met if we are willing to pay the costs. There are numerous alternatives ranging from surface reservoir storage to weather modification. Preserving water quality through pollution avoidance and improved reuse and recycle technology offer some of our greatest and least cost opportunities. Our research efforts show great promise of economic processes for desalination of both ocean water and brackish ground water. Weather modification has the potential of supplementing natural water supplies at low cost. How we treat our public and privately owned watersheds can have significant impacts on water quantity and quality. We have identified a wide range of alternates. Through analysis, we will be able to evaluate such alternatives as a basis for selecting the courses of action that should be followed to most effectively provide for regional water needs.

This is already showing us ways we can bring into sharper focus the developments of technology which have at times not been brought into the decision focus because of the fact that recommendations for a line of action tend to come out of organizational units. So by running it through this kind of discipline, it does show us the alternatives that can be met.

At the same time, we must also have a system that appropriately recognizes related impacts on other major social and economic factors as the solving of water problems cannot be completely isolated. Eliminating industrial pollution may add to the cost of manufactured goods; in fact it probably will add to cost.

Adequate treatment of coal strip mines to avoid pollution can increase the cost of coal which in turn may affect costs to all coal users. Significant increases in coal costs could result in conversion to other energy sources with reduced coal consumption. Land utilization and management practices for agriculture, timber, grazing, recreation, et cetera, while improving on-site resource values and uses, can result in reduced water yield downstream.

On the other hand, proper watershed treatment measures can do much to mitigate flood hazards, improve underground recharge, reduce reservoir siltation, et cetera. Through the integrated planning and programing system, we are developing the techniques whereby we will be better able to evaluate all of the major factors and considerations using the full spectrum of quantifiable data, economic analysis, social considerations, available technology, and departmental expertise. From such evaluation, we hope to be able to select the optimum mix of alternative courses of action to achieve the most timely and effective satisfaction of water needs.

We still have far to go. Some of our biggest problems involve lack of adequate basic data, the need for additional research, and operating experience in the application of new technology.

A specific water-related problem we are now studying is that of our estuaries which are both valuable and vulnerable. Where the river meets the sea, nature creates one of our richest treasures, the estuary. Biological resources of shellfish and finfish are of prime economic importance. Estuaries also have important mineral resources such as oil, sand, and gravel. They provide harbor and transportation routes for commerce, the best locations for many industrial plants as well as recreational areas for hunting, swimming, boating, and fishing.

What is a swamp to a housing developer is a bird breeding ground to the ecologist or a recreation area to a duck hunter. In our society, we cannot exploit, or abuse, one major resource factor without its having an effect on all other related resource considerations. Population growth has forced encroachment on estuaries. Industrial expansion has increased pollution problems. Increased leisure time has resulted in greater outdoor recreation demand, dredging for navigation has destroyed entire estuaries.

In the Department of the Interior, we have seven bureaus having major involvement in the planning, management, and utilization of the 27 million acres of America's estuaries. Similarly, other agencies such as the Corps of Engineers, Housing and Urban Development, local governments, and private interests have major involvement. What each does has a significant effect on both the estuarine resources and the conduct of other programs.

We are now completing the first stage of an analysis of all departmental programs associated with estuaries as a part of the "National Estuarine Pollution Study." This study is to be presented to the Congress in 1969. It will—

(1) document and analyze the various aspects of estuarine pollution, including sedimentation;

(2) make recommendations for a comprehensive national program to preserve, study, use and develop the estuaries; and

(3) recommend the respective roles of Federal, State, and local governments and public and private interests.

Even as the study progresses, data will be fed into operating programs just as soon as it becomes available. Such data can have significant impact on programs of water, energy, minerals, recreation, commercial fisheries, waste disposal, urban and industrial development, et cetera. Areas may be identified that involve agencies outside of Interior which may require approripate program adjustments. Through application of the system of program planning and analysis, it will be possible to coordinate better all related estuarine activities to best satisfy public need.

Senator JORDAN. Before you go on, you have indicated that there are seven bureaus in the Department of the Interior which are directly concerned with water supply and control, there are seven that are indirectly concerned. I assume that this is a correlation of activity and work between the several bureaus of the Department of the Interior.

Mr. SHOOSHAN. Yes, sir.

Senator JORDAN. The Department of the Interior, however, is not the only department of the Government interested in water quality and control. We have the Corps of Engineers, Public Health, Department of Commerce, and various other agencies. What correlation do you have with those different departments?

Mr. SHOOSHAN. Well, Senator, the principal coordination now is through the Water Resources Council, which was set up under the Water Resources Planning Act of 1967——

Senator JORDAN. 1965.

Mr. SHOOSHAN. Time has gone by. And on this Council, of course, are the other agencies, other principal agencies in the business, such as the Corps of Engineers, HEW, Department of Agriculture, and so forth.

UNITED STATES DEPARTMENT OF THE INTERIOR
WATER SUPPLY AND CONTROL CATEGORY--PPBS, FY 1969
WATER-SITUATION PROFILE

	Situation element	Unit	Region		
			Present	1973	2000
Econ. Base	Population	MM			
	Industrial production index	I.No			
	Agricultural production index	I.No			
Regional Water Needed	Public water supplies:				
	Withdrawn	mgd			
	Consumed	mgd			
	Returned	mgd			
	Industrial water supplies:				
	Withdrawn	mgd			
	Consumed	mgd			
	Returned	mgd			
	Agricultural water supplies:				
	Withdrawn	mgd			
	Consumed	mgd			
	Returned	mgd			
	Subtotal--withdrawn water consumed	mgd			
	On-site water consumption	mgd			
	In-channel water requirement	mgd			
	Total water requirement	mgd			
Reg'l Sply.	Average annual natural runoff	mgd			
	Practical maximum "with-storage" supply	mgd			
	Existing "with-storage" supply	mgd			
Regional Problems	Potential supply balance (+ or -)	mgd			
	Existing supply balance (+ or -)	mgd			
	Pollution - municipal	BOD			
	Pollution - industrial	COD			
	Pollution - recreational	BOD			
	Pollution - agricultural	%R			
	Pollution - thermal	%R			
	Pollution - other	%R			
	Excess sediment	%R			
	Excess salinity	%R			
	Watershed deterioration	MM acres			
	Annual flood damage potential	MM$			
Potential Alternative Actions by USDI	Surface reservoir storage	mgd			
	Underground reservoir storage	mgd			
	Interbasin transfer (+ or -)	mgd			
	Ground water storage depletion	mgd			
	Municipal pollution abatement	mgd			
	Industrial pollution abatement	mgd			
	Agricultural pollution abatement	mgd			
	Recreational pollution abatement	mgd			
	Thermal pollution abatement	mgd			
	Other pollution abatement	mgd			
	Desalination, ocean water	mgd			
	Desalination, ground water	mgd			
	Other water-quality enhancement	mgd			
	Recycle - reuse	mgd			
	Weather modification	mgd			
	Watershed treatment (+ or -)	mgd			
	Flow augmentation and control	mgd			
	Water use control and allocation	mgd			
	Evaporation suppression	mgd			
	Watershed restoration - conservation	MM acres			
	Annual flood-damage reduction	MM$			

7-a

Now, we are working with them and through them and in fact, they have gone to this river basin planning basis as well. I think, in other words, we are moving through the coordinating mechanism set up by the Congress in that Council to move down that path. We are in touch with that staff and our sister agencies rather continuously to see that what we are doing is compatible with what they are doing.

But we are conscious of this. You are quite right, sir, that we are

only one of a number, and hopefully, we will all be working with the same data.

As the Senator knows, that act calls for, and there will be this year, a report to the Congress on an assessment of national water need. So this will tend to establish the need aspect of the Nation for all agencies.

We have a lot of work still ahead of us, of course, but we are working in concert with the other agencies, both within and outside of the Council. For example, the Federal Water Pollution Agency works now with the Corps of Engineers in the development and operation of its programs. This kind of coordination will have to continue as routine day-to-day business.

I am sure that there is room for improvement, but we are consciously working at coordination.

Senator JORDAN. I was cosponsor of the Water Resources Planning Act of 1965. We had hoped that this legislation would reduce the overlap and duplication, get a good coordination among the various agencies toward achieving national goals and come up with some sound answers.

I just wondered how the program is being implemented.

Mr. SHOOSHAN. Senator, let me give you another specific "for instance" of where this is working.

I think the Congress in general, and the Senator in particular are to be complimented for the insight reflected in this act.

We have just recently completed an agreement between the Department of the Interior and the Corps of Engineers on the problem of dredging that has plagued us. This kind of forum is now forcing us—I do not mean forcing us in a sense against our will—to think in terms of the other fellow.

I think we are finding the cooperation among us, given the sharp focus of the Water Resources Council, a most useful tool and in turn, then, the various river basin commissions that are in the process of being set up will also help achieve better cooperation. This all augurs very well, sir, and we have really made remarkable progress, because again, we are all moving down the same path. It is a little hard, and one can get a little impatient with the movement given the urgency of the problems we face, but it is coming, sir.

Senator JORDAN. Very well, let's get on with the rest. We do not want to spend too much time on the water problem necessarily.

Mr. SHOOSHAN. Yes, sir.

ENERGY PRODUCTION, DISTRIBUTION, AND SUPPLY

Our basic energy objective is to assure the availability of a dependable supply of energy at the lowest cost consistent with other national objectives. Energy demand by 1980 is expected to be approximately 60 percent greater than 1965. Fortunately, we have an abundance of energy resources, however, they are not necessarily in the form or location that may best meet our energy requirements and be simultaneously compatible with environmental factors, cost, and other resource, social, or economic values. We have a wide range of alternative energy sources such as oil, coal, natural gas, oil shale, uranium, hydroelectric power, geothermal and even potentials of tidal and solar energy. Current research efforts indicate that we now are approaching

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an economic process for conversion of coal to gasoline. We also have the vast oil shale resource that is yet undeveloped due notably to lack of technology. Atomic energy is playing an increasing role in electrical energy production. Low head turbines have the potential of producing base load electric power from river flows. Research is constantly developing other technology of significance to energy considerations.

As a part of energy program planning, analysis of all such potentials is being made to determine which alternative actions will best achieve national energy goals consistent with appropriate consideration for the preservation of the quality of the environment, the most effective energy resource utilization, and proper coordination with other natural resource, economic, and national security factors. Simultaneously, consideration must be given to providing a climate for industry to produce efficiently under competitive conditions and to maintain safe and healthful working conditions during extraction and processing of fuel resources.

The analysis process of PPB will be an important function in the planning of future energy related programs since we have such a wide range of alternatives capable of satisfying energy needs under widely variable factors. For example, what are the best ways of meeting future liquid petroleum needs—improved recovery technology for natural petroleum, conversion of coal, oil shale, or perhaps substitutions of electrical energy? What needs to be done in the next 5, 10, or 15 years to develop one or more of these alternatives? How can the necessary research and resource development best be accomplished?

Aquatic Living Commercial Resources

The United States requires continuous access to adequate and dependable supplies of fish and shellfish products to meet the demands of an increasing population and improved standards of living. The oceans sustain a vast resource not now fully utilized. For example, it is estimated that marine finfish resources within reach of the U.S. fishing fleet could provide an annual sustained yield of about 15 billion pounds worth $640 million to fishermen—about 4½ times the present annual catch of marine finfish. Projected demand for U.S. industrial and edible fish products forecasts a 134-percent increase by the year 2000 (1966—12 billion pounds, 2000—28.1 billion). This demand will not be met without adequate resource and industry programs, particularly in the face of increased foreign catch and utilization with the potential of declining imports, and an American fishing industry that is not modern, economically sound, and prepared to meet increased competition.

Our primary objectives for these fisheries programs are:

(1) To insure an adequate, dependable, diverse supply of fish and shellfish products of good quality at lowest cost for an expanding population and growing industrial economy.

(2) To encourage optimum use of aquatic living resources, thus creating the climate or industry to produce efficiently under competitive conditions and creating employment opportunities for labor and capital with incomes and returns comparable with employment in other industries.

The primary program responsibility is assigned to the Bureau of Commercial Fisheries, however, the planning and programing process

must fully recognize other major program considerations such as the utilization of marine energy and mineral resources, marine-oriented recreation, conversion of sea water to meet water needs, navigation, and even use of the sea for waste disposal.

Within the fisheries program, we are beginning to apply systems analysis to the major species groups to better determine the relative payoff and priorities of various program alternatives and funding levels to achieve optimum accomplishment of program objectives with the financial resources available. As we develop more sophisticated input-output relationships, we can better determine needs and evaluate effectiveness of alternatives as a basis for planning program activities. The development of more positive and reliable data should provide decisionmakers at all levels of government with improved factual support, alternative actions, and judgment considerations.

This is not a simple task as there are significant international considerations, problems of management of common resources available to all nations, and a great lack of knowledge of the marine environment and its resources. The relationships of the values of programs of research, resource management and assistance to the industry in functions such as gear development, location of resources for harvest, vessel construction, are being evaluated. We have only begun this approach, but it already has proven its value and potential as we are getting a better feel of the relationship between individual program efforts and opportunities and the achievement of fish supply and industry objectives.

As programs such as these are developed, we also must recognize relationships to other program objectives of the administration and the Congress. For example, for several years, the Bureau of Commercial Fisheries has conducted research on the development of fish protein concentrate using underutilized fish species. This research has now developed an acceptable product for human consumption and we are moving into the pilot plant operation phase. While this can be of significant value to meeting American nutritional needs, particularly for lower income families, it may prove to be of even more value in alleviating critical world food shortage problems as recognized by the President and the Congress. However, if we are to most effectively utilize this resource in this manner, related programs within the Bureau of Commercial Fisheries, the Department of the Interior, State Department, Agriculture and other involved agencies must be fully coordinated. Through the PPB process, we have the tools to effectively develop programs to achieve such coordination.

Indian Programs

Our Indian program is one of our three people's programs.

We have some responsibility in addition for the Indian citizens of the Nation, also for the people of certain territories, and also for the Pribilof Islands in the Aleutian chain off Alaska. This has been an interesting experience for us, too.

Our Bureau of Indian Affairs people have risen to this challenge in a remarkable fashion.

There are over 600,000 Indians in the United States, two-thirds of whom live in varying degrees of geographic, cultural, and social isolation from other Americans on lands held in trust for them by the

Federal Government. To overcome problems of poverty, isolation, and dependency, the need is to broaden the range of options and opportunities for Indians to permit them to advance socially, economically, and politically.

The magnitude of the problem can readily be appraised from the following key factors:

(1) Education—On the average, Indians are only two-thirds as well educated as other Americans.

(2) Employment—Approximately 40 percent of the Indian labor force is unemployed at a time when national unemployment rates are 4 percent or less. I think it is actually 3.8 percent.

(3) Health—In 1963, the average age at death of Indians was 43.5 years; for other Americans, it was 63.5 years.

(4) Income—In 1964, the median family actual cash income of Indians was about $1,500.

Just a footnote: We talked nationally about the poverty line being around $3,000.

The Federal Government has a significant Indian program. In fiscal year 1967 the total Federation effort amounted to some $450 million of which over $193 million was provided through programs of other agencies outside of Interior. This multiagency effort is focused on achievement of the same objectives so there is need for one single agency to assume responsibility for coordinating these efforts and in assisting Indians to identify and take advantage of the opportunities provided.

The planning-programing system can provide an effective means for accomplishment of this coordination. We are developing total program plans which we are furnishing to all other agencies involved.

Let me say without reading this, sir, that the heart of what we are trying now to do is, having identified rather specifically the problem and our objectives, to share this with other Federal Departments and Agencies who are identified here with some of the programs involved, with the object of giving them, in terms of the Indian problem, an identification of the need.

They frequently are in the dark, other than as they get these sporadic applications for assistance, as to what the total dimension of the problem is and where the request before them fits in and where this fits in with what we are doing.

So in terms of rational allocation of resources, this is an effort to identify very specifically, reservation by reservation, as I will attempt to explain in a moment, the magnitude of the problem for the other agencies, without our attempting to tell the other agencies what they should be doing, but rather to give them the framework within which they can better judge the kind of assistance they can be giving.

I stress this because the acceptability of new economics for the Nation as a whole obscures the responsibilities of the Federal Government and the realities facing most of our Indian citizens who live in resource-scarce reservations in relative isolation. A 40-percent rate of unemployment as compared with a national average of about 3.8 percent today tells us a story that can get lost in the mainstream of our national thinking. We have to devise the kind of framework that allows people to see the nature of the problem, the isolated life and opportunities that many of our Indian citizens live within.

Senator JORDAN. Let us see if I have an understanding of the dimension of the problem—600,000 Indians for an annual expenditure of all agencies of $450 million. This is about $750 per Indian. Is this true?

Mr. SHOOSHAN. Right, although, the expenditure figures should be associated with the figure of about 400,000 Indians living on reservations.

Senator JORDAN. 400,000 on reservations?

Mr. SHOOSHAN. Right.

Senator JORDAN. And a program of $450 million for 400,000. That is over $1,000 per capita.

Mr. SHOOSHAN. Right.

Senator JORDAN. I want to pose a question to you to take back to your agency:

What would have happened if we had had an Emancipation Proclamation a hundred years ago for Indians? What do you think would have happened?

Mr. SHOOSHAN. I have an opinion. It is not based on PPB, Senator.

I think we really must see, as I am sure the Senator sees, the Indian problem in this form: I do not think it is a question of keeping them in an unemancipated status, but rather, the fact that as the Senator knows, the history of what has happened to the Indians has been, in effect, to put them on the most barren lands on the whole that man seemed to have at that stage of time.

Senator JORDAN. I do not expect an answer to it now. I want you to take it back to your agency and back to your Department, because I think the Indians, and I know lots of them and I have a high regard for them. They are equipped with the mentality and the physical characteristics and the motivation, if it is properly released, to do much more than they do. I do not think we are making much progress under our present situation.

Mr. SHOOSHAN. Senator, I certainly will take it back, but let me say this:

As fast as the Indian tribes are willing and able to move into what people will call the mainstream of our life, we are ready to have them move.

On the other hand, we are not simply saying, you are free to go your own way when many of them, at least, would remain in utter poverty. We are working at emancipating them from poverty.

I suppose in part, there is a good bit of a legislative twinge of conscience that plagues some of the things we do. But I will certainly take that question back to my Department.

Senator JORDAN. Go ahead.

Mr. SHOOSHAN. We are engaged in a program of in-depth analysis on all major Indian-related program activities to evaluate program effectiveness and to determine what must be done to accelerate achievement of the administration's objectives of raising the Indian living standard and of helping Indians to achieve a greater measure of economic self-sufficiency and fuller participation in American life.

Following are examples of analyses now in progress:

(1) Rather than dealing with the Indian problem, as many of us do, as a monolithic problem—all Indians identical—each reservation is being subjected to an analysis of its natural resources potential—

agriculture, minerals, timber, forage, recreation, et cetera, that are in many instances not being fully utilized.

Likewise, many reservations have Indian populations that may be in excess of what can be economically supported even by full resource utilization and taking maximum advantage of other economic opportunities within or adjacent to the reservations.

Preliminary studies are now being made of major factors such as employment, tribal and personal income by source, potential employment by source, cost of developing attainable employment potential, and population projections. Further detailed planning then will be completed for each reservation.

From such studies we hope to determine the cause of existing and anticipated serious social and economic situations to ascertain the best approaches to solving individual reservation problems.

(2) Studies are being made of alternative cost and benefit relationships associated with development of reservation resources such as irrigation, dry farming, timber, forage, and recreation. Such studies will identify relative potentials, priorities, and time factors involved for both immediate and long-range benefits.

(3) Major Indian educational factors such as analysis of school operating costs; teacher turnover; educational standards; the need for special education and training programs such as expansion of the Head Start program and kindergarten, special adult vocational training, and application of the most modern teaching methods.

(4) Indian housing needs involve 57,000 substandard dwellings of which only 16,000 are judged worthy of renovation. Studies are being made to ascertain the nature, extent and source of housing assistance that will best meet Indian needs in a time-based schedule.

Large amounts of money are being spent on the Indian problem.

I apologize. I would like to censor myself. I do not like to talk about the Indian problem, but I find I have slipped into that. Significant progress has been made but it has not been adequate, as evidenced by the present social and economic plight of these people. We must find better ways to cope with these problems, and the answers may not necessarily be limited to more programs and more money.

We must develop improved methods for evaluation of program accomplishments under both existing, proposed, and alternate courses of action. Application of PPB techniques will provide the means whereby we can do a better job of finding the most effective, timely, and economical means of achieving Indian goals.

I will refrain in the interest of time from elaborating on one of our most exciting other activities which some might feel to be a rather dull subject. We have been conducting and we have gone through a first-generation effort, Mr. Chairman, of a manpower projection by classes of manpower skills over time and have discovered some very revealing things, such as the possibilities of severe program constraints. If we cannot get enough water experts, for example, we may not be able to do some of the things we used to do. The mix of professional and technical skills has been identified as a set of problems that we must look at very carefully. In the water field, also, we are going to be in competition with State, local, and private people for water experts. How much? Now, we have a first-generation study that is already showing us some major deficiencies with possible adverse program consequences unless decisions are made to take corrective action.

Manpower Requirements

As a part of our program planning and analysis effort, we have initiated a system of manpower requirements evaluation directly related to program proposals and projections. Our initial effort has broken manpower data into five broad groupings:

Professional and technical specialists.
Technicians and aids.
Administrative.
Clerical.
Wage board.

As a part of our 1969 planning cycle, we are analyzing manpower requirements for each discipline in the professional and technical group. From this we will be able to evaluate better the manpower requirements for each program, bureau, and the Department against the total number of college graduates anticipated and the probable demands of the private sector, State and local governments, and other Federal agencies. Examples of the application of such analysis are:

(1) Identifying problem areas where availability of qualified personnel could have significant adverse impacts on accomplishment of program objectives.

(2) Evaluation of the extent to which technicians and aids are or can be used to supplement and support professional disciplines to obtain maxinum professional application to program accomplishments.

(3) Determining opportunities for reassignment or sharing within the Department of critical professional personnel.

(4) Ascertaining the need for and effectiveness of educational assistance programs to encourage students to enter into educational programs that will increase the number of qualified professionals for areas of greatest need.

(5) Evaluation of recruitment and job placement effectiveness.

Conclusions

The principal objective of PPB is to improve the basis for major program decisions by giving the decisionmaker more choices and better supporting data than he has had in the past. To do this, we must have clear statements of what the decisions are and why they are to be made. Program objectives and alternative methods of meeting these objectives must be subjected to systematic comparison.

To date we are pleased and proud of our accomplishments in installing and operating an effective PPB system for the Department of the Interior. We have a system well tailored to the programs of the Department. To the extent possible, we have coordinated our program structure with those of other agencies outside of Interior, but full coordination will not be possible until all civilian agencies have fully operational systems. We now are completing our second complete planning cycle under the PPB system and are very satisfied with the results. Never before have we had the degree of capability that is now developing to appraise all related programs, establish relative priorities and tradeoffs, evaluate major alternatives, and make program and budgetary decisions supported by quantifiable data and analysis. Both line and staff now have available to them the broader scope of national needs, objectives and goals. They can better see how each of their programs fits into the total departmental and Federal effort.

They participate more fully in all phases of the decision process and provide the basic data, analysis, and recommendation for use by the decisionmaker. We now have a tool for development of department-wide programs that can assure maximum effectiveness of each program component.

While we are enthusiastic about our progress, we recognize we still have far to go. It probably will be another 2 to 3 years before we begin to get the full payoff from the PPB system. There are so many program areas in need of real hard in-depth analysis that we must set priorities as we do not have the analytic capability to do but a few each year. Much of the analysis we have undertaken has been hampered by lack of suitable or comparable data. However, we already have had enough benefit from our PPB system to know we are going in the right direction. We have a great amount of enthusiam for, and confidence in, its potential.

Stripped of all of the "buzz" words, we feel that PPB really is no more than the use of sound wisdom and good commonsense based upon the best possible factual, economic, social, and opinion considerations that can be developed for use by the decisionmaker. Initially, PPB will require extra effort. Most of the "tools" of PPB have been used in bits and pieces in the past but never before have we had a uniform, coordinated approach on a Government-wide, departmental, or even bureau basis. We are confident that once the system is fully operational, benefits will far exceed whatever costs may be involved.

Forgive me, I know I have taken too much time. It is a very exciting subject, Senator.

(Additional material submitted by Mr. Shooshan follows:)

USDI—WATER SUPPLY AND CONTROL CATEGORY—PPBS, FY 1969 WATER SITUATION PROFILES BY REGIONS

EXPLANATION AND DEFINITION

COLUMNS

Units as follows:

MM—millions of people.
I.No.—production index number, referenced to a base of 100.
mgd—millions of gallons per day.
BOD—biochemical oxygen demand, 5-day.
COD—chemical oxygen demand.
%R—percentage of average annual natural runoff adversely affected by indicated problem.
MM$—millions of dollars.
"Present"—latest year for which figures are available, usually 1965 or later.

REGIONAL WATER NEEDED

Population.—Self-explanatory; use latest "medium level" projections available.

Industrial production index.—Use an accepted index of total industrial production, specifying period to which the "100" base is related.

Agricultural production index.—Use an accepted index of total agricultural production (or a predominant factor of agricultural production), specifying period to which the "100" base is related.

Public water supplies.—See USGS Circular 456, "Estimated Water Use in U.S. 1960", p. 3.

Industrial water supplies.—Self-supplied industrial, plus fuel-electric power, plus self-supplied air conditioning. See USGS Cir. 456, p. 5–7.

Agricultural water supplies.—Irrigation, plus rural for domestic use and livestock. See USGS Cir. 465, p. 3–4.

On-site water requirement.—To be considered only in those regions where average annual lake evaporation exceeds average annual precipitation. Includes water consumed by man-made reservoirs, lakes, ponds, wetlands, and watershed conservation and treatment measures. The requirement shall be estimated as the net effect upon "downstream supplies" in the future years—years beyond the "present".

In channel water requirement.—Flows needed to maintain interstate water quality standards at "standards-stipulated" low-flow levels or to meet navigation or fish and wildlife requirements, or compact commitments, whichever is the greater flow. Water for hydropower is assumed to have a nonpre-emptive right in time and, therefore, is not considered as a "need" in the potential water-balance profile. Unless and until better figures are available, use "runoff available 95 percent of the time" in profile for 1969 FY program memo.

Total water requirement.—Summation of "Public", "Industrial" and "Agricultural" water consumed, "on-site water consumption", and "in channel water requirement".

Average annual natural runoff.—The summation of subbasins long-term average annual runoff, adjusted for changes in major reservoir storage effects, where significant. Use same figure for all three "time" columns.

Practical maximum "with-storage" supply.—A part of average annual natural runoff that can be developed with .98 probability of success with reservoir storage as estimated by Löf and Hardison, 1966, "Storage Requirements for Water in U.S.", Water Resources Research, vol. 2, no. 3, p. 348, table 11.

Existing "with-storage" supply.—The runoff that can be sustained with existing or under-construction storage projects as of time indicated.

REGIONAL WATER PROBLEMS

Potential supply balance (+ or −).—"Practical maximum with-storage supply", less "total water requirement".

Existing supply balance (+ or −).—"Existing with-storage supply", less "total water requirement".

Pollution—municipal.—Total pollution load being discharged to the natural water system.

Pollution—industrial.—Same as "Pollution—municipal".

Pollution—recreational.—Wastes of all types resulting from water-based recreation. Regional gross measure of this pollution is taken as percentage of average annual natural runoff that is contaminated above levels permitted by interstate stream standards.

Pollution—agricultural.—Pesticide, herbicide and fertilizer pollutants, irrigation return flows, and other wastes. Regional gross measure of pollution same as for "Pollution—recreational".

Pollution—thermal.—Heating of streamflow above levels permitted by interstate stream standards. Regional gross measure of thermal pollution same as for "Pollution—recreational".

Excess sediment.—Suspended sediment in excess of interstate stream standard or in excess of that deemed to be normally and economically acceptable. Regional measure same as for "Pollution—recreational".

Excess salinity.—Same as for "Excess sediment".

Watershed deterioration.—Badly eroded or potentially erodable lands where land treatment, structural, and conservation practices are considered to be economically feasible and where a significant share of benefits from treatment accrue to the water resource.

Annual flood damage potential.—Figures shown in Senate Select Committee Print No. 15, p. 5, table 3, appear to be the most complete figures available at this time.

POTENTIAL ALTERNATIVE ACTIONS—USDI PROGRAMS

Surface reservoir storage.—Additional net "with-storage" supply that can be physically achieved.

Underground reservoir storage.—Additional "with storage" supply that is estimated to be achievable through artificial ground-water recharge.

Interbasin transfers.—Potential water-supply gains from or losses to adjacent basins by interbasin-transfer projects considered to be technically feasible.

Ground-water storage depletion.—Estimated yields of "mined" ground water.

Pollution abatement-municipal, etc.—Estimated additional quantities of usable water obtained by waste treatment and control facilities.

Desalination-ocean and ground-water.—Estimated additional quantities of usable water obtainable at costs considered competitive to other alternatives.

Other water-quality enhancement.—Estimated additional quantities of usable water obtainable by watershed treatment and other similar programs.

Recycle-reuse.—Potential quantity of water released for other uses by recycling-reuse processes.

Weather modification.—Estimated additional quantities of water obtainable from atmospheric moisture control.

Watershed treatment.—Estimated quantity of downstream water supplies added to or decreased from "present" supply.

Flow augmentation and control.—Additional quantity of water obtainable by phreatophyte control, water-catchment sealing, etc.

Water use allocation and control.—Increased efficiency of water use by allocation, metering, and rationing, in terms of equivalent additional supply.

Watershed restoration-conservation.—Additional acreage restorable to production use.

Annual flood-damage reduction.—Achievable by the pertinent combination of foregoing alternative actions.

Chairman PROXMIRE (now presiding). I apologize for having been absent during so much of Mr. Ross' and Mr. Shooshan's presentation. I did hear Mr. Gorham's, and I had a chance to see the statements.

I did not have a chance, unfortunately, to study them as much as I would like.

I think you gentlemen have done a fine job from everything I have been able to see.

I have a question for Mr. Gorham.

In your presentation, you talked about offering new programs and finding that sometimes the alternative of providing for expanded old programs might be wiser. You put it in the most optimistic terms, in terms of progress, I suppose. You have a department we all approve of, but the taxpayers might be concerned with looking at it another way; in other words, the alternative of not offering new programs on the one hand versus cutting old programs.

So if you want to offer new programs, finding some way that you can offer the programs within the same budget limitation.

Has PPB been helpful to you on this score?

Mr. GORHAM. We are intensely interested in the subject that you are raising, which is not only the expansion of promising programs and the search for good additional ones, but the discovery of programs that have ceased to be performing——

Chairman PROXMIRE. That is so difficult, unless you get some objective kind of system such as PPB, which gives force to the Secretary. It is very, very hard to interrupt a program that is ongoing, even though its functions may have evaporated.

Mr. GORHAM. I could not improve on your summary of the situation. Last year, the President did recommend—in fact, it was the year before last—a cutback in the impacted area program.

Although I think the arguments made were very persuasive to many on the Hill, not a single person that I know of on the Hill would support the cutback.

Chairman PROXMIRE. I supported it. But the Subversive Activities Control Board is an example. It is right out there in front.

Here is a board whose functions stopped months and months ago. And it is the hardest thing in the world to eliminate.

Mr. GORHAM. Each program gets a constituency which is individual to that program. The general constituency of people interested in cutting back unnecessary expenditures has difficulty focusing on a

specific program. Although this constituency is large, frequently it cannot apply force at specific program points.

Chairman PROXMIRE. Has PPB been helpful in this particular area?

Mr. GORHAM. I think PPB is extremely helpful in locating what should be considered low-priority programs and I think in the future we will see some more persuasive arguments brought forward for possible program reduction.

The next step toward making that argument effective will depend on the relative impact of information and special interest.

Chairman PROXMIRE. Now, is there any way that this program to date has been operated in the executive branch and within the departments—can you or can any of you gentlemen see a way in which this can be made available to the Appropriations Committees of the Congress so we can use this program to determine within the priorities which the Congress may establish what are the low priorities and where we can most sensibly and with the least damage to the public interest reduce spending?

Mr. GORHAM. I would be happy to make a quick answer and Bill Ross probably wants to say something, too.

I think the answer is very definitely yes, the very openness of the process—studies which are published—just invites participation by Congress. What use to make of the system beyond getting information about the basis upon which decisions were reached, is something for the Congress itself to decide.

In other words, whether they want to creat their own——

Chairman PROXMIRE. It would be a systematic way of presenting the PPB to the Appropriations Committee, the subcommittee, say, dealing with HEW or Interior or whatever, HUD, just as soon as possible in the year so that the members of the subcommittee, and especially the chairman and ranking minority member, will be in a position to understand it, evaluate it, ask questions about it, and then maybe establish their own priorities and go back to the Department to get further enlightenment.

Based on this kind of objective analysis?

Mr. GORHAM. Yes, I think that is a possibility.

We have not yet taken the step of providing a program budget to the Congress. The budget presentations will be, as of now, in the old appropriation categories.

Chairman PROXMIRE. You see, the trouble, though, is that the departments come up and they are fighting—they have to. After all, you have to have some discipline in the executive branch. You cannot have the President saying one thing and the Department, the Secretary, saying something else and some other member come up and say something else.

They have to act together, have one voice. You would not have an effective presentation or be serving the public and the Congress if you did not do that, but if there could be some way in which the whole program could be set forth to the members of the Appropriations Committee so they could exercise their independent judgment and on that basis raise or reduce appropriations.

Mr. GORHAM. I think that would be highly desirable.

I would suggest that when the members of the Bureau testify, you raise the same question. I think it is an important question and one which has not been resolved in that way.

Chairman PROXMIRE. Mr. Ross?

Mr. ROSS. Senator, I think the way in which you have asked this question possibly implies a degree of development of the PPB which does not exist anywhere. While the program category system helps to organize for the broad priority judgments, it does not, at its present stage, produce anything that is in any sense withheld from the Congress in terms of how the priorities were selected.

In defense, the presentation to the Congress includes the purposes of the broad categories and the rationale behind the series of actions which the Congress is asked to approve. It does not get into the competition between the categories. These are still very heavily intuitive judgments.

Chairman PROXMIRE. Yes, but your own department is an example of a whole series of programs and of agencies working to achieve a very laudable purpose. But you have all kinds of—it would seem to me—efforts to achieve the same objective. And sometimes similar objectives or very close objectives.

If there were some way that Congress could assess each of these efforts, it would seem to me we would be able, in a situation such as the present, to know where we could cut without cutting the heart out of a very vital and necessary service.

Mr. ROSS. The problem, though, Senator, is that you make decisions about—for example, in the housing program areas—about a mix of programs between public housing and rent supplement housing and below-market interest-rate housing.

Chairman PROXMIRE. Very helpful, applying PPB comparison to rent supplement and public housing would be most helpful. You would do more to sell the rent supplement program on this kind of basis than any other.

Of course, we disagree, in the Congress, because that is the nature of it.

I serve on the Housing Subcommittee and on the Banking Committee—I am ranking member of each. I think I would have been helped greatly if I could have had a PPB study of public housing on the one hand and rent supplements on the other—realizing you have oversimplifications and difficulties and so forth. But it would be most useful.

Mr. ROSS. The presentation of the relative role of these is simply a matter of reorganization of the way the budget is presented. But in the appropriations process, of course, the Congress has to go back and act on them in terms of its own requirements. The Appropriations Committee likes to get down to business as quickly as possible in making decisions. But the opportunity to present the total impact—for example, how much public housing we are proposing this year, how much rent supplement, how much of each of these—is there if the Congress wants it and the Department can reorganize.

Chairman PROXMIRE. What you are saying is that this, as far as Congress is concerned, is an information service to some extent and if we ask the right questions, we can get a lot of this right now.

Mr. ROSS. Yes, but even if you do not ask the questions, I think you are going to get the benefit of a lot of this analysis in the presentations made by the Executive in terms of its request.

Chairman PROXMIRE. We cannot expect the Executive to condemn its own case. We have to ask the right questions so we are in a position

to know whether they are right or whether they are wrong and make our own independent decision.

Mr. Ross. Yes, that is right.

Chairman PROXMIRE. Mr. Shooshan, did you want to comment?

Mr. SHOOSHAN. On this question, Senator, I must say I think I see what the Senator is getting at. I think if PPB is good for the Executive, it ought to be good and helpful for the Congress.

Chairman PROXMIRE. Let me just add to that that if the Executive has an effective PPB system and the Congress does not even understand it, this is one other way Congress becomes impotent. Our principal duty in the Congress, it seems to me, is control of the public purse. If we are so incompetent that we do not have this kind of information available to us and we do not study it precisely enough and in sufficient detail, we cannot really serve our purpose, the Constitution's check and balance system fails, because the Executive has the know-how, they have the manpower, the competence, the time. We are just not in a position, unless we can get something like this that gives us an implement that we can use, we are going to be very seriously handicapped. And this can be very helpful.

Mr. SHOOSHAN. Yes, sir; and as Mr. Gorham said, it is probably more appropriate from the Bureau of the Budget than each of us. They have not crossed this bridge.

But specifically, we have furnished the Congress, for example, one of our particular studies on analyses of the recreation land price escalation. This talks about the kind of problem we are faced with in acquiring lands for public purposes and the price escalation problem associated with it. Now, the alternatives involved are only somewhat displayed but it is the best we could do. We displayed it, the Bureau of the Budget agreed, and we have furnished it to the Congress. I think we could do much of this and hopefully will.

I mentioned in your absence, sir, probably you saw my written statement, that our estuarine study is another one we will be submitting to Congress in 1969. I would think that all of these major public issue questions, where there are alternatives, are important to see what the options are.

I suppose our friends from the Bureau of the Budget would be a little bit concerned about the possibility that we are talking large numbers. To be very frank with you, I do not know in detail what some of the other agencies have done, but one of the specific things we have done is while we have applied in our multiyear projection a budget constrained figure, we have also developed an optimum program appraisal with no constraint on it.

In other words, if we had all the money necessary to do the natural resources conservation job, what would it be? This gives us a funding spread. This is why, even now, we are in a position to talk about what we are giving up in the optimum versus the constrained type of situation.

Chairman PROXMIRE. I see my time is up. What I want to know is Congress can make blind percentage cuts. We can cut 1 percent or 5 percent out of your budgets. It is much better if, instead of doing that, we can determine what in our view may be the lowest priority, 5 percent, and cut that. But we have to make our own judgment. We cannot just ask you what to cut, because of course, it is our responsibility, our duty.

Mr. SHOOSHAN. Yes, sir. I might say, and I do not say this at all critically, but there have been, without identifying individual cases. I think there has been some concern on the part of certain Members of Congress over PPB and the feeling that if you want to know policy and what to do, come to us. Now, this is fair; Congress makes the law. But some who have interest in our program have expressed real concern over the fact that we know the course we want to take and that is the one we want to follow, we do not care about the alternatives.

Chairman PROXMIRE. I have some more questions, but I yield to Senator Jordan.

Senator JORDAN. Thank you, Mr. Chairman.

I have appreciated the three statements that we have had this morning and the colloquy that has ensued from the presentations.

I would ask you, each one, if you believe that the system, the PPB system, has helped you identify your national goals and to choose those goals which you regard as being alternative, as the chairman indicated more or less in his opening statement, and has enabled you to search for alternative methods and means of reaching those goals most effectively, at least with respect to cost, and so on.

I will start first with you, Mr. Gorham.

Mr. GORHAM. Senator Jordan, there is a very short answer and a very long answer. I am going to try to give one which is a little above the very short.

On identification of goals, I would say that mostly this first process was one of trying to understand what goals had been set out, often explicitly and sometimes implicitly in the existing programs we have. It is not a search for what new goals we should be achieving; rather for the goals that the Nation, through the Congress, is apparently after now.

On the second part, which is the evaluation of alternative ways of achieving goals, I would say the system has done that, because it has forced us to put together the various programs that contribute to individual goals. It naturally puts them in competition with each other. When you move from that natural competition to an explicit examination, you have solved the second of the three points.

I think perhaps unexpectedly to us, the third thing which the system has given so far is a very heavy emphasis on the importance of evaluating programs. To make the comparisons, you have to understand what existing programs are contributing toward objectives. I would say that my own Department has in the past year, through legislative recommendations and budgetary recommendations, given explicit attention to the necessity for determining what it is the Nation is buying in our programs, what is coming out of the other end. That is a very basic and important change.

Senator JORDAN. I can understand the cost effectiveness, the application of cost effectiveness to, oh, such things as the natural resources, the benefit-cost ratio of navigation or power projects or reclamation, something like that. But how do you apply that to human resources? How do you apply cost effectiveness to human resources in deciding whether it is best to do research into diseases of the young or diseases of the elderly, and so on? How do you make that evaluation?

Mr. GORHAM. Let me go back for a moment to our disease control study, because it is an example of where we, I think, effectively

apply cost effectiveness techniques to a problem, a human problem of diseases. And basically, we ask the question, if you have a certain amount of money and the money is limited, and that is always our situation, how can you spend it among several different programs in such a way as to minimize the loss of life and minimize the loss of disability. In fact, the cost-effectiveness techniques are very effective in answering a question when it is posed in that way.

When the question is posed, how much money should the Nation spend for disease control programs, cost-effectiveness techniques are much less effective and I think you are quite right in saying that that kind of a question cannot be answered by cost-effectiveness techniques. If you have, in another way, decided how much you want to spend in a broad area, cost-effectiveness methods are useful in indicating the best ways to spend it.

Senator JORDAN. Thank you.

Mr. Ross, have you heard my question originally? Has this helped you identify your goals, set up your priorities, and so forth?

Mr. ROSS. Senator, I think my answer is quite similar to Mr. Gorham's. In terms of the amount of attention that has gone into the identification of and the attempt to restate broad goals, I think we have been pushed very significantly. Surprisingly enough, I think there has been as much pressure from below in the organization for getting on with that job as from the top. People who are working on a piece of a program and who know they are facing choices from day to day which, depending on which philosophy the Department feels is the most useful umbrella under which they should be working, will affect that decision are quite impatient that we have not been able to get down a completely agreed upon full statement of specifications for the Department's missions. But in those particular topics where we have been able to put in the most time, we are substantially further along and it has been a big help.

I think we have benefited also, in terms of beginning to use the analyses of specific activities, to the extent that these really get to something specific. You know, the broad statement of national goals is a little bit vague, and it should be. But in terms of what you actually do and what it produces, the analysis gives you an opportunity to think back to what do we really mean about that goal. So there is a feedback between the analysis of activities in specific programs and what we understand of the broad statements.

Again it is really on a sample basis and not wholesale, because the type of analysis is quite difficult and the number of people we can put on to it at any given time is quite small. And I think the base is not one that can be accelerated rapidly, because it takes a great deal of interaction with program activities as well as thinking about the bigger picture.

In terms of helping us choose our priorities, weigh priorities between broad objectives, I do not think we have gotten a great deal of help and I do not expect it until we understand each of our activities considerably better. So I think this is probably the weakest link and the one that will be effective much later than either the first or the third in terms of the three questions that you asked.

Senator JORDAN. How do you determine, for instance, how would you determine what the national housing needs of the Nation are? Could you use the system effectively in that?

Mr. Ross. Well, we have, of course, paid a lot of attention to that. We have used the census surveys of the States of the housing condition in terms of quality and crowding. But these are the kinds of areas in which, as Mr. Gorham pointed out in his statement, a great deal of research and additional data is needed before we can, in any sense, get down to very specific quantitative comparisons.

Senator JORDAN. Your results are no better than the base of information you are able to feed into it?

Mr. Ross. That is right, sir; and it is a little discouraging at times to work on the 1969 budget and try to explain the national housing needs in terms of 1960 census data. But this is the position that we are in.

The thing that I find most encouraging about that situation is that the kind of analysis we are doing also helps to highlight the needs for the research and the data we need. Thus, we can explain to the Congress when we ask for research and studies what we hope to gain in the way of helping the Congress as well as ourselves make better decisions on the allocation of housing resources and Federal resources against those needs.

Senator JORDAN. Has it enabled your agency to identify the project of low priority that you might otherwise have thought was excellent?

Mr. Ross. We take the positive approach, Senator. We have identified projects of higher priority.

Chairman PROXMIRE. That is the trouble.

Mr. Ross. Well, Senator, the Congress provides sufficient or insufficient funds that the low priority things do not happen.

Chairman PROXMIRE. In this budget, I wonder.

Mr. Ross. We have in several of our programs in the last year established what we call funding priority systems, which are a relative innovation. For example, in the urban renewal program that Senator Proxmire is familiar with, we have established the priority of funding of new projects which are submitted for approval. Priority will go first to those projects which improve or preserve the supply of housing for low-income families. The second priority will go to projects which increase the job opportunities for this same group, and the third priority will go to dealing with problems of the heavily deprived areas—the very serious kinds of neighborhoods where renewal has not necessarily been so effective in the past because it was not complemented by the kinds of economic opportunity programs, the job and training, and the other kinds of programs which are necessary to be effective in a very severe slum situation. These priorities, applied at a time when we have $750 million in funds and $1½ billion worth of applications, mean that we have made very explicit choices that certain projects within a program will not go forward. We have similar kinds of systems in other programs which attempt to reflect what the Congress really meant for us to do. As you know, the Congress sometimes establishes criteria of eligibility which are broader than the highest purpose for which the program is established. What we achieve with these funding priorities is that more of the projects which actually are funded fall within the primary purpose and intent of the program and fewer of the things which are technically eligible but less pressing will survive.

Senator JORDAN. Thank you.

My time is up. I yield.

Chairman PROXMIRE. Go ahead.

Senator JORDAN. I would like to put the same question, then, to the Deputy Under-Secretary of the Interior, here. Have you been able to achieve, identify your goals and set up priorities and so on?

Mr. SHOOSHAN. Well, Senator, I think, like my colleagues, we have done very well in terms of identifying our goals and specific objectives in specific terms. For example, we have focused rather clearly on the facts of, as I used in one example here, our Indian programs. Now, how much housing are we talking about? What is the situation? And let's get a time plan. Let's associate it with that, so that so many houses are to be constructed to eliminate all substandard housing by 1973 or 1980 or whatever the target date may be.

Now, it is not that there was any lack of action on the part of the Bureau in the past and that PPB said something entirely new, but we have divided jurisdiction with our friends at HUD now on housing responsibilities. So some of these things—as they affect their authorities, have perhaps been divident. Maybe we should be a little more abrasive with our friends in other agencies. At any rate, we have now set forth this kind of objective in very specific terms. In terms of Indian education, for example, if we say the average education level is at eighth-grade level and the national average is at 11th grade, we say, how do we get from eighth grade to 11th grade? As we examine facts against these goals, it may mean getting certain kinds of teachers, kinds of school buildings, et cetera, to correct unacceptable situations. We are putting these components together in that kind of form. As we find another point that should be emphasized in that connection, it will be included so we get a full system's cost and appraisal of what we are talking about, not just the year before or the year that is immediately ahead of us.

So I say we are strong on having gotten our objectives fairly specific. I think we are very short in identifying the lower priority programs because these have not tended to come up as a result of PPB. There is a heavy element of judgment here. We do not do it by vote. We have major constituency interests—somebody can say, well, the most important program you have had is your water pollution program and so you should give up your sport fisheries program, for example. I am overstating it this way. But it is that kind of situation where somebody's low-priority program is somebody else's high-priority program. But in sport fisheries, somebody could say, "give up your wildlife refuges, these are outdated, obsolete, turn them over to the States." This is fine, but it just may not work out this way. Those who have a real interest in this do not believe that that is the thing to do. So I say it is a little difficult.

Also, I might say, and this sounds a little bit defensive, but we have been conscious about this, we have tried to more heavily relate our PPB work and our analytical work to the new program thrusts, and major issues, not because it is easier to talk about new programs, but rather, there is a good question of judgment, on how much time one should spend on ongoing programs that are pretty well set. So you restate its mission and you put it in PPB wrapping and what have you really accomplished?

There are going to be new program proposals, new thrusts of doing something in certain areas. Let's relate our analyses to that and get

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the alternatives documented as well as we can for the decisionmakers. So it is a combination of on the one hand it being difficult to identify low priorities in a manner that really means something and on the other hand, it is the fact of what have we really accomplished by simply putting old programs in new wrappings when new programs really should get the emphasis right now in terms of what are the decisions now before, in my case, the Secretary of the Interior, in terms of what should he know before he makes decisions relative to where he is attempting to go. If I can relate PPB to the decisions on his desk today and the near future, I can sell him and in turn, our own Department on the contribution that we can make.

Senator JORDAN. Thank you.

Chairman PROXMIRE. It occurs to me that one of the most difficult things we have in Government is where you find, perhaps in part through your PPB analysis, that a function can be performed more efficiently in one department than in another, one agency than in another. I wonder about how much incentive there is to shift a function to another agency if they have a comparative advantage in reaching an objective?

You see, what I have in mind is that we achieved, I think, a very great efficiency increase in defense when we merged the War Department with the Navy.

Out military objectives can be achieved, I think, in a more rational way. The objectives, instead of being by the Navy, maybe the Air Force can do it better, or the Army. PPB has been applied to determine which service can more efficiently achieve the same objective with the lowest cost. I am wondering if maybe PPB, as it comes along, and Congress maybe should be thinking about the possibility, and the Executive, of course, thinking about the possibility of applying this by having some similar kind of merger of HEW and the poverty program, HUD, and so forth. It may be one way of achieving more with the same money by providing something of this kind.

Have you had a chance to think about that, Mr. Gorham?

Mr. GORHAM. You cannot help thinking about it when you are in this business. When you develop a program structure, as we have, that has health at the top of it, you try to put everything you are doing in health. And then you realize, of course, that there are other agencies putting out money for health. OEO, for example, has neighborhood health centers—very important, helpful, useful. So PPB does highlight where various agencies are contributing to the same function. It highlights it.

It does not say a great deal about, necessarily, the efficacy of the administration. It perhaps could be turned to that purpose, but that is not its purpose now.

PPB as we formulate it also tells something when you look across target groups, people. You see, we are organized in two ways in the Government. We have people-oriented, target-group oriented units—the Bureau of Indian Health is concerned with Indians. OEO is concerned with poor people. So naturally, in OEO, they cut across other agencies' interests.

Chairman PROXMIRE. Let me interrupt to ask, do any of you gentlemen know of any instance in which the Budget Bureau, for example, has applied PPB to say that a function which has been performed in one agency ought to be moved to another—what has been per-

formed by the poverty program ought to be put into HEW, or instead of HEW into HUD or something of that kind?

Mr. GORHAM. I think they have made such decisions, but I doubt very strongly that they have grown out of PPB thus far.

Chairman PROXMIRE. Why would not that be a good way to do it?

Mr. GORHAM. It may be a fine way; I just doubt that it was done that way.

Mr. SHOOSHAN. I think a potential case may be that the Federal Water Pollution Administration was transferred to the Department of the Interior. This was not as a result of PPB. There just has not been time yet. What we are giving the BOB for fiscal 1969, from our standpoint, is the first product that we think is anything but a pilot thing. In other words, they just have not had this. I think they are going to be able to see this and of course, they have seen this through other means in the past. The Federal water pollution control decision, I suspect, on the whole was made on the basis of the magnitude of water activities in Interior to which this program is so closely related.

Chairman PROXMIRE. I am not saying PPB should be it, that you should run everything through a computer and say this is more efficient. Obviously there are other considerations, sometimes much more important. But I do say if you have this objective kind of test, you would be able, in my judgment, probably be able to save a lot of money.

Mr. SHOOSHAN. I am confident that we will be submitting suggestions, strangely enough, from our Department to the Bureau of the Budget for suggested transfers out.

Chairman PROXMIRE. That is not so strange.

Mr. GORHAM. Within our own agencies, we have made some recommendations to transfer functions from one of the subordinate agencies to another as a result of our analysis.

Chairman PROXMIRE. Let me ask you, the Defense Department is probably the prime example of PPB. The Hitch study is the one that popularized this.

Mr. GORHAM. It is the first.

Chairman PROXMIRE. They had a large body of trained analysts from RAND. Has there been a shortage of potential PPB analysts on the civilian side? If so, how do you overcome this handicap?

Mr. ROSS. Senator, I think the problem is that PPB, in application, is a combination of—judgments can vary, but my own feeling is it is somewhere between—10 and 20 percent technique and 80 and 90 percent substantive knowledge. In each of the areas in which we are all working——

Chairman PROXMIRE. What are those percentages again?

Mr. ROSS. These are my own. They probably will differ from those of the Rand specialists, but my own thought is it runs 80 to 90 percent substantive knowledge and 10 to 20 percent technique.

Chairman PROXMIRE. But if you do not have the 10 to 20 percent technique, you do not have very much, do you? You have to have that?

Mr. ROSS. You have to have that, but whether you put it in fractions between the same people or in mixes——

Chairman PROXMIRE. Is that available, the 10 or 20 percent know-how available?

Mr. Ross. I think we need it, yes, it is fairly readily available. We have the training programs that the Budget Bureau has worked out and we have pirated technicians with background from other agencies, as Mr. Gorham has done also. But even so, each of us, in our own substantive fields, has great shortages of really high powered analytical talent that is available foı use in these kinds of situations. So I think the biggest shortages are on the substantive side rather than the technical side, which we can get in part by training and in part by high leverage use of technicians.

Chairman PROXMIRE. I just have one more question, and this is a question that fascinates me and all of us on the Joint Economic Committee are very interested in it. I am wondering if, in the civilian sector, there may be trouble applying PPB because of the fuzziness of the objectives. I wonder if maybe we will not develop more problems in the future because of fuzzy objectives? What I am getting at is the CED implied—they did not directly recommend, but they implied that the Joint Economic Committee would be a logical committee to hold hearings on our national goals, to try to make our goals somewhat more precise, define them more clearly and eliminate as much of the fuzziness as possible and make PPB more applicable. I can think of two good reasons for this: One is to achieve more definite goals so that we, the Members of Congress, are aware of them. The other would be to bring Members of Congress into this very promising area, this PPB area of establishing goals, priorities, and securing objective analyses of how to reach those goals for the lowest cost. I should think something of that kind might help us achieve this. I would like to have your reactions on that. I admit it is a very broad and general question.

Mr. GORHAM. Let me just say a word about fuzziness of objectives. I think in a way, the juxtaposition of civilian as being fuzzy in objectives and the military as being clear is not valid. It would take a long time to explain, but when you really look closely at objectives on the military side, I think you move into an area of fuzziness which is not superseded by the fuzziness of objectives of our civilian programs.

But without question, there is going to be fuzziness of objectives. What you have to do is drop down from grand objectives to narrower ones.

Let me give you an example. Education. What we want our kids to be as a result of going to school is the level of objective which is the proper and the broadest one. But we want our children to be different sorts of people. We want them to be capable of different sorts of things. We have, in other words, a plurality of opinions about what we want our schools to turn out. So you drop down a level and you talk about objectives in terms of educational attainment—years of school completed and certain objective measures of quality. Here you move in education from sort of fuzzy objectives but very important about what it is that you want the schools to be doing, to the more concrete, less controversial, more easily to get agreed upon objectives having to do with such things as educational attainment, percentage of children going to college, et cetera.

I think the same thing is true in health and in social services, that at the very highest level objective, where in theory, you would really like to say something, the difficulty of getting and finding a national

consensus is so great that you drop down to something which is more easily and readily accepted as objectives.

Chairman PROXMIRE. Maybe it would be helpful, Mr. Ross, and Mr. Shooshan, for you to answer if I indicate more precisely some of the things I have in mind. Obviously, the Joint Economic Committee is not in a position to hold hearings with regard to national goals in civil rights, which divides the Congress and is not in our jurisdiction. On the other hand, we might be able to make a contribution in the area of housing. I have always wondered why we did not set an annual goal for housing starts. We talk about what we might achieve, but it might be helpful to talk in terms of what would be most desirable. We might consider goals in terms of real per capita income, in terms of reducing the number of families living in poverty, in terms of overall national growth. These are economic goals and goals that in turn might give a much more specific objective, basis, for determining the goals for your own particular departments.

Mr. ROSS. Senator, while you were out, I mentioned the fact that I feel that in the field of housing and urban development, we have been unusually blessed by serious congressional broad statements of objectives in an organized way that probably is unusually good.

Chairman PROXMIRE. We do not have, for instance, a goal for housing starts for this year.

Mr. ROSS. Now you are talking down about three levels from the kind of thing Mr. Gorham was talking about.

Chairman PROXMIRE. This is the level, though, that is important.

Mr. ROSS. Yes, but that is at a lower level of refinement. But if you look in terms of broad statements of what the Congress has in mind—for example, if you will look at the Housing Act of 1949 supplemented with the statements of purpose in the departmental status act—you can see the broadest congressional objectives for the mission of the new Department. I think, at this level, we are very well set.

If you get down to the level of what is our housing starts goal for the next year, you are really getting into a lot more than the housing policy. There you are talking in terms of not just the allocation of resources into housing, but you are talking about housing in competition with the balance of the industrial sectors, the total economy, and the balance of investment generally.

Chairman PROXMIRE. What is wrong with that? You see, what we do, we have set an employment goal, and unemployment goal. This committee, for example, said 3.5 percent unemployment should be our immediate goal and 3 percent over a somewhat longer period.

Mr. ROSS. I think, though, Senator, when you get into this level, you are starting to talk also in terms of what is our total capital investment goal the following year.

Chairman PROXMIRE. That will be very helpful. We have neglected this housing field. I think it is one of the biggest economic failures that we have, and you perhaps agree that we have fallen far short of what we should have done in housing.

Mr. GORHAM. Let me just interject. The problem is not selection of goals but what do you do after the selection of goals.

Chairman PROXMIRE. But if you do not have any goals, you do not have anything to shoot at as a basis for action. At one point last year, we were at a pitiful 800,000 annual rate of housing starts. Now we

are up to about 1.3 million but it is far short of what a national goal ought to be. We could get to 2 million, maybe 3 million annual starts.

When you have a goal, then I think the pressure for the Congress and the Executive to begin to move is far better than if you do not have any.

This is so in employment. I think one of the reasons we were able to reduce unemployment between 1961 and 1966 the way we did was because there was this 4 percent to shoot at and we designed our tax policies and other policies to hit at it. The Congress was conscious of it, the President was, business was. I think it helped us a lot.

Mr. Ross. But, Senator, at that time, the Congress was shooting for the growth goal and the unemployment goals which it could achieve and had the tools for working with it in form of tax policies and, to a certain extent, in some of the expenditure policies that were adopted during that period 1961–65. But when you start getting into more precise goals—if, for example, last year, you had set a goal of 1.5 million housing starts and put the Congress' reputation and the administration's reputation on the line for coming through with that at the time that housing was declining because of financial reasons, we were——

Chairman PROXMIRE. We would have had a much stronger weapon to combat tight interest, which killed the industry.

Mr. Ross. I think the actions we undertook in order to counter that slide were probably the same actions we would have undertaken if we had had a stated goal of a million and a half starts. We would still have fallen well below the share of investment that we would have wanted for the housing industry.

Chairman PROXMIRE. Perhaps we would have failed; if we did, we should have known about it. It would have helped us in future years.

Mr. Shooshan?

Mr. SHOOSHAN. I hate to appear to be differing with anybody. I think I understand the chairman's question. I must say I subscribe heartily to the idea that to the extent we can—and this is very difficult, I will admit—sharpen up our goals, we are all better off, in my humble judgment. I know in our own case, in working in the areas we have talked about, we have had our most difficult problems internally in trying to identify our specific goals, particularly where, say, in the water field, we have talked about seven bureaus having direct interests.

But what is the alternative? As a result of this, we are getting to a point where we are able to say that on a river basin basis, here is the supply-demand situation and this profile that we are manipulating now may soon be telling us that we are putting in not enough or too much of some things in that area as against others.

Now, on housing in terms of Indian housing, I shudder to think that when we are talking about maybe a million and a half houses, we are talking about 57,000 Indian houses that are substandard. I would like to see this thing cleaned up in one fell swoop. It seems to me you lose more of this in sputtering around in that problem. But we do not have a consensus of any sort here as to what our goals and targets are. So I could run the spectrum here but I am trying to stay within my purview.

But I would say one of the things we have had to do for our own people is try to set out some economic indicators we would use so that

everybody has some kind of planning base so that each bureau and office is not reinventing the wheel. Whether they are right or wrong, we have said we are all using the same kind of tool and they can be changed. That is the whole merit of it. I would say whether it is a housing start or any of it, you change this up and down. You have to. It is a dynamic thing. But it does give you a focal point for efforts.

Without disagreeing with my colleagues, I do think the strongest suit, and maybe that is where we get a meeting of minds between the Congress and the executive branch in any of these areas, is the pursuit of programs for which goals are identified.

Mr. GORHAM. It is not proper for a witness to ask the chairman a question——

Chairman PROXMIRE. It is very proper. The chairman does not have to answer, though.

Mr. GORHAM. Would you set goals for the rate of increase of the CPI or GNP growth? Would you set specific goals for large, macrochanges, such as that?

Chairman PROXMIRE. We do set some of those goals.

Mr. GORHAM. Do you have specific goals for the CPI?

Chairman PROXMIRE. We guessed about the CPI. Of course, our goal would be stability in the Consumer Price Index. That is what you are talking about.

Mr. GORHAM. Zero?

Chairman PROXMIRE. That would be our goal, although I think it is generally recognized that if it is one and a half percent per year or less, you are doing pretty well. We achieved close to that in the 5 years, 1961 through 1965, and it is the best performance we have had in several years and the best any country in the world has had.

Mr. GORHAM. Do you think the setting of the goal was instrumental in the achieving of it?

Chairman PROXMIRE. There is no question in my mind that setting of the goal in unemployment was very helpful. I cannot understand why it should not be helpful in all areas. It may be politically embarrassing. It might defeat a Member of Congress, might defeat a President of the United States. In my mind, that is one of the reasons why the Presidents, whether Eisenhower, Kennedy, Johnson, whoever, have not hit hard on this, because it could be very embarrasing for them. I think it would be wonderful for the public interest, because you could have these goals debated and discussed as to whether they are adequate or inadequate. Then you would have a basis for comparing achievement. I do not say you should go right across the board on goals all over the place, but it seems to me you could set far more of them than we have.

Mr. GORHAM. I would like to be the one to give the first goal. The first one in is always in the best shape. The more goals you have, essentially the less useful any one is, because the conflict among them becomes so sharp. We have that problem in the gross economic goals.

Chairman PROXMIRE. It is a matter of debate.

Also, you know, I am not so sure. Remember the old saying, the first liar does not have a chance.

Well, gentlemen, this has been very, very helpful. You are a fine panel and it has been most informative. I appreciate it.

We shall recess until next Tuesday at 10 a.m.

(Whereupon, at 12:30 p.m., the committee recessed.)

THE PLANNING-PROGRAMING-BUDGETING SYSTEM: PROGRESS AND POTENTIALS

TUESDAY, SEPTEMBER 19, 1967

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON ECONOMY IN GOVERNMENT
OF THE JOINT ECONOMIC COMMITTEE,
Washington, D.C.

The subcommittee met, pursuant to recess, at 10 a.m., in room S–407, the Capitol, Hon. William Proxmire (chairman of the subcommittee) presiding.

Present: Senators Proxmire and Javits.

Also present: John R. Stark, executive director; Daniel J. Edwards, economic consultant; and George Iden, staff economist.

Chairman PROXMIRE. The Subcommittee on Economy in Government of the Joint Economic Committee will come to order.

Today we continue with our second day of hearings on the planning-programing-budgeting system.

This Subcommittee on Economy in Government has a continuing concern with improvement in management of Government, and today we have three witnesses who are directly involved in applying PPB at the State and local level.

Our first witness today is John F. Daley, Lieutenant Governor of Vermont. Prior to his election to this position in 1965, he served 4 years as mayor of the city of Rutland.

We have as our second witness Frederick O'Reilly Hayes, New York City budget director. Mr. Hayes brings to his present position an extensive background in community program planning. From 1964 to 1966 he served with the Office of Economic Opportunity as Associate Director and then as Deputy Director of Community Action Programs. Previously he has had extensive experience in program development in the areas of urban renewal, housing and small business, and school building.

I am especially pleased to welcome our third witness, Warren D. Exo, who is a fellow Wisconsinite. Mr. Exo has served for 10 years in various phases of budgeting and management on the staff level in State government. His present position is director of management services division, in the Wisconsin department of administration.

We are particularly interested in evaluating your experience for the formulation of guidelines for Federal action.

Lieutenant Governor Daley, will you begin?

STATEMENT OF HON. JOHN J. DALEY, LIEUTENANT GOVERNOR, STATE OF VERMONT

Mr. DALEY. Good morning, Mr. Chairman.

Vermont's recent executive budget submission for 1968 amounted to $142 million, and for 1969, $195 million. And to begin with I would just like to give you some background as far as the State of Vermont is concerned as compared with the United States.

Our relatively low per capita income: for calendar 1966, Vermont, $2,590; the United States, $2,940.

Our relatively high standards for public services, per capita: for fiscal 1966, Vermont, $465; the United States, $423.

The relatively high tax effort to provide the public services demanded by Vermont's citizens: for fiscal 1966, Vermont, 12.1 percent; the United States, 10.2 percent.

Chairman PROXMIRE. As I understand it, Governor Daley, this is a comparison of Vermont with all the 50 States, is that right?

Mr. DALEY. Yes; the 50 States.

Governor's urgent need for information on the wide range of problems—better procedures for assuring that appropriate information comes to the Governor is a primary first step.

It has been well over a year now since we first began looking into planning-programing-budgeting (PPB) system concepts, and the Federal experience with them, to determine their applicability to our own State's activities. This past June, the Governor made the decision to proceed to undertake the initiation of such a system in the State government. I expect personally to be taking an active part in the implementation of the system. We are one of five States—along with five cities and five county governments—who are participating in a Ford Foundation sponsored project to determine the applicability of PPB system to the State and local government level. We look with great enthusiasm toward this experiment in the attempt to foster better government at the State level.

Through the implementation of this PPB system we will be able to:

Evaluate State programs in the context of the fundamental objectives of Vermont.

Establish priorities in the pursuit of those objectives.

Consider carefully the various optional ways of reaching our program objectives, including their relative payoffs.

Examine the full cost implications of alternative program proposals including future costs and benefit impacts.

Link planning and budgetary implementation of planned programs.

The approach will give us a systematic process of asking about all the parts of a public problem and of assessing how these parts relate to each other. We have started down the road of effective coordination of programs into meaningful packages of public services for our citizens. As we move to fuller implementation of an integrated PPB system, we expect to have a better mechanism for a total approach to the solution of public problems by harnessing more fully the resources and competency of all our State agencies.

For example, the University of Vermont and our other public colleges graduate each year young people who enter our hospitals as interns and nurses, our schools as teachers, our public welfare agencies

as caseworkers. How does the output of our colleges and universities compare to the needs of the State for physicians, nurses, teachers, caseworkers? What steps should be taken to broaden and deepen the opportunities for training for public service? Are the higher education institutions in the State contributing as fully as possible to the development of new methods of education in our schools, and medical institutions? How many capable young persons are not continuing their education? Why? And how can we best overcome barriers to continued education?

Unemployment in the State is now down to 3.8 percent (1966). The unemployment rate is, however, uneven both in different areas in the State and among age groups. Are our existing employment service programs effective in helping the unemployed find satisfying employment? Are our services of manpower training, adult and continuing education adequate? How can we best assure productive job experience to our young persons entering the labor force for the first time? What steps should be taken to match the skilled capacity of our citizens and the employment opportunities in the State? Is the income maintenance protection afforded to those temporarily out of work sufficient as a family safeguard?

Vermont ranks high among the States in its fiscal effort for public health work. Are these resources being devoted in appropriate share to the prevention of disease and injury that could reduce the toll that illness takes? Are we making full use of our outstanding medical capability?

These questions are merely a small sample of the many vital program issues that Vermont, as most States, faces, and about which we eventually expect considerably improved information from the PPB system.

It is critical that we find and use effectively the varied agency resources in the State in meeting our program objectives. Problems cut across several departments and agencies each with its separate mission but together directed toward the same broad problem. For example, if we really hope to do something about the general problem of unemployment and underemployment in Vermont, we find that upwards of 15 separate organizational entities must be involved. The PPB system, through its focus on objectives rather than organization, will be a vital element in developing a reasonably effective plan of attack. We find this phenomenon recurrent in most of our vital problems.

For a number of years Vermont has projected ahead its future expenditure requirements and the fiscal consequences of projected outlays. However, we also recognize that these projections of expenditures will be far more meaningful if they are made for objective-oriented programs and represent plans based on analysis of the most effective direction for commitment of our resources.

The systematic implementation of an integrated planning, programing, budgeting system affords us a procedure for testing how well we are doing in meeting our objectives. It is not sufficient to develop plans and program. We need tools for evaluating the consequences of what we have undertaken under authorization of our legislature so that future plans can be more effectively developed.

We need facts about our program operations. We need to know, for example, whether we are getting through our highway program the most effective transportation system for our citizens. Is our highway

program effectively assisting in the development of the natural resources with which our State is so uniquely endowed? Are the transportation outlays contributing to ease of movement of persons and goods, to safety in travel? Is it facilitating use of the State's recreational resources.

It is not sufficient to have legislative authority on the statute books at the State capitol. We need a system for continuous review to assure that we are doing well what we are trying to do. For this continuous review and the consequent revision of program plans we look to the new management tool of PPB.

Even as we initiate the processes of implementation of a PPB system in concert with other States and jurisdictions, we recognize that our expectations must be kept within reasonable limits. Perspective is needed on what a PPB system can, and should, be expected to do. A PPB system is hardly a cure-all for all the major problems of government. It is aimed at the improvement of management of government through program evaluation and selection. We do not look upon a PPB system as providing much direct assistance in the day-to-day administration and control of current operations, including such problems as the selection and assignment of personnel and the resolution of any governmental organizational or structural problems.

Even for the major management problem toward which it is essentially aimed, that is, program evaluation and selection, PPB should not, and can not, be expected to provide complete or definitive answers. We look with considerable optimism to the likelihood that it will provide the Governor, the department heads, with considerably improved information as to the full cost implications and with little knowledge as to the important results that these programs were expected to achieve. And seldom have we been able to get a reasonable picture as to the major alternatives open to us.

We do not expect the information that comes from the PPB system, certainly at any time in the near future, to provide all the information we would like. We do expect that there will be numerous and sizable uncertainties in the information provided, both because of the inherent uncertainties in attempting to predict the future and because of the lack in many areas of good historical data. Nor do we ever expect that all of the program implications will be quantifiable in any complete manner. Yes, I do expect that the Governor, Lieutenant Governor, and the department heads will still have a job after the system has been implemented. In fact, I suspect that, if anything, it will require us to work much harder—in order to be able to grasp and understand the meaning and limitations of the considerable additional information that is expected to be provided to us by the system. It seems obvious to me that there will continue to be a need for considerable judgment in making program selections, as well as in subsequently implementing successfully these decisions. We are hoping that the information provided by the PPB system will make these decisions more enlightened than they often seem to have been in the past.

The problem of executive-legislative interface in a PPB system is of considerable importance. I know that you here in Congress are particularly sensitive toward this relationship and how PPBS has, and is likely, to alter it. In Vermont, the general assembly is a major and active participant in State policymaking. We have a biennial budget with the general assembly meeting in January each odd-

numbered year. Nevertheless, the assembly and its legislative council does maintain a continuous activity in policy matters. There has been much interest among State legislators in the application of PPB systems to State affairs. I understand that in response to this interest the National Legislative Conference at its annual meeting later this month is considering legislative processes under a planning, programing, budgeting system. The factual information flowing from this system should assist the State legislative body in its tasks.

It is clear that there is no easy road to improving the management of State government. The tasks ahead in implementation of a PPB system in Vermont are many. It will take time.

We also look to this system to encourage innovation and creativity in the development of program alternatives. Despite occasional views to the contrary, we believe that if the system is properly used, it will tend to encourage our people, at all levels of the government, to provide new and useful ideas for meeting the real objectives of government.

State government in our federal system is a laboratory for experimentation and innovation. This innovation role of the States can be given new vigor through the implementation of planning-programing-budgeting systems, for it is through this system and the procedural requirement for the development of alternative program options and choices that innovation in State government will not only be encouraged, but used widely. The strength of our federal system of government in this process will be reinforced.

We in Vermont look to a system such as this to give us the first real tool to work with to project our thinking and to cut down the guesswork. And I believe our cities in Vermont will also benefit from the information that we will gather and use and help them with in turn. So we are looking toward this program as being a real help to all the 410,000 people in Vermont.

Chairman PROXMIRE. Thank you very much, Mr. Daley.

Mr. Hayes?

STATEMENT OF FREDERICK O'REILLY HAYES, BUDGET DIRECTOR, NEW YORK CITY

Mr. HAYES. New York City in starting a program planning and budgeting system has done things a little bit differently than they have been done in most other State and local governments. We have deliberately been opportunistic rather than systematic and comprehensive. We have attempted to concentrate our efforts on analysis rather than on the problem of program structure and accounting.

Chairman PROXMIRE. Let me interrupt to say, Mr. Hayes, that since your statement is a little long, I might suggest that you are free to present it as you wish, and if you desire to skip or paraphrase any part of it in the interest of time, we will include the prepared statement in the printed record of the hearings.

Mr. HAYES. Why don't I do that.

Essentially what we have done is a very, very uneven job, attempting to focus on end products and analysis, rather than the development of a basic structure of accounts.

We felt that this made sense in terms of what was available in New York. The issuance of an instruction like the Federal Bulletin 663

would not have produced results. There are very few people in most agencies who could have read it and responded. I think it probably would have suffocated the whole effort.

We have had at the same time to take on a whole series of other problems.

Let me run quickly over what we have done—we did put last February's capital budget together on a functional basis. Speaking of reactions of legislative bodies, one of the major changes the council made in the capital budget was to reprint it in alphabetical rather than functional order, and to break up the functional categories. An interesting response, I think.

Second, we attempted in every area, with varying degrees of success, to establish the universe of need, which had not been done before, against which we should measure these new projects.

The city of New York, for example, has a thousand school buildings. And we know a little bit more now than we did at the beginning of this as to what the school needs are. But basically the school budget seems to have been put together for the last several years on the assumption that the school board would ask for about $250 million, and the city would give them about $150 million, and without any real effort to tack down a long-term program.

Lastly, we began to put projects together, not initially for analysis purposes but more for demonstration and exposition, in terms of the various communities within the city of New York. When you see the city of New York as a collection of 80 cities of 100,000, this becomes, I think, very important. And these include great undeveloped areas in the city like the East Bronx, Staten Island, and even parts of Brooklyn.

In the expense budget we made some similar changes. We went to an analysis by function and objective, and attempted to provide, again, some sense of the universe of need—although not as comprehensively as in the capital budget.

And secondly, we did probes in key areas on a very, very limited budget of time and men.

In the meantime, to really get things moving, many things have been done in New York. We have set up a new Division of Program Planning in the Bureau of the Budget.

We have now started the 1968–69 capital budget on a joint team arrangement with our program planners and our engineers working with the planning commission on developing guidelines for each agency program, the kinds of questions that have to be answered, and attempting to identify alternatives and to direct attention to issues of cost and effectiveness.

We have proposed legislation that we expect to go to the legislature on next year integrating the capital and expense budgets which are now separately submitted and prepared under a separate scheme with the planning commission doing the job on the capital budget in the first instance.

We have put into effect a project information and scheduling system for capital projects, something which has been absolutely essential, because the budgeting of a project has meant almost nothing in terms of when it was actually going to be built.

We have begun the process of making more flexible and loosening up the whole process of budget modification which precedes on a line-

item basis. What this means is that a secretary who gets a $600 promotion can't get her higher check until a certificate is signed by the Director of the Budget or his designee and sent to the Comptroller's office.

We have been doing the same thing on capital projects which go through the Bureau of the Budget an average of 11 times after the appropriation is made. An architect's contract can't be let, a preliminary plan can't go forward, and final plans can't go forward into construction until they have been approved by the Bureau of the Budget.

These are all areas where we need performance specifications in an attempt to identify what we want to do, and do it more rationally.

Recruitment has been another process. We are in the middle of that now. We have, for 30 positions, something in the vicinity of 1,200 to 1,500 applicants. I hope we get some good people out of it.

Lastly, and rather important, we have a policy planning council set up with a deputy mayor, the city administrator, the budget director and the chairman of the city planning commission, and of course the mayor. This is designed to begin to take up issues that can't wait for the cycle of budget preparation, and issues that by and large are going to have to be resolved with the same kind of full cost and effectiveness analysis that goes into PPBS. We have had a $50,000 grant from HUD to work on techniques of handling complex issues before this kind of a group. And we have a very effective one that we have put through a couple of trial runs now.

On the individual cases, we are doing a number of things almost on a patchwork basis. On police, we began with an effort to see what we could do to increase effectiveness of patrol. We were operating under the assumption that more men on the street could reduce crime, although I don't think anyone in the country knows that more men on the street will definitely reduce crime.

The evaluation of efforts so far leads to results that are ambiguous. One of the things that you get with more men on the street is more crime reports. It is very difficult to find out what actually happens.

We did work out a concept—essentially the idea that the effectiveness of surveillance could be measured by the number of patrol units. And we took a crack at just about everything that went into the allocation of police manpower in this sector. And we were a little bit surprised. We programed, with the agreement of the police commissioner, a 26-percent increase in the level of the effective patrol force, the highest such increase that the city has ever had in 1 year. And we did it with an increase of about 1 percent in the total police budget. We did it by substituting $5,700 civilians for $10,000 policemen, substituting $5,000 police trainees for policemen in certain activities, discontinuing some jobs, and a series of other actions.

And incidentally, a far more interesting part, we programed 1,300 additional men on the street. We have, now, in the first 3 months of implementation, 1,500 more men, and it will probably be close to 2,000 before the end of the year.

A lot of other things have been going on in police. And I think that the key to this—I won't go over all of them—is the fact that when you get into an area that is as determined as most municipal operations are, by a traditional wisdom and standard practice, someone has to go in and do the design work on alternatives. Someone has got to really work on it.

Often, in police, you must have the cooperation of the courts and the district attorneys. For example, police work in handling prostitutes and alcoholics. Some 210 hours of an average policeman's time every year goes into court appearances. We have used the Vera Foundation in cooperation with the courts, including the State supreme court, which has been interested in it, to begin to determine alternatives and evaluate them.

We also expect to do more with police. We have discussed the problem with one of the major "think tanks" in the country, and I think we are very close to the point where we will be able to announce a joint enterprise on this.

Health services are one of the most difficult problems in the city. We operate a municipal hospital system with 17,500 beds. We spend $800 million a year in the budget on health. And most of that has gone into hospital and personal health care—through medicare, through charitable institutions, for which we budget $90 million a year into private hospitals and health institutions alone, and through our own hospital system for which we provide $360 million.

I think the key point that we have now reached is that the provision of health care must shift to explicit recognition by the city that we are dealing with a mixed public-private system, with the consumer choice of a medicaid and medicare system. This means that we are going to have to plan not for a segregated market, but for the residual needs of a customer who is now equipped to go to a private doctor, private hospital, private health institution, to the extent that they are adequate to take him.

We are now attempting to do the job of getting requirements and needs by area within the city, so that we can establish a better basis for the programing of ambulatory care facilities, replacement hospitals, and other facilities.

One of the results of this, incidentally, is that we are probably going into a system of creating some kind of a device that will provide financing for private hospitals, on the theory that this will not only provide better health care in the city, but will also permit the private, voluntary hospitals and teaching hospitals to take over the responsibilities the city would otherwise be obliged to meet.

On housing, we have done a basic design, a long-range plan related to needs, an attempt to get down to cost-benefit factors for something like 15 or 20 different methods of providing financial aid and stimulating construction of housing.

Education has proceeded pretty much on its own. It has used the firm of management consultants, Cresap-McCormack-Paget, to develop a system which is mostly an information, accounting, and budget category system.

Evaluation of cost and effectiveness is very difficult in the area of education. We are now talking about the possibility, for example, of using as one measure of effectiveness, the number of lower income, perhaps a number of Negro or Puerto Rican youngsters that actually matriculate in the university system, just on the theory that the rationale for the city's expenditures is $150 million a year on a system of higher education is largely in the area of social mobility and economic mobility.

Human resources has worked largely on the establishment of accounts—moving away from a rather obsolete budget structure.

The board of education has done a considerable amount of work. We have worked with them. They have a program structure that is primarily input oriented. It will for the first time give us an opportunity to have costs on the various educational programs and categories of educational programs.

The problem of the effectiveness is partially met by existing evaluation, but it is still, I think, very inadequate. And the whole question of alternatives in education, as far as I can see, is mostly hoping that the next idea turns out to be a little bit better than the last one.

One comment: Probably some of you read that we have a teacher's strike in New York. One of the issues at stake is the More Effective School program, which has been in effect for 2 years. The evaluation shows some of the control group schools outrunning the More Effective Schools, although the results are very murky. It costs us about $578 more per pupil on the More Effective School program, and it may well be that PPBS and adequate program evaluation to the contrary, the city may ultimately be driven to accept an expansion of the program that the evaluation will not support. It is an interesting development, and not unlike a good many other things that we face.

The fire department is a fascinating problem. I have come to the conclusion that in the fire department, except for the incremental changes, that we are still doing things pretty much the same way that we did at the time the wagons were drawn by horses. We have some 300 stations in the city, and 10,000 firemen. The data are not there, or in any other large city that I am aware of, to support even the most primitive type of analysis, on the most effective way of handling the various problems of the fire department.

We have developed conceptually and laid out two basic models which we feel are essential to any further progress. One of them is fire prediction, which is extremely important, because fire incidence and alarms are shifting among areas. The current action in slum areas has really shaken fire departments. Some of them are pulling out alarm boxes, for example.

But in an area like Brownsville, no fireman can learn to be a pinochle player because he is out on call literally all the time. This puts a great strain on resources. And all kinds of tactical systems have been developed by the fire department to handle it.

But still in terms of the basic problem of what they need at a fire, how fast they have to get there, what the containment period is—this is all traditional wisdom. The alarm calls for three and two—three pumpers and two ladders every time.

We feel that we must have the prediction model, and then must do the job of simulating response to it.

On air pollution we are well ahead, with some rather interesting results, particularly on the onsite incineration question. This is pretty much complete. We will have a program memorandum in the next 30 days that handles the air pollution problem in terms of everything from effect on rents and private investment down to government cost.

In sanitation we have a number of illustrations. One observation is that if the city had done a good advance planning job 6 to 7 years ago, and if in selecting among alternatives it had taken the worst or most costly and least effective alternative, we would have been better off today than we are. But 6 or 7 years ago the city did nothing in

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terms of handling the longer range problems on incineration and land fill. The net result is, we have a major problem just in getting rid of waste on any basis at the present time.

And we have had to go in with the development of all kinds of alternatives, some of which are interesting, like the shipment by rail of garbage out to old coal pits. The city actually has a tentative bid from a railroad on this kind of a proposition.

We have about finished the basic analysis and projection of waste disposal needs. And a good part of the problem has been tying this in with air pollution, and also with park development. It is the parks department and the conservation values that, for example, keep us from putting garbage into Jamaica Bay, which otherwise the sanitation commissioner would be certain to do.

Waste collection and street cleaning is basically a management problem. Our major finding in that area has been that it is almost impossible to find a capital substitution program that couldn't be pushed to the last straw. The faster we replace trucks or automobiles, the faster we are doing anything that cuts on labor costs, the better off we are.

As a matter of fact, just to make the point on the side, if in police, fire, and teaching anyone could come up with a robot that would carry out the function of a policeman or a teacher or a fireman, and it would cost us, say, no better than $100,000, and last for 15 years, we could make the substitution on a very economic basis. That means that we could invest $3 million in additional capital in a school, if it eliminated 30 teaching positions. And I don't think that this kind of a figure is really being exploited in most of the things that have been done in this area so far.

I will provide for the committee later the presentation that we have been using on these issues before the Policy Planning Council. We have been rather astonished at how effectively finally we could get some of these things finally down for discussion with the mayor and his chief advisers with a practical limit of an hour or an hour and a quarter. This involves reducing everything to a series of cards that fit on a magnetic board. It really is a matrix. And on an issue like onsite incineration, you have everything from projections of need on both the amount of waste that you add by cutting out apartment house incinerators, the cost to apartment house owners either for getting the additional rubbish out to the street or handling it inside the apartment house, the cost of upgrading incinerators, and all the rest of it. We can get all of this in really coherent form on one board that measures, say, roughly about 6 feet by 3 feet. With a skilled individual handling it, it works very, very well.

I think that I can conclude about there. This is at least a rough summary of where we stand. We obviously expect to do a lot more things over the course of the next year, and I think we are going to be able to do them.

I suspect our largest problems are going to come in attempting to do some of the things that we have avoided doing so far. And that is the construction of the information systems and the accounting back-up, the whole structure of plan and program in the agencies themselves. The capacity of the bureau of the budget in the city to take

on the kinds of responsibilities that this involved for them is, I think, great.

But to really make this sort of a thing go, the chief battleground is in the agencies themselves. We are probably going to have to move to setting up deputy assistant commissioners for program planning, and do a very extensive recruitment job to get the right people in. And we are going to have to spend a lot of money on it.

I don't think there is any way that that can be avoided.

I think we are making progress.

(The prepared statement of Mr. Hayes follows:)

PREPARED STATEMENT OF FREDERICK O'R. HAYES

PPBS IN NEW YORK

New York City in initiating a programming-planning-budgeting system, has pursued a strategy sharply different from that of most other State and local governments. Our overall approach has, deliberately, been opportunistic, rather than systematic and comprehensive. We have concentrated our efforts on analysis, rather than on program structure and accounts, and we have focused on sectors of high apparent yield. The City, after an intensive effort over a full year, has yet to issue any formal PPBS instruction comparable to the Federal Bureau of the Budget Bulletin 66–3.

One reason for this approach was the conviction that the massive effort to classify expenditures by program category, to articulate and quantify program objectives, and to establish the mechanism of this program plan, all on a government-wide basis, would literally suffocate the basic concept of PPBS as a means of rational choice among alternatives. But more important, our strategy was based upon a recognition of realities—the strengths and weaknesses, the constraints and limitations inherent in the existing pattern of municipal government.

The Federal Government, in initiating PPBS, had in its agencies and departments: (1) a highly developed budget making capacity; (2) long experience in budget administration; (3) information systems of varying quality; and (4) some experience in program planning and development. These conditions do not prevail in New York or in most other municipalities. There are many reasons for this. The centralization of budget control, the line-item basis for budget construction and administration, the predominance of established practice in key municipal programs (e.g., Police, Fire, Sanitation), and the lack of funds for innovation or experimentation have all contributed to the limited capacity of most operating agencies in planning, programing, budgeting and data handling.

The capital budget submitted by the Mayor on February 1, 1967 contained the first steps toward change. Among these were:

1. An analysis of the capital program by function and objective.
2. An effort to establish the universe of need—the proximate goals—against which new projects were directed.
3. A review of projects by community area within the city.

Changes of similar character were made in the expense budget submitted to the City Council on April 15th.

1. An analysis of the budget by function and objective.
2. PPBS "probes" in key areas.

At the same time, parallel changes were being made in organization and procedures:

1. A new Division of Program Planning was set up in the Bureau of the Budget.
2. The preparation of the 1968–69 Capital Budget was initiated through program teams jointly staffed by the Bureau of the Budget and the City Planning Commission. The teams have established guidelines for each agency to relate capital proposals to program objectives, to identify alternatives, and to direct attention to issues of costs and effectiveness.
3. Legislation has been prepared for the next session of the State Legislature to integrate the capital and expense budgets and in effect to assign full responsibility for budget preparation to the Bureau of the Budget. (The capital budget is currently prepared, in the first instance, by the Planning Commission and subsequently reviewed and revised by the Budget Bureau to accord with the policies and views of the Mayor.)

4. A project information and scheduling system has been put into effect for capital projects—a most important step, not merely to expedite City construction efforts, but also to provide a basis for introducing time as an important variable in program analysis.

5. A new system of budget modification has been introduced to increase agency management responsibility and to permit budget staff to focus on key policy issues. Similar changes have been made in the execution of the capital budget.

6. An intensive recruitment effort has been begun to strengthen the capacity of the city to undertake a program-planning and budget system. There are, as a result, over 1200 applicants for the pending examinations for budget examiner, roughly four times normal expectations. New civil service titles are in process of establishment for the economists, operations researchers and other key skills needed for PPBS.

7. The Mayor has established a Policy Planning Council including the Deputy Mayor, the City Administrator, the Budget Director and the Chairman of the City Planning Commission. Techniques are being developed, with the aid of a $50,000 Department of Housing and Urban Development grant, to handle major issues of greater immediacy on a basis linked with PPBS and with same full cost scope.

Our progress in the various substantive program areas is uneven. Better analysis and better knowledge often uncovers problems more difficult than those initially evident, and our approaches to specific functional areas have varied according to the nature of the problems and challenges these areas pose for the city.

Police

The aim of the 1967 Budget probe in Police was to identify and cost out the actual level of regular police patrol throughout the City and to define and evaluate alternative means of increasing that level. The concept of the Effective Patrol Force was developed by the Budget Bureau and Police Department, and as a result of this analysis the 1967–68 budget programmed a 26 percent increase in the level of the Effective Patrol Force, the highest such increase in the City's history, at a cost of about 1 percent of the total Police budget.

Yet, the Police Department constitutes only one link in the complex and inter-related, inter-agency system of criminal justice. In many areas, the ground rules are dictated by the courts and district attorneys. To meet these problems, the Mayor established a Coordinating Council on criminal justice and engaged the distinguished Vera Institute of Justice to work with the cooperation of the courts on the development of more effective systems in criminal justice. The introduction of a rehabilitation program for alcoholics under the Vera Foundation and the discontinuation of traditional police apprehension of alcoholics has greatly reduced the demands on policy manpower in this area. The courts have instituted a 24-hour arraignment system in Manhattan and established a release-on-recognizance program which is designed to eliminate unnecessary bail and detention. Both projects are being monitored and evaluated by Vera. Vera is also working on the problem of system-wide, inter-agency information needs for the criminal justice system. These activities are of critical importance to PPBS in its application to criminal justice as they develop new alternatives to the procedures of a presently compartmentalized system.

The overall analysis of police problems has attracted the interest of a major research organization and we are exploring the possibilities of expanding the current effort as a joint project.

Health Services

The extensive program of health and medical services provided by the City of New York was built upon the assumption of a rigid separation between those able to pay for care and, hence, served by the private sector and the indigent dependent upon the city. With the advent of Medicaid and Medicare, and the spread of health insurance, this division is rapidly disappearing. Municipal health services must now meet the test of the market and of consumer preference. The needs of the medically indigent can frequently be as well served by private vendors of medical services as by the city. The City is now engaged in a massive re-design of its health programs reflecting the new conditions and the need for extensive and complex private-public mixer in the provision of services.

Initial PPBS efforts have centered on developing the foundation basic to both cost-benefit analysis and the establishment of a program-planning-budgeting system for Health Services.

Administration of the Health Services budget is scattered throughout several City agencies, and the first task has been to analyze the relationships between

these components to relate public and private resources, to define and analyze health problems in programmatic rather then departmental terms.

A second effort has begun to identify program objectives which can ultimately be related to quantifiable measures of output and program effectiveness. One of the interesting achievements in this area has been in the field of Narcotics. In co-operation with the Office of Coordination of Addiction Programs, the Budget Bureau has developed a program scheme which identifies and projects program inputs and outputs as well as program costs, and which incorporates first-generation measures of efficiency and effectiveness. The program plan and projection is now being developed along these lines.

In addition, a cost-accounting system will shortly be installed in the municipal hospitals which, if effective, will be extended to other health services facilities. And work has begun on the construction of a requirements model to assess the effect of changing population trends and new government programs on the demand for health services by City residents over a multi-year period.

Housing

We have set out, in the housing area, the structure for and projection designed to deal comprehensively with the needs, resources, costs and impacts of City housing programs and policies. The program plan will attempt to: measure and describe housing needs; identify and project city housing commitments, the existing inventory, and probable private construction and relate these elements to need; and identify and project alternative program inputs, costs and outputs.

This is an effort to assemble, relate and analyze key housing information in a contract of maximum operational and policy relevance. A special study on the issue of tax abatement is being completed for the Policy Planning Council.

Higher Education

The Board of Higher Education was the first city-financed agency to initiate work towards the establishment of a program-planning-budgeting system. With the assistance of a management consulting firm, the Board prepared and submitted a program analysis of its budget request for the fiscal year 1967–68. Major emphasis has been placed upon the construction of budget program categories supported by an appropriately modified information and accounting system. Both the Board and the Budget Bureau recognize that this effort represents a significant beginning and not a final product. At this stage, the system is oriented more toward inputs than outputs. Alternatives cannot be clearly identified or costed and impact cannot be measured on a comprehensive basis. All of these problems are typical of the difficult adaptation of the PPBS structure to the problems of education. An extensive analysis of this problem has been completed by Bureau staff over the course of the summer and the futue direction of PPBS is now under review and discussion by both the Board and the Budget Bureau.

Human Resources

This adminstration was the first City agency to launch its own PPBS effort without outside assistance. It presented for the fiscal year 1967–68, a completely new budget structure which identified expenditures by functional program areas and objectives. This has been a remarkable accomplishment for an agency which has virtually had to organize itself from scratch, and which is charged with administering some of the City's most critical and innovative programs.

Board of Education

The Board of Education has engaged the Stanford Research Institute to develop a program-planning-budgeting system. The initial phases of this work are now well along. The new system will provide, for the first time, reliable cost data for both geographically and functionally defined areas of operation. A generally acceptable program structure has been designed which is primarily input oriented, but carries sufficient flexibility to identify measures of output as they are developed. The major problems continue to be the design of alternative approaches to education and of an evaluation system which will provide adequate indicators of effectiveness for both existing programs and the various special incremental program such as the More Effective Schools. Some additional problems are imposed by the prospective decentralization of responsibility within the educational system by virtue of legislation enacted during the last session of the State Legislature.

Fire Department

The Bureau of the Budget has worked with the Fire Department in the development of the conceptual framework for two basic analytic models. The first aims at the development of a satisfactory method of predicting or projecting the probable level and instance, in terms of geographic area, and time of fires, false alarms and emergencies for the next five to ten years. This is, in our opinion, a feasible venture and absolutely essential to a resource deployment strategy approaching optimum cost-effectiveness mixes. The second analysis aims at the evaluation of alternative resource-allocation strategies to meet the need predicted by the first model. This is a difficult and complex venture, dependent in many respects upon data such as fire containment periods, response time and its relationship to effectiveness, etc., that we do not now have. This approach has been developed with the assistance of interested members of the Fire Research Advisory Committee of the National Academy of Sciences. We hope to proceed with the development of both models shortly.

Air Pollution Abatement

New York City enacted new basic air pollution control legislation early in 1966 with staggered subsequent dates upon which its basic provisions became effective. Problems, incident to enforcement, indicated the need for a comprehensive review of the program, its probable effectiveness and its impact upon both rents and City costs. The On-Site Incineration provisions have already been so analyzed and discussed before the Policy Planning Council.

On site incineration accounts, however, for one-sixth to one-fifth of the particulate matter in the atmosphere. A similar analysis of other pollution sources is now being completed for presentation to the Policy Planning Council.

Sanitation

Waste disposal, one of the major programs of the Sanitation Department, has been carefully analyzed for discussion before the Policy Planning Council before the end of this month. The issues involve not merely costs and effectiveness but also the impact of absolute intermediate term constraints on land fill and incinerator capacity. The Department has vigorously sought alternatives and supplements to present disposal techniques; it has as a result (a) developed an arrangement for rail shipment of solid waste for out of city land fill, (b) received Federal financing for an experimental incinerator, and (c) explored a new low pollutant design for open pit burning. Decisions have tentatively been made for the phasing out of two small old high cost incinerators. The entire issue of waste disposal is, of course, intimately related to air pollution abatement.

Waste collection and street cleaning have not yet been fully reviewed in terms of cost-effectiveness impact and long term requirements. However, decisions have been already made on a new design sanitation truck with 25% greater capacity and low maintenance features; the Department intends to immediately replace 60% of the existing fleet and drastically cut the normal period of useful life because of the indicated effects on maintenance and productivity.

Other Areas

At the same time, the Bureau of the Budget has applied the same techniques of national cost analysis to many issues of narrow scope and impact.

An analysis of motor vehicle usage, operation and maintenance supported a 20% cut in vehicles and drivers, a new one year replacement policy, and a new purchase policy aimed at maximizing re-sale value.

A review of alternative sources of asphalt supply led to the using of one asphalt plant with unit costs substantially above those in the private market.

To carry on work of this character, the Bureau of the Budget has established a yardstick cost program. This program will measure the efficiency of various appropriate activities by comparison with the best experience we are able to identify in private industry or in other governments.

Short-Term Policy Issues

We are in the process of developing another tool to deal with shorter-term, more specifically defined policy issues within the context of the PPB systems we are developing with the various City agencies. The Mayor has asked the Policy Planning Council to act, in effect, as a sort of Board of Directors for the Administration in defining, considering, and acting upon major near-term policy issues confronting the City Government. The Policy Planning Council will consider a number of issues over the coming months, including the problem of refuse management, the

problem of setting City strategy on air pollution control, and the use of tax relief as a tool of City policy in the area of middle income housing.

The staff research and systems analysis for each issue will be done by members from the Budget Bureau's Program Planning Unit, the City Planning Department, and the City Administrator's Office, working with a private consulting team which has developed a new technique of graphic issue presentation. The issues to be examined are selected for intensive and systematic cost-benefit analyses within the framework of the broader programming-planning-budgeting systems we are developing, and should substantially supplement our work in that area. I have brought with me a copy of the analysis presented to the Policy Planning Council at its meeting on the issue of On-Site Incineration and Air Pollution.

This rough summary of our efforts to date omits many areas in which we feel we are making progress. One other area merits particular comment.

The creation and renewal of its public facilities is central to the City's concern. Almost no major program can achieve its objectives without reliance on physical plant to house its activities or heavy equipment to support them. New York has been notorious for its inability to get capital facilities built quickly. Last winter, the Budget Bureau and the Department of Public Works employed Meridian Management, a consulting engineering firm, to design and implement a capital facilities management system which would permit the City to identify systematically cost and time hurdles in the execution of its projects. We have set standard target cost-and-time schedules for capital facilities, and determined milestones for the completion of individual projects. For the first time the City has been able to establish and monitor a comprehensive system of priorities in implementing its capital plan. And, the work of City agencies with Meridian has resulted in significant streamlining of the construction process through the identification and elimination of unnecessary procedures.

The Future

During the course of the next year, the many bits and pieces of a PPBS approach must be welded into a genuine system. We feel confident of the capacity of the Bureau of the Budget to deal, by the end of this period, with this approach on a budget-wide basis. Our uncertainties relate to the speed with which comparable capabilities can be built up in the operating agencies. This is a matter not merely of planning staff but also of the information and management systems needed for program design and implementation.

In New York, PPBS should be regarded as one aspect of an overall program to raise the capacity of the municipal government to deal effectively with the problems of the City. New York City faces tremendous problems, and its government operates under tremendous pressures. To cope with labor problems, revenue crises, and the possibility of a long hot summer at the same time that we try to restructure the budgetary and management systems of the City severely taxes both our personnel resources and our financial resources. We cannot afford to invest personnel or money in any effort which will not pay off in the short run as well as the long run.

The tension between the desire to do a comprehensive, professional job from the bottom up and the necessity of getting tomorrow better answers to our problems in health, education, housing and law enforcement than we had yesterday, is always with us. It is probably a healthy tension, though it constrains us.

The future of PPBS in New York City very probably means another year like the one we have just finished. We will pick up more momentum, and the PPB approach will in fact help us to find better answers to more problems tomorrow than it did yesterday. We will still be desperately short of funds to invest in the development of new systems, and desperately short of good people to make the systems work. The builders of Rome, when told it could not be done in a day, must have answered that at least a part of it was built that day.

Chairman PROXMIRE. Mr. Exo?

STATEMENT OF WARREN D. EXO, DIRECTOR OF MANAGEMENT SERVICES, DEPARTMENT OF ADMINISTRATION, STATE OF WISCONSIN

Mr. Exo. I am pleased and honored to be invited to appear before your committee today to share with you some of the experiences we have had in Wisconsin in implementing a planning, programing,

budgeting system. Mr. Wayne McGown, secretary of the Department of Administration of Wisconsin, who was originally asked to appear before your committee, was unable to accept your invitation because of previous commitments.

In his original letter extending an invitation to Wisconsin to appear before your committee, the Chairman asked us to discuss specific cases where a planning, programing, budgeting system has been applied to State programing in Wisconsin. Let me say at the outset that, while we are pleased by the progress our State has made in shifting toward a more meaningful budget process utilizing the concepts of PPBS, I would be less than candid if I gave you the impression that we had fully achieved the implementation of these concepts.

First, let me explain why we in Wisconsin believe that a new system of State budgeting is needed and why we think the concepts of PPBS will meet those needs. Secondly, I would like to describe Wisconsin's goals for implementing PPB and what we have done to achieve them. Finally, I would like to discuss projects underway which illustrate the impact of PPB as well as offer some suggestions where we think this process will lead us.

The Need for PPBS in State Government

Fundamentally, budgeting is a decisionmaking process. First of all, it serves as the means for top managment to plan the future programs and services of their agencies. Secondly, it provides a continuing vehicle for both executive and legislative branches of Government to review existing policies and to make comprehensive policy decisions about the needs of Government and the ways in which those needs will be met.

With respect to this policy decision making role, let me make it clear that we in Wisconsin look upon PPBS as a means for achieving economy in government, but economy in a very positive sense. By that I mean that we do not consider PPBS as a convenient and simple tool for meat ax approaches to budget cutting. Rather, we see it as a way of rationalizing the decisionmaking process in a way which will assure that decisionmakers fully understand the service goals of State programs and will be able to relate the proposed level of spending to those goals. In our view, then, PPBS is a way of insuring that appropriations will be wisely and efficiently used to achieve stated objectives in the most efficient manner. While budget cutting can be accomplished with any system, we believe it is important that decisionmakers fully understand what the program effects will be of decisions to either cut or expand proposed levels of spending.

Another need we believe a PPB system will satisfy is to serve as a means for monitoring the manner in which past budget policy decisions have been executed. Under older systems of budgeting, where appropriations were granted in terms of how much money agencies were authorized to spend for personnel, materials, and equipment, there was virtually no way of determining how efficiently programs were executed or how effectively program objectives were achieved. A PPB system which expresses program objectives and relates those objectives to relevant output measurements, can meet this need by requiring agency administrators to report results and accomplishments measured against previously stated objectives.

A final advantage we see in the shift to a PPB system is the vast improvement it makes in the ability of citizens to understand the programs of their State and to comprehend and participate in the budget process. Wisconsin has a long and proud tradition of citizen interest and participation in government. To the extent that PPB can expand this understanding and participation, implementation of these techniques will have strengthened this tradition and achieved a broad public purpose.

The successful implementation of the program budget in Wisconsin to date has already stimulated one columnist to observe:

> It can be said . . . that the budget making process in Wisconsin today is more careful and deliberate than ever before in its history . . .
>
> . . . The all-important process of distributing state funds in appropriation laws is now more refined and accurate and most of all, understandable, than ever before. The most untrained legislator, the greenest state-house reporter, no longer has any excuse for failing to comprehend. It is clearly set out for all to see who want to see.
>
> Wisconsin may be spending too much or too little, taxing too much or at a reasonable level. But for the first time in modern history, perhaps, the men chosen to make such decisions are in a position to know precisely what they are doing.

As you gentlemen realize, it is not often that a political reporter will be so complimentary about a newly developed technique for management and policy decision making.

Chairman PROXMIRE. Who is that, John Wyngaard?

Mr. EXO. Yes, sir.

WISCONSIN'S GOALS AND PROGRAM FOR IMPLEMENTING PPBS

Wisconsin is deeply committed to the full implementation of a PPB system. This commitment began even before the term "PPB" was coined. It began, in fact, in 1961 when the budgets for several Wisconsin agencies were reshaped into a program format.

A key element in this commitment was a rare display of joint executive-legislative leadership and cooperation. This cooperation took the form of providing strong joint support for the efforts of the State budget office staff, which for several years previously had been carefully developing the tools and techniques for recasting the old line item budget into a new program format.

An equally significant aspect of this cooperation was the fact that during this period there was a division of political parties between the executive and legislative branches. An explanation of these early efforts, together with a description of the rationale and intent of Wisconsin's comprehensive program budget, is well explained in an article coauthored by former Gov. John Reynolds and the Senate cochairman of the legislative joint finance committee, Walter Hollander. This article appeared in the autumn 1964 issue of State Government, published by the Council of State Governments. Copies of this article have been supplied to your committee staff. (See appendix 2, p. 243, for article referred to.)

To give a better idea of how Wisconsin has moved to implement the concepts of PPBS, let me describe some of the steps that have been taken thus far. The first fruits of the initial program budgeting efforts were realized in 1965 when the State's budget—framed in a total program format—was considered and enacted by the Governor and the legislature. For the first time Wisconsin focused its appropriations

and allocated its resources in a form that concentrated on the objectives of the State and the services to be provided.

Prior to that time the budget was not a formulation of agency plans, but rather a mechanical exercise in which State agencies took the dollar formulation of plans and recategorized the dollars into a rather meaningless set of appropriation accounts which did not in any way reflect the proposed accomplishments of State programs. Thus, the budget had become a reformulation of the dollars rather than a dollar formulation of program plans. To a great extent the key policy decisions on program plans were made prior and external to the budget formulation process. As a result, important policy decisions often lay buried in the mass of detailed characteristic of the line item budget.

Our solution to this problem was to develop a rationale which defined the program according to a framework which corresponded to the structure within which agencies planned. This rationale was based on the phrase "what, for whom, and how." In other words, in analyzing agencies programs we asked the question, "What are you doing?" and then, "For whom are you doing it?" Finally we asked "How are you doing it?"; that is, by what administrative technique? By applying these questions in a detailed analysis of State agency operations we developed a comprehensive format for restructuring budget categories.

At that stage, then, we had achieved one important aspect of the overall concept of PPB—the creation of a rational budget format which could provide the basis for more meaningful budget planning and policy decisionmaking. This step has already been acclaimed. In his budget message to the legislature last February, Governor Knowles stated:

> The program budgeting system has enabled me to thoroughly understand the purpose, objectives, and methods of state programs and to evaluate past and proposed accomplishments against the costs of those programs.
>
> The emphasis this system places on programs and their objectives serves to bring the important policy issues into sharper focus. It is the resolution of these policy issues that is the crux of the budget process.

Now that program budgeting is a reality, Wisconsin has moved to build upon the decisionmaking base that program budgeting provided. In 1965 a program planning component was created in the State budget office to make full use of the program budget as a planning tool and to make planning an active contributor to the policy decision process.

Even more recently, in fact in the last 2 months, a further major step has been taken toward adding planning as a second dimension in Wisconsin's drive toward full implementation of PPBS. A comprehensive reorganization measure was enacted by the legislature which consolidates nearly 90 separate State agencies into a functionally devised structure of 26 State departments. This functional integration in itself should provide a better framework for program planning. In addition to this functional realinement, one provision of the Reorganization Act transferred the full responsibility for State comprehensive planning to the department of administration where it will be closely integrated with the budget process.

Two other steps have been taken to build Wisconsin's capability for implementing PPBS. Early in 1966, a management sciences unit

was added to the range of services in the department of administration. Resulting in large measure from the recommendations of a businessmen's task force studying State government operations; the purpose of this unit is to stimulate the use of modern scientific techniques in managing State government activities and to help formulate the quantitative measurement tools necessary to develop the programing dimension of PPBS.

Another dimension to the budget policy decision process has recently been added. Massive budget documents can tend to obscure the major policy decisions implicit in the budget. As an aid for the legislature to better understand and act on the major policy issues, a series of papers explaining the Governor's budget policies were provided to the legislature. We found that these papers, which outlined the broad policy areas, provided background information related to the policy area, and stated the Governor's policy decision, have been enthusiastically received by the legislature. One leading legislator claimed that the policy papers provided him the ability, for the first time, to truly understand the policy ramifications of the budget. Because of the new format, which concentrates attention on broad program areas, and through the use of these policy papers, legislative budget hearings now focus primarily on the policy issues. Consequently, legislators are better able to fulfill their responsibilities as policymakers.

I apologize for what is probably an overly detailed description of Wisconsin's concept of PPBS and the past efforts that have been made toward implementing these concepts. I think it is important to understand, though, that while Wisconsin has not fully implemented PPBS, we are in the process of doing it.

To summarize this progress, I believe that we have accomplished several things. First of all, the budget process has already brought about significantly better executive and legislative decisionmaking. Decisions are now increasingly made on the basis of expected program outputs and results rather than on the basis of detailed inputs. Second, we have begun to develop the staff capability and the analytical tools necessary to refine this process.

What we still lack are the quantitative tools with which to measure the scale and results of predicated outputs. In other words, we need to develop the means to add substance to the framework which has been established in order to systematically relate past accomplishments to planned future action. We need to be able to relate present decisions to future plans and alternatives so that current decisions provide the flexibility to respond to future changing needs.

Future Plans and Programs

In seeking to add this substance to the framework already established, a number of steps are planned to continue the process of implementing PPBS concepts. First of all, we plan to refine our present program format. This revision follows the comprehensive reorganization act which I have already described. In addition, we have begun to realize that the original rationale for defining programs was not completely adequate in all cases.

Secondly, we expect to substantially strengthen agency program planning capability. Responsive and responsible government depends

upon the ability of the elected decisionmakers to control and chart the direction of Government activities. This requires a solid base of thorough operating agency plans which are systematically reported to the Governor and the legislature. Since agency functional plans are the building blocks of a State comprehensive plan, it is vital that a strong emphasis be given to the development of a planning capability and process within line agencies. We have already developed a comprehensive planning guideline for this purpose. Seminars and workshops will be held to formulate a common concept of the planning process and its product.

In the past, most State agency plans have been focused on physical facilities, and not around the program services that generate the need for facilities. Agency program planning should first examine the level of program services needed in the future years, explore alternative methods of providing those services, and only then identify the facilities needed to carry them out.

Two steps have already been taken to expand this planning capability. First of all, partly at our urging, the Department of Housing and Urban Development has revised its planning guidelines to permit greater flexibility in the way States may allocate Federal 701 planning grants for their comprehensive planning programs. This will assist Wisconsin in its commitment to strengthen its program planning capabilities. Secondly, Wisconsin's current budget set aside $300,000 as a State commitment to strengthening its overall planning programs.

In order to develop the technical capability to carry out this planning, we intend to conduct a variety of training programs throughout State government to develop agency staff capability to perform this vital function.

Another short-range effort will be to add to and strengthen our analytical abilities for defining more meaningful expressions of program results and developing the necessary criteria with which to measure them. This, to us, is the toughest aspect of implementing PPBS concepts. Simply creating the new budget format has not in itself been an easy task. But the development of relevant techniques of measurement will be even more difficult. This will require the use of sophisticated systems analysis techniques. It will probably also require the creation of mathematical models with which to test alternative courses of action. It will certainly demand the development of better information systems—which in turn should lead to the creation of an integrated management information system. These efforts will require the skills of professional mathematicians, economists, systems engineers, and other disciplines which are not now commonly employed in State government, and because these skills are in such short supply, these tasks will be doubly difficult.

Finally, what we hope to do in the near future is to integrate the budgeting and planning and decisionmaking process. As we understand it in Wisconsin, this is the heart of the PPBS concept. In Wisconsin, as in most other States, budget decisionmaking has focused on the allocation of funds to meet short-range objectives. At the same time the planning process has concentrated entirely on the very long-range future—usually 20 years. Thus, while short-range budget allocations are often made with little knowledge of their longer range implications, conversely, long-term planning has often not dealt realistically with short-range needs and the political context

in which decisions are made. Thus, budgeting and planning have neither served nor complemented each other. By combining these central planning and budgeting functions into one organizational relationship, and by strengthening both budgeting and planning capabilities in operating departments, we believe that we can achieve a workable and meaningful integration of these two component parts of the PPB system.

I might add that the State of New York has probably progressed farther than any other State in the development of a systematic method of integrating budgeting and planning in a structured time cycle. New York has developed a six-phase annual cycle for integrating the planning and budgeting process and has established immediate, short-range and long-range time scales and integrated reporting processes with which to relate the two.

Long-Term Development Plans

If these short-term efforts succeed, as we believe they will, they should provide the basis for some longer term objectives we have established in achieving a comprehensive, integrated, workable PPB system. One of these long-term objectives, which should both contribute to and help refine our PPB system, is the development of an integrated management information system.

While we have already begun these efforts, the development of a total statewide management information system appears to be a number of years distant. Yet the beginnings of this process appear promising.

For example, the Wisconsin Transportation Department presently has underway a large scale, comprehensive study of the department's planning and management system. Undertaken by a leading management consulting firm in conjunction with the department staff, this study is aimed at developing an integrated information system for the department's management and decision processes.

A similar study is now underway to develop a modern management information and control system in the Wisconsin Department of Health and Social Services. The study's objectives are to create an information system that will supply the necessary management tools, provide timely information, employ uniform control concepts, identify cause, effect, and trends, and fully integrate planning, reporting, and program control techniques.

In still another project, Wisconsin is working with the IBM Corp. to apply computer technology and systems analysis techniques to the State's information needs. This multiyear pilot project will evaluate the State's needs for management information and design an integrated management information system. In our preliminary evaluation of existing State information systems, we have found that even though the State is paying enormous sums for information gathering, only a limited amount of that information contributes significantly to management and policy decisions. Inadequate information, then, may be caused not so much by inadequate investment in necessary information gathering as it is by inadequate direction and evaluation of current information systems.

These long-range studies, we believe, will contribute significantly to the overall development and implementation of PPBS. By design-

ing new meaningful management systems, they will provide a key element in our Wisconsin PPB system—relevant, useful, management information. They should serve two other purposes—developing agency capability for utilizing information systems in planning and budgeting and, second, serving as prototypes for similar efforts in other departments.

A second long-range effort will be to work with other governmental jurisdictions in developing inter-governmental PPBS systems. As you may know, Wisconsin is currently participating with four other States, five counties, and five local governments in a pilot project to demonstrate the feasibility and usefulness of program budgeting for State and local governments. This study is being undertaken because it is believed that the full benefits of the process at the national level cannot be realized without counterpart efforts in States and localities. Each participating jurisdiction is using the tools of PPBS in developing multiyear program and financial plans to aid decision-makers in allocating resources. Beyond this, we hope that once Wisconsin State government has developed an effective PPB system, it can assist its own local governments in realizing the benefits of these techniques.

Target Dates

If we can acquire the necessary skills, it is our hope to complete development of the component parts of a PPB system and achieve implementation of a comprehensive process by the middle 1970's. As I implied earlier, however, this does not mean that we will have put together a final systematic process that can then function easily by itself. Budgeting and planning are dynamic processes and the needs of that period may be quite different than those of today. Therefore, it is virtually certain that refinement and further development will continue to be necessary if these tools are to remain useful in the governmental policy decisionmaking process.

What PPBS Has Accomplished in Wisconsin

Having described the historical development of PPBS in Wisconsin and explained the goals and plans we have for its future refinement, let me illustrate briefly how the steps we have taken have produced meaningful results.

Although our progress toward implementation of PPBS is still quite incomplete, the program budget format itself, together with new analytical techniques and the focusing of attention on policy issues, has upgraded the legislative decisionmaking process. Let me cite two examples of how our system has produced comprehensive analytical evaluation of broad policy issues.

In the area of vocational, technical, and adult education, Wisconsin is seeking to revamp patterns of post-high school education by 1970. The approach for changing this emphasis has been basically to use the combined planning, budgeting techniques inherent in PPBS:

1. To define the needs and present capacity to serve them;
2. To reach agreement on the desirable outputs, particularly the educational values to be achieved; and,
3. To appraise realistically the costs necessary to achieve these values and bring these costs within the capacity of our resources to accomplish them.

Our proposed value states: Vocational education opportunities should provide the student with the financial ability to sustain himself and his family after completing the initial learning experience. The value—sustaining oneself—is universal both to the individual and society. Furthermore, education for productive work is one of the greatest needs of our society. Acceptance of the value implies that we have reached agreement on desirable outputs and that recognition has been given to society's needs. We then analyze this agreement by determining the costs necessary to achieve the values, particularly in the framework of our State's resources. Elements which will determine costs are derived from criteria which, in turn, will evaluate the relative achievements of the value when considered in a fiscal context—in this instance the financial resources of vocational school districts.

A second example will illustrate legislative uses of PPBS concepts. In the recent legislative session the University of Wisconsin Medical School requested funds to move its entire facility to a new location. The request was directed to an interim body of legislators. Normally, the decision to move or not to move would have been based upon space analysis calculations. Today, because of its experience with program budgeting, the legislature is no longer satisfied with this criteria alone. Rather, it has sought development of a master plan for statewide medical education and has asked that the specific role of the medical school be placed in the broader context of statewide medical education.

In the past, the budget submitted by the State's educational institutions permitted decisionmaking in form—consideration of the number of books purchased, teacher-pupil ratios, the proposed purchase of laboratory equipment and classroom supplies. The examination that took place did so without reference to a framework of output objectives. By contrast, today's requests are set in broad program terms: teaching underclassmen, financial assistance to students, continuing education for adults, research for industrial application - substantive matters for the decisionmakers.

Conclusion

These examples illustrate that Wisconsin has indeed achieved significant benefits from its efforts to implement PPBS concepts. However, as I indicated at the outset, we have in no sense "arrived." But with the support and cooperation given us by Governor and legislature, we believe Wisconsin can progress steadily in the development of the sophisticated tools necessary to refine and make this process truly useful, particularly to elected decisionmakers.

Finally, let me point out one area in which we believe Federal policy should be modified to permit States to more fully utilize PPBS concepts. I am referring here to the restrictive provisions of some existing grant-in-aid programs. Certainly States should recognize that the Federal Government provides these programs in order to achieve broad national goals, and that this necessitates spelling out criteria for the States to meet in assuring that these goals are realized. But where these criteria impose priorities on States or force States to organize or devise data and accounting systems which clash with other State practices, they prohibit the kind of flexible decisionmaking which balances and selects among alternative courses of action.

I appreciate this opportunity to appear before your committee. I hope this presentation has been of some value.

Chairman PROXMIRE. I have the impression from all of you gentlemen—and certainly from your paper, Mr. Daley, to begin with—that whereas there was some enthusiasm and some interest on the part of the legislature in the planning, programing, and budgeting system, that it was primarily useful to the Governor and to the administration heads, the agency heads, and that they were using it far more than the legislature was.

At the same time you also indicated that this was a system that was peculiarly useful for policy decisions, rather than for, as you put it, day-to-day administrative decisions.

Under these circumstances do you think that there is much prospect in Vermont that the Vermont Legislature would take a greater interest, have a greater knowledge, and be able to come to more rational decisions based on the kind of more precise and objective definition that PPB can give?

Mr. DALEY. I certainly do, Mr. Chairman.

Chairman PROXMIRE. Is there any evidence so far that you are getting a more objective debate or discussion and decision based on objective criteria?

Mr. DALEY. As the information about this system begins to filter down into the legislature, we find that there are more and more of these ladies and gentlemen who are requiring more information before they are willing to cast their vote. And I think as time goes on that they will use it more and more within their own committees. Right now they seem to want to come to us and ask for the information that would be necessary to make decisions that are not purely based on their own opinions, as they did in the past, but rather they are looking for a deeper insight into the problem before they want to commit themselves.

Chairman PROXMIRE. What I am getting at, to be more specific, is, supposing a legislator has a strong feeling that there ought to be money put into a program to increase highway safety, but putting more emphasis on the one hand on using a big campaign to get people to use seatbelts, or on the other hand a campaign to require teaching of driver skills. I notice that one recent article reported a study showing the number of dollars that it cost to avert one death by the various techniques. As I recall, it showed that campaigns for the use of seatbelts averted one death for every $87 spent, whereas the techniques, driver techniques, cost $15,000 or $20,000.

Now, would this kind of specific analysis—and not necessarily regarding highway safety, but in any field at all—result in the persuading of the legislature to shift from a marginal and questionable investment to achieve an objective into a means which was of more proven value?

Mr. DALEY. The answer is "Yes, I do."

Chairman PROXMIRE. Can you think of any specific example of this?

Mr. DALEY. Well, we have had many questions arising concerning our recreational facilities, such as State parks, and issues of that nature. And it always results in taking property off of the ground list of some town, and how much it is going to hurt the town, and how much it is going to improve the facility and increase the number of dollars brought in totally to the State through the recreational

media. And I think that this has helped a great deal. These decisions through this analytical determination have been filtered down to the legislature, and they have used them a great deal in their deliberations, and I am sure to firm up their decisions.

Chairman PROXMIRE. You see, there is the feeling on the part of the legislature, whether it is Congress, the city council, or State legislature, that the President and executive branch hold the whip hand. In this area where there is so much expertise—and this is a new field—and so many bright people who are working in this area, the Members of Congress have all kinds of responsibilities that are varied, and so forth, and there is a real temptation on the part of any top executive, whether it is President Johnson, or Governor Hoff, or Governor Knowles, or Mayor Lindsay, to use it to serve their own purposes.

In other words, they will come in with a PPB study when this is the way to get what they want across. But when it is something that they may have a particular interest in promoting, and the PPB information might tend to frustrate their position, it might not be as readily available. What did the legislature do to overcome this advantage that the executive has, and to equalize the expertise elements here?

Mr. DALEY. First of all, if the system ever becomes a tool of the Governor or the President or the mayor, then I would assume that we would be going in the wrong direction. We believe that the information——

Chairman PROXMIRE. Well, we live in a political system. There is always a conflict of some kind between the executive and the legislative. And it is more a duty when you have one party, as Wisconsin had, in Mr. Exo's experience, in control of the governorship, and the other party in control of the legislature.

But in New York we have the same kind of a situation.

Mr. DALEY. We have the same thing in Vermont.

Chairman PROXMIRE. You have the same thing there, then. It is a common occurrence. Even where you have, as we have it on a national basis, the President, who is a Democrat, and the Congress, which is Democratic, you still have differences of opinion and differences of objective and conflicts, and so forth. And this is, I think, an important function of this particular committee, to try and make this system as understandable and useful and as provocative as possible to Members of Congress so that they will inquire about it and begin to use it, and so that we can begin to make more rational decisions ourselves, and at the same time recognizing that it can be used by both Congress and the President, or by the legislature and the Executive to reach objective and intelligent conclusions in the public interest.

We will just have to keep working on it.

Mr. DALEY. Right. I believe that actually if we are going——

Chairman PROXMIRE. Of course, in a State legislature or city council it is more difficult. In the Congress I feel that it is a matter to some extent of staffing ourselves but, so that we have competent people, not only on the committee level, but also advising Senators and Congressmen directly, so that we can perhaps have at least somebody on our staff who becomes expert in PPB, and knows what it is, and knows what it is all about, and who is in a position to balance the expertise the executive branch has.

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But can you develop anything like that on a State level, especially a small State like Vermont?

Mr. DALEY. Yes. I believe we can. We already have some legislators who are working on the system, and who probably have as good an understanding of it as anybody in the executive department.

Chairman PROXMIRE. Is that right?

Mr. DALEY. And one of the things is an information center.

Chairman PROXMIRE. Do you staff your legislature? Do you have a staff for your leaders?

Mr. DALEY. All we have is a legislative counsel. Legislators do not have any staff.

Chairman PROXMIRE. I don't mean individual legislators, of course, you couldn't have that in a small State. But you have a staff for the Republican majority and for the Democratic minority?

Mr. DALEY. No.

Chairman PROXMIRE. You don't have any staff?

Mr. DALEY. No.

Chairman PROXMIRE. Is there a reference library, or anything of that kind?

Mr. DALEY. Yes, there is. But we feel that this information center is going to be the initial kickoff, and the base of a great many operations. And we have on the committee a group of both House Members and Senators who are beginning to put this together. And everything that is done in Vermont in the legislative area is done rather in the wide-open places. And everybody has a chance to take a good look at it. I have often said that there are no secrets up there. What is being done is known by all.

Chairman PROXMIRE. It sounds like you are ahead of the Congress, because we don't have anybody that I know of in the Congress who is any kind of a real expert on this—they may be and are hiding their light under a bush. But by and large the expertise of the PPB is in the executive branch entirely.

Mr. DALEY. What we have done, some of us have gone to the Harvard Business School from time to time to see if we couldn't pick up additional information and background on this. And when we have come back we have tried to counsel with some of our council with some of our other people, both in the legislature and within the departments, and try to sprinkle this information around as best we can. So that this is not just a system where you have got one pocket that knows it all and the rest of the people depending on them, but rather a broad-based operation where many people are involved in various capacities, both legislative and in departments. And I think it is working out rather well.

Chairman PROXMIRE. I have got other questions, but on this particular question I would like to ask Mr. Hayes and Mr. Exo to comment too if they would like to do so.

Mr. HAYES. I guess I have two reactions, Senator.

First, I wonder whether your question doesn't exaggerate the degree of expertise that it takes for understanding, in effect to be able to read PPBS. I am not talking about the work that has to be done by an analyst, although even that is ordinarily conceptually fairly simple.

But I think the output, the program memorandum, the explanation of why a choice was taken in terms of cost and effectiveness, is

actually giving the legislative body a good deal of information that they have never had before.

Chairman PROXMIRE. It is not so much a matter of intelligence as it is a matter of time. You pointed out, for example, that your major, as I recall, has an hour and 15 minutes available for a briefing, and it is done on a 10-by-6 card. But a Member of the Senate probably wouldn't take or wouldn't have under most circumstances an hour and 15 minutes available for briefing except in the broadest, most general kind of way that might not be very useful.

Mr. HAYES. I think this is the real difficulty. And it comes down—when you make the shift from actually looking at a budget—to just a few issues, almost like plums in a Christmas pudding that are pulled out because they have visibility, and forgetting the rest of the budget. This is how budgets are traditionally reviewed.

But when you move to the point where you are questioning objectives and cost and effectiveness down the line, you are providing something that is far closer to full exposure. You are providing something that is easy to communicate, except that when it is done on a budget-wide basis for a budget as large as the Federal budget, or even our $5.2 billion budget in New York, this can amount to an enormous amount of material. Maybe it means more legislative staff to handle it, and perhaps it means a different type of hearing or presentation to really bring it across. I suspect that the big problem the legislative body has to contend with is the pressure which forces them to point up some issues and ignore others. This selection is not the kind of thing that a city councilman or Senator can determine solely on his own. If it is an issue of great importance to his constituents, he recognizes that, but he knows also that he can get around to other matters in the budget next year on the next round.

And this is perhaps more true in a city council than it is here. Our city council is staffed, and they have to handle a budget in a very brief period of a month. And if they fail to come up with a budget, the budget is enacted as submitted. The charter provides this. They have to do it through tradeoffs, because anything that they put into the budget on expenditures they have to compensate for by taking something else out. The budget has to go in balanced, and it has to come out balanced. And it is a tricky proposition to pull off in 30 days.

I have a feeling that perhaps our city council could make more effective use of the staff of the Executive in reviewing the budget simply by asking the questions and spending the time on it.

But it is a difficult matter. I don't think there is any question about it. It is very difficult to find enough time to do a thorough job of it.

Chairman PROXMIRE. One way you get the time is to get people sufficiently excited and confident in the PPB system, so that they feel it is worth their while. Certainly there is a tremendous desire on the part of Members of Congress to come up now, for example—and it is always true, but it is truer now than usual—some rational, defensible proposals for reducing Federal expenditures. This is something we all are striving to do. We want to do it in a responsible way. We want to do it without turning our backs on social responsibilities, or our national responsibilities. But it is very rarely discussed in terms of the kind of objective criteria which I think would be most convincing, and which PPB should offer Members of Congress.

Mr. HAYES. Yes, I think that it is hard. You know, we can make our case to the councilmen, who believe that we need a thousand additional policemen. We can come in with the kind of argument that we have here and say, the city can't afford a thousand additional policemen, but we can get the equivalent, which is really what you want, a thousand additional policemen on the street. And I think there is a response to that. It is always hard to say. The fact is that we went to the budget without having this issue forced, despite the great political attraction.

Any public opinion poll you run into indicates that crime on the streets is the major public issue in the cities, New York or any other. So, it has great political sex appeal. But in spite of this, the issue was not pressed in a council and board of estimate dominated by members of the Democratic Party while the mayor is Republican. I think this probably says that this was an area where the result of our analysis was conveyed and the impact felt—although I am not really sure.

Chairman PROXMIRE. Gentlemen, I have to go down and vote. I will be back in 5 minutes.

We will recess for 5 minutes.

(Short recess.)

Chairman PROXMIRE. Mr. Exo, why don't you proceed with your answer to the question I was asking these gentlemen about what I think is a serious problem of the executive branch, whether it is the mayor's office, the Governor's, or the President having the expertise and the understanding and the knowledge of PPBS, and the legislature being in a position where it could be, if not victimized, at least not having the staffing and not having the understanding to use or the time, taking the time to use PPBS information effectively to achieve its own independent objectives.

Senator JAVITS. With the emphasis on the fact that this is for us a tool, not a weapon to be used on us.

Chairman PROXMIRE. Exactly. That makes the point much better than I do.

Mr. Exo?

Mr. Exo. May I make the point first by saying that we have very carefully involved the legislature leadership in the process of developing an understanding of and really an enthusiasm for this concept that you mentioned earlier. And the legislature has used the kind of information we have presented. And I think we have used it well.

Chairman PROXMIRE. Has the joint finance committee ever come up with alternatives to the Governor's program?

Mr. Exo. While we have an excellent relationship with the joint finance committee from the executive budget side, the joint finance committee has also engaged its own staff. They now have a staff of about five people. But I think this will have to be strengthened, and strengthened in two ways. One, they must develop the capacity to evaluate the techniques—the technology involved in the process of how the executive side has come up with its policy decisions. And secondly, the capacity to develop alternatives.

It is our role on the executive side to provide alternatives to the Governor. But I think the legislative finance committees have to be able to not only evaluate the technology and the process by which the executive came to decisions, but also to develop its own alternatives.

And I think that this will come over a period of time. But its legislative staffs have been typically weak.

Chairman PROXMIRE. On the basis of your assumption, you say the best answer to this is more effective staffing by the legislature?

Mr. EXO. I think this is one of the big needs on the State level.

Chairman PROXMIRE. But you have made real progress by doing your best to bring in legislature leaders and others who are interested in this as best you can?

Mr. EXO. Yes.

In these policy papers I mentioned we not only develop the background on the issues I presented, but discuss the alternatives that the Governor considered in arriving at his decision. So the legislature is given at least some basis for deciding whether the alternative chosen was the best one.

Chairman PROXMIRE. It strikes me that one very useful way of getting this would be to try to get this in the political dialogue as much as possible, having the parties take an interest in this, even though they make up claims that are hard to support, that the PPBS has been very helpful to them, with emphasis on the PP and not on the BS, that have been helpful to them in making their economy record, and in achieving a more objective and effective system of establishing priorities, and so forth.

And it is too bad that there isn't more dialog in the press, editorials, for example, commending or criticizing the Governor or the legislature for following certain policies based on PPBS analysis. This is the kind of thing I think that is going to get members of the legislature involved knowledgeable about it, using it. As long as it is in an area where the experts know about it and are using it, no matter how well they want to do it and how highly motivated the mayor or the Governor or the President may be, it seems to me that we are not going to have nearly the opportunity for using this that we can if we can open it up a little more.

Mr. EXO. I think you are right. I think that raising it above the technical level to the policy level, or even to the political level, is what is needed. Because the press simply doesn't become interested in a technical level.

Chairman PROXMIRE. There is very little discussion of this when you consider the enormous significance of it in terms of what it can really do in achieving efficiency, what it has done in the Defense Department, and some of our cities and States.

Mr. Hayes, New York City, probably has the most complicated and difficult problem, first, because it is the biggest city in the country, and second, because of course it is a city we all know has many different ethnic groups, and many problems have developed over the years. How is PPBS most helpful to you in approaching this tremendous spectrum of need?

Now, you have cited the police situation, which I think was a very exciting instance of it.

Can you give us other indications of either where it has been or where it is likely to be useful?

Mr. HAYES. The first thing I would say, Senator, is that PPB in New York has to be looked at as one aspect, important, because it is comprehensive, but as one aspect of a job of reconstructing the way

that we do things in New York. The mayor's reorganization program and a whole series of other measures all go into this.

I think that what PPB has done is this. By going into every agency and department in the city to get more rational decisionmaking, and more effective implementation, we have used PPB—and if it weren't for PPB we would invent something else—as a means of beginning to apply all across the government, common standards on decisionmaking and implementation. It uncovers problems and it gets at them. It is like the job that we have been doing with public works. We couldn't make a rational decision, nor could the department of public works, nor could the city council on capital allocations, given what we knew or what we didn't know about how speedily or how fast projects could be implemented, or where we stood on the projects already authorized at the time the budget went to bed.

We had, for example, a budget, taking funds within the debt limit, providing an addition of just under $500 million to a pipeline of about a billion. Quite obviously, in terms of the needs of the people of the city, that billion dollars of unbuilt but authorized construction is as important as the new authorizations. And whether those new authorizations are in fact going to result in buildings at one time or another is going to depend upon what happens to the projects ahead of it in the pipeline.

Chairman PROXMIRE. Let me just interrupt at this point to ask, is it your conclusion that capital investment is now tremendously economical on the part of the Government?

You indicated that in almost all cases you find that because of the rising labor costs, if we can make a capital investment as a substitution for the enormous labor costs, there is a big payoff. Have you been able to use that kind of argument effectively with the city council and the newspapers and others to get support for your position?

Mr. HAYES. Yes, I think we have. But part of it, frankly, comes out of the fact that the limits that are placed upon our capital financing are far less rigid than the ones that are placed on our expense budget.

But let me give you an example. We did a fairly thorough analysis of the city automobile fleet because city automobiles are a sensitive problem. We have been able to reduce the fleet by about 250 vehicles, or thereabouts, out of a total of 1,500, excluding police and fire.

But as we got into it, we became very concerned with the problem of maintenance.

Now, we know from police department experience that we can maintain, operate, and handle amortization on a car for a total cost of maybe about, say, $750 a year under very intensive usage. We discovered that major parts of the automobile fleet seemed to be costing us an average of about $1,500 a year under much less intensive usage.

You could try and find out how you get the management to handle the problem better. We went at it from a different point of view. Management is always a scarce resource. It is difficult to make changes. It always is hard to get the guy who can cut a situation. We took a look at the replacement policy, which is almost identical with that used by GSA—60,000 miles or 6 years, whichever comes earlier. We decided that we could replace our automobile annually and save money on it. We could save money because we buy them at a very favorable price, whereas we purchase our maintenance—which we do

ourselves—at a very high price, because city salary levels are high, and because management capacity is low. We could buy an average automobile for about $1,500 and probably sell it at the end of the year for $1,400 or $1,300 and have virtually nothing but routine maintenance during that period.

We went a little bit further. In the Department of Purchase, we were able to get, as consultant, the former regional manager of the Ford Motor Co. And he has fed his input into this. Now we are going to shift to a policy of car buying aimed largely at resale value. The city buys, say, a standard transmission because it is cheaper. We are going to go to automatic transmission, because automatic transmission adds more to the resale value than it does to the cost. We are also going to eliminate the standard color. We have found a man that will produce a city seal on a decal that will come off without leaving a mark on the car.

We believe that perhaps we can reduce the capital cost per year of owning an automobile by about 50 percent if we are lucky.

Senator JAVITS. Mr. Hayes, is PPBS just the application of management brains? And what has the new legerdemain of the PPB got to do with it?

Mr. HAYES. That is just the application of management brains. And a good part of the application of PPBS in New York is something that would have been called management analysis if it had been done 10 years earlier. Some of it is not. When we enter the problems of the health system in New York, when you begin to talk not just about how you manage a hospital system or a system of health stations, but about the provision of health care to the individual New Yorker, this is PPBS. You find that these health needs can be met not only by a city system, but also a private system, and you develop a whole series of complex objectives and choices far beyond management analysis.

The motor vehicles study is management analysis. I think it is even management analysis to substitute taxis for city cars. But PPBS does drive you into broader considerations, a broader understanding of objectives, and, I think, alternatives that fall beyond the range of management analysis.

Senator JAVITS. Is there any analogy between this system and what we called in the Army backtiming?

Mr. HAYES. I don't know what backtiming is.

Senator JAVITS. Backtiming means you want to get to place A at a certain hour with a certain strength, and then you work backwards to determine your starting time and strength. The last thing you put in is the first thing you do.

Mr. HAYES. In anything where you can state an objective that clearly, that is exactly the way you have to go about it. Time phasing has not been a strong aspect of PPBS. But it is one very important to us in New York.

The most beautiful school or hospital in the world, the most economical and most effective facility may not be worth a tinker's damn if we can't get it built until 1975. And these constraints can be handled by a backtiming sort of technique.

Senator JAVITS. Mr. Chairman, may I say that I am so pleased that one of our very gifted administrators is able to give our country and our committee the benefits of his views.

Chairman PROXMIRE. He has been very helpful.

Can you clarify this $3 million figure for teacher equivalent? That is really a fascinating figure you gave us.

Mr. HAYES. Just off the top of my head, and it is very rough figuring. Say, if you figure an average teacher, under the new contract the average teacher will certainly cost us about $10,000 a year, which happens to be about what the average policeman or fireman costs us at the present time. So that you could take almost any set of figures. I took $100,000 and figured that I could amortize and probably maintain that piece of equipment over a period of 15 years, at an annual cost——

Chairman PROXMIRE. How many years?

Mr. HAYES. Over 15 years at an annual cost that is no more than that $10,000.

So, if we have 30 teachers in a school, we could invest $3 million more for a school without teachers. But essentially what it means is that that $100,000 investment on the assumptions I have stated would be an acceptable substitute for a teacher or fireman or policeman in any kind of an application where you can do it.

What are the real economics of computer-based instruction? I don't know a thing about it at this stage.

What about TV surveillance of the streets as opposed to the use of policemen on them?

There have been experiments on this. But I feel we have not really exhausted the possibility of using capital as a substitute for labor.

We tend in most cities, perhaps in most governments, to be a little bit stingy on capital requirements. We have done it on an effectiveness basis, for example, on—let me just give you an example. A walkie-talkie is a very expensive piece of equipment for what you apparently get out of it. They cost us $700 each.

On the other hand, you don't need much of an increase in the effectiveness of an average policeman to be able to justify a walkie-talkie. A walkie-talkie, for example, at $700 will last, say, a half a dozen years. It can be justified if it adds a small percentage to the effectiveness of a policeman, and permits you to get along with fewer policemen. So it is very easily justified.

To take another example—if you can use one man in a patrol car for certain types of activities, if you have an automatic recall device on it, the $100 you put into the device is a really great investment.

I feel that we have not really fully explored all of the possibilities for capital substitution.

And if you do this on a straight substitution basis, that is, that the machinery or equipment will enable you to get along without people who are costing you the same amount of money per year, by the time you have actually amortized that piece of equipment you are going to be way ahead because of increases in salary.

Chairman PROXMIRE. Some of this is artificial. You indicated, for instance, that you get some kind of an artificial advantage in pleading for capital equipment because of the capital budget being more flexible than the expense budget.

This may be something that PPB might enable you to correct, perhaps. And, after all, when you look at your whole groundwork, the basis on which you are computing this, one of the first things you

should do, I should think, would be to examine whether the system is rational and is giving you a rational objective choice which is fair. And when you do that, you might perhaps question whether the expense budget is too rigid, or whether the capital budget is too loose; isn't that true?

Mr. HAYES. This is, frankly, something which is not going to be considered.

Chairman PROXMIRE. This is something that is given, and you don't think the legislature is going to do much about it?

Mr. HAYES. We did not end up very well in New York's first constitutional convention in 32 years. There seemed to be a rather resounding vote for maintaining the fiscal straitjacket that the city is in.

The convention was more interested in providing relief through other devices, such as taking over welfare payments, than they were in providing us with any taxing authority. For all practical purposes, the city of New York, except for the amounts needed to repay bonds, has virtually no unused taxing authority. There are a few nuisance taxes that could be levied and are not levied at the present time. Because we are a creature of the State and the State constitution, and operate under the local finance law, opportunities for change in this direction must come by changes that can pass two successive legislatures and be approved by the people at a referendum, which is difficult, or by the constitutional convention.

Chairman PROXMIRE. Now, this is just a gimmick that you have to pretty much accept.

Mr. HAYES. The city of New York has outgrown the constitutional restrictions under which it has historically been financed. It is a suit of clothes that is many times too small.

Chairman PROXMIRE. Let me ask Governor Daley and Mr. Exo if Federal grant programs do make it more difficult for States to plan their finances. I notice Mr. Exo had quite an emphatic negative comment on the grant program.

Governor, would you like to comment?

Mr. DALEY. You mean the programs that the Federal Government helps to finance, such as our road program, and things of that nature?

Chairman PROXMIRE. I think all of the grant programs, welfare, roads, and so forth. And especially you might direct yourself to the point that Mr. Exo raised in his statement when he pointed out that this seems to clash sometimes with the objectives and the priorities established by the States.

He could understand why the Federal Government might feel this way, but apparently we don't sometimes give the kind of consideration we should to the States' priorities.

Mr. DALEY. It appears to me that sometimes the Federal Government plans a program on a national scale, and they leave very little room for movement within the State, once the grant gets there. And this puts us into rather a straitjacket as to what direction we are going in.

Chairman PROXMIRE. Why wouldn't PPB under these circumstances be helpful in protesting it, and doing it in objective terms, and on the basis of an established system? So that if the States could bring this to the attention of their Senators and their Congressmen, and to the appropriate agency of the Government, wouldn't this be a more logical argument than just to say, we want to do it our way?

Mr. DALEY. Of course, I think that this is one of the big tools that this will offer to us. Many times we find ourselves at a loss as to how to communicate with our people in Washington as to what our problems are, and how to prove our point.

I think that this would offer a tool to do this.

Chairman PROXMIRE. I understand in your remarks you are addressing yourself to something else. But where you can show that the Federal program establishes a system which is uneconomical in a demonstrable way, the arithmetic just doesn't prove out. And this, it seems to me, could be a devastating case against the grant program.

Mr. DALEY. I agree with you. This is most difficult. For instance, we find that sometimes we get into a program simply because the Federal Government is offering a certain amount of money to go into it. And the need for that program by our calculation is probably further down the line in demand than a lot of others, but yet there is no need for the others, so the more important ones go wanting and the less important ones are funded. So we put in our 10 percent and go along with it.

We are being 10 percented right out of operating within the area where we should be operating.

Chairman PROXMIRE. Mr. Exo, is there any way that you think the Federal Government can coordinate, integrate its PPB with the States, so that this can be overcome? Is there some other way of meeting this problem?

Mr. EXO. Let me first say, with respect to the point I was making on the last page of my statement, I can think of two areas where recent moves by the Federal Government have enhanced the flexibility of States.

One is in general health area, where, until 2 years ago, the categorical grants for health purposes, for general health, heart, cancer, stroke, and so on, were made within very rigid kinds of segmented pieces. Now these have been loosened up considerably. So there is one total health grant made to the States, so that I think the States are now in a better position to allocate those Federal funds and match them with their own resources to achieve the priorities as they decide them.

I in no way want to imply that I don't think the Federal Government should have the freedom—in fact, I think they have an obligation to assure that Federal goals set down in these programs are achieved. But I think States should have the flexibility to operate within those goals.

Another area which is not entirely related to the question of how this affects, or how the PPB system affects State decisionmaking is in some of the requirements with respect to the agencies which administer Federal grants. I am thinking particularly now of vocational rehabilitation programs, where formerly there were rather specific guidelines laid down to the State about the kind of organization the State had to have to administer these programs. Those have been loosened up. And partly as a result of this, Wisconsin has now taken its vocational rehabilitation program out of an educational agency and placed it in a health and social services agency, where it is much more directly related to other rehabilitation programs, mental hygiene, corrections medicare, et cetera.

Chairman PROXMIRE. It works both ways. You didn't mean to imply that the Federal grant programs are consistently negative?

Mr. EXO. No.

Chairman PROXMIRE. What can we do to make it work more consistently in a positive way in the Federal Government?

Mr. EXO. I am not sure how the Federal Government would approach it. But I think, whatever techniques are used, they should attempt to allow the States greater flexibility in how they allocate Federal funds to meet State priorities and in loosening the restrictions on organization structures.

Chairman PROXMIRE. Do we have any institutionalized system of determining the States' views before we get into some of these programs, any system of finding out what the States' experience may be, what their desires are?

Mr. EXO. I think in the public welfare field particularly that HEW consults consistently with States before new programs are implemented. I know our director of public welfare——

Chairman PROXMIRE. Implemented in the sense that it is proposed in a bill to the Congress and becomes a Federal law?

Mr. EXO. I am not aware of it, if there are any institutional arrangements for consulting States during the process of developing legislation.

Chairman PROXMIRE. Do you want to comment, Governor Daley?

Mr. DALEY. Doesn't Farris Bryant's group going around from State to State get a sounding from the States and bring them back to Washington, and then deliver them to the proper groups here, doesn't that constitute really what we are talking about?

Mr. EXO. This is mainly on behalf of the executive branch, though.

Chairman PROXMIRE. How broad is the Bryant inquiry? Is it across the board, do you know?

Mr. DALEY. I believe it is quite broad in its scope, sir, from our experience with it.

Chairman PROXMIRE. Does it use PPB to any extent?

Mr. DALEY. I can't say for certain whether they particularly use it, but we can bring it to them.

Chairman PROXMIRE. You can use it, I see.

Mr. EXO, you indicated that PPB is just not used as a meat ax way to cut the budget. Why not? Why can't it be used for that? Suppose you want to make a meat ax cut at the budget, why can't you use PPB to do it?

Everybody is for the skeleton and nobody is for the poor old meat ax.

Mr. EXO. I think it makes it more difficult, because one of the things you try to do is present better information which will demonstrate the effects of given levels of resource allocation in each area.

Chairman PROXMIRE. It makes it a little more painful but at least you know what you are doing. You have a priority system established.

You know, it is very, very difficult. When a recent distinguished Governor came into the Government as a secretary of a department, he said that before he came in that any department could function more efficiently if it had 10 percent less money. Yet his department increased substantially on the basis of his request in the period that he was a secretary here.

But at the same time I think there is a certain wisdom in the basic and generalized feeling that we are very negligent in reducing the expenditures for old departments whose functions are no longer as useful, and in vigorously going about questioning priorities constantly, trying to eliminate low priority programs. Because an old department has a terrific built-in power. In the first place, it has a human appeal. You don't want to throw anybody out of a job.

In the second place, they are established very often because of some political influence, and that grows as the years go on, and they get their influence in the States, and in the Congress, and throughout the executive branch. And this is true in cities, it is true in States, and it is true in the Federal Government.

How can PPBS help us really accomplish this in a radical way?

Mr. EXO. I think it can help accomplish that, not through a meat-ax approach, but focusing a greater line——

Chairman PROXMIRE. If you find that a department ought to be abolished, whether it is the Subversive Activities Control Board, or some other, because its functions have just ceased, why can't you abolish it—meat-ax style—why can't you just show that no longer does it serve an objective that can be justified?

Mr. EXO. Perhaps your example of the Subversive Activities Control Board and the experience you have had with that illustrates why it is so difficult.

But I think the use of PPBS concept helps define objectives and goals more realistically, and throws a bright light of inquiry on them. It forces you to look more realistically at what all the programs are achieving. And if they are not achieving needed objections, they should be abolished.

Chairman PROXMIRE. So it could be used to abolish them?

Mr. EXO. Yes, I think it can. I think, though, that as compared with the percentage cut, which I would term somewhat of a meat-ax approach, that it would abolish them with a full understanding of what the effects were. And this would be healthy.

Chairman PROXMIRE. You used something that was very technical and that went over my head, and I am just curious to know what it was.

You said a six phase annual cycle for integrating planning and budgeting process. This was something that was used by New York State, I guess.

Mr. EXO. Yes.

Chairman PROXMIRE. What in the world is that?

Mr. EXO. This is a technique that the State of New York is using to integrate its budgeting and planning concepts.

Chairman PROXMIRE. Why in six phases, every 2 months?

Mr. EXO. No, six phases in terms of its time cycle over a period of, I think, 20 years. So that they look at it in terms of 1 year, 2 years, 5 years, 10 years, and 20 years. I am not sure it is six, but there are a number of time perspectives built into this evaluation process.

Chairman PROXMIRE. I see. So instead of just looking at it over a year, or two, or three, you look at it over a broad period as well as an intermediate period?

Mr. EXO. Yes. I think New York State has probably gone further than any other State.

Chairman PROXMIRE. Any other city or State that has done this?

Mr. EXO. As far as I know, as far as any other State, I believe, they have gone further. And we are trying to pattern ourselves to that. We had a staff member who spent a week in Albany trying to learn more about their process and avoid the problems they have experienced.

Chairman PROXMIRE. The Federal Government goes up to 5 years, as I understand it, to get the cost over 5 years and the benefits over 5 years.

Mr. EXO. Yes.

Chairman PROXMIRE. What does the city of New York do?

Mr. HAYES. The city of New York in its capital budget is required to include a capital improvement plan that runs for 5 subsequent years. I think nearly everyone recognizes that the capital improvement program, because it does not involve current appropriations, has been rather more casually treated. It is a good way to handle the school that you can't build this year—by defering the issue until next year.

On the expense budget, there is no requirement, and there has been no practice, for longer time planning. The system that we are moving into is using as a standard, to be rather unevenly applied, a 6-year period, with the understanding that in some areas that we are going to have to push it out substantially longer to be able to make it worthwhile, say, in planning landfill or incineration, involving eventual conversion to parks, and long-term capacity to dump garbage. In areas of this kind, 6 years is not enough. You have to go to 10, 15 and 20 to make sense out of the capital decisions.

Chairman PROXMIRE. Governor Daley, do you have any rigid system at all that requires you to make a short and a long time commitment?

Mr. DALEY. We never did, sir. But we have begun to go to 10 years. Historically, there was a system in Vermont where the budget was brought in and passed, and everybody took a deep sigh of relief in hopes that the revenues were going to live up to expectations. And then 2 years later they began the same procedure all over again.

But there has been a change that we have begun. And that is that rather than just review the programs in dollars and cents at our budget hearings, we began to review the programs without mentioning dollars, and making a determination as to, say, a 10-year program which was instituted 5 years ago. And during the time of this hearing we will determine whether or not the program is still living up and approaching the desired goal, whether it is 50 percent completed—if it is 80 percent completed, then we can project a cutback in expenditures within a relatively short period of time, we won't have to go all the way to 10 years.

And we are beginning to find that some programs that were, well, very important 5 years ago, began to slow down and deteriorate as they approached the end of their term.

So what we are trying to do is not let them just stay there, because the initial time limit was 10 years, but rather get them completed and then get out of it, and use these people and the funds on something different.

Chairman PROXMIRE. I would like to ask each of you gentlemen to answer two questions before we finish.

In the first place, what are the alternatives to PPB for decision-making, absent PPB, what can you do? To some extent this was implicit in Senator Javits' question to Mr. Hayes, in which he pointed out that many of these advantages could have been taken by any intelligent management study.

How does PPB have a unique contribution to offer?

And if you don't have PPB, what else can you use in its place?

Governor Daley?

Mr. DALEY. Well, if we don't get into PPB, I would say that with the awakening of a good many people as to new approaches to the problem of government, we will probably go along or begin to approach sort of a 50 percent PPB, until some better thought comes along.

And it is true that a lot of studies come up with the same answers that PPB would.

But actually what you are doing is having a consultant come in and use the same technique that PPB does to arrive at their conclusions. So all you are doing is increasing your expenditures by hiring an outside firm to come in when actually you could be having your own people do it, and applying their technology to a lot of other different areas that the hired firm wouldn't even begin to look into.

Chairman PROXMIRE. Mr. Hayes?

Mr. HAYES. I think this is a little bit tricky. I think that we wouldn't really have to have all of the apparatus of PPBS. But we would have to have most of the things that are incorporated in it and which make it as good a tool as it is.

First is the idea of advance planning just by itself. To be able to see the repercussions of actions over a reasonable period of years, the kind of period that is related to the action, to set out objectives for a long period of time, is an essential element of rational decision-making.

By the same token, to do the job on the basis of a comprehensive or total view of costs and effectiveness is also necessary.

And, finally, to be able to identify your objectives and relate your effectiveness criteria to them—these are also essential.

These all go into PPB.

But PPB is much more than that. It is an elaborate structure of plan and plan change, linked to program and program implementation. I have been talking about, and most of us have been talking about, one aspect of PPBS. And that is how you make decisions under PPBS.

We haven't talked about the rest of the structure of plan and program where there are many other alternatives.

But by and large, PPBS is really an effort to develop a generalized structure for decisionmaking. Because it is generalized, PPBS is not as specific a system as, for example, some of the particular techniques that the econometricians develop to deal with certain problems, such as linear programing and queuing theory. These are all specific techniques to handle one type of a problem.

PPBS is just a generalized structure. You put the kind of input into it that seems to make sense. And it is simply, I think, a concept that you should take into account all the basic factors that go into a problem, and you should have a rational process in making the decisions on it.

I think we would be there if we didn't have the name.

Chairman PROXMIRE. Mr. Exo?

Mr. Exo. I think Mr. Hayes is right, that if we didn't use the words or the letters PPBS to achieve, as he puts it, a rational decision making process, we would have to think up some other jargon.

Chairman PROXMIRE. Didn't you indicate in your statement that you constantly used this before the name came along, as Governor Nelson and Governor Reynolds used it?

Mr. Exo. This was initiated under Governor Nelson back in 1959, I think. He was very instrumental in creating the climate where this kind of new thinking was acceptable.

Chairman PROXMIRE. Was it called PPBS then?

Mr. Exo. We simply referred to it then as program budgeting. And I think this term has been around a long time.

Chairman PROXMIRE. Program budgeting has been around?

Mr. Exo. Yes. The term PPB started after Secretary McNamara set his people to thinking, and the Rand Corp. really refined the process.

But I think, as Mr. Hayes has pointed out, that PPB by developing a common terminology and comprehensive approach for governmental jurisdictions throughout the country at all levels is going to serve a very useful purpose. And I think that the way in which these various jurisdictions implement the process will be quite different.

But I think that by creating a new set of terminology and a new awareness on the part of the decisionmakers and administrators, they will have to use new kinds of analytical tools.

Chairman PROXMIRE. Do you know how widely used this is now in the States, how many of the 50 States have something like a program budget or a PPB system?

Mr. Exo. Probably not over eight or 10 States.

Chairman PROXMIRE. Is that right?

Mr. Exo. Yes.

Chairman PROXMIRE. Have you any idea, Mr. Hayes, how many cities have something like this?

Mr. HAYES. Yes. There are quite a few of them.

Chairman PROXMIRE. Do all the big cities have it, Chicago, Los Angeles, Detroit? Milwaukee has it, I know.

Mr. HAYES. I don't think all of them. But I think most of them are moving into this direction, and they are in various stages of it. I think one of the components of this, the program budget and the program budget design, has under the impact of PPBS started to become almost universal in the large cities.

Chairman PROXMIRE. Of the 12 largest cities would you say all of them have something close to it?

Mr. HAYES. No. They have something underway.

Chairman PROXMIRE. The cities seem to be ahead of the States.

Mr. HAYES. That is not the opinion of the people in the George Washington University project, Selma Mushkin and Harry Hatry. They feel that the States have made more progress on it.

Chairman PROXMIRE. The States that have it, perhaps. But if only eight or 10 States out of 50 have it, and 12 cities, the 12 big cities have it—and undoubtedly some of the smaller cities, too—it would seem that you have some situations where a city has it or more than one city has it and the State does not. Maybe that is true in Illinois, for example.

Mr. HAYES. Well, there is a problem of nomenclature here. You can't make a change in a budget process anywhere in the country any more without calling it PPBS. The title is there, and there are a number of efforts that are going on that are at the stage which should properly be called program budgeting and not PPBS. There are very few efforts——

Chairman PROXMIRE. What is the difference?

Mr. HAYES. Program budgeting, let's say, at the very minimum, and it rarely goes beyond the minimum, is simply a decision to make your appropriations by program rather than by some other arbitrary classification. If you are running a rat control program, instead of having it buried in miscellaneous health activities, you have an appropriation for a rat control program. You attempt to have some figures on how many rats you are killing and a few other measures of this kind that relate to the program.

It is an essential first step.

Chairman PROXMIRE. And then, when you go on to PPB, what do you add?

Mr. HAYES. You add two things. Program budgeting does not have in itself longer term perspective. The integration of plan and program into the budget is part of this. Nor does a program budget really contemplate the structure of plan and plan and program modification that goes into PPBS.

But finally it may imply, but it has rarely carried, the analytic structure, the analytic structure of PPBS. That is hard to say. Most program budgets have been associated with low yield, relatively conventional techniques.

Chairman PROXMIRE. Are you saying that what happens with the budgeting is that you are unlikely to go back over the budget and find out what it achieved, and whether or not it constituted a good investment of the taxpayers' dollars, and then on that basis, modify the budget for the coming year, and so forth?

Mr. HAYES. A program budget is a little bit like this in traditional practice.

Let us say that a city is running a series of well-baby clinics. You would identify this as a program. You would put in your budget some idea of what the use was, and probably even get down to how much it cost per patient visit or per child taken care of.

You would probably do your projection for the coming budget year on the basis of an estimate of use adopted to higher cost conditions.

It is very unlikely that in a program budget system there would be any diligent scrutiny for alternatives to this particular system of handling the problem of taking care of well babies in areas of high indigency, nor, on the other hand, would there be any great concern as to what the effects of that program were. Does a well-baby program really do anything to keep well babies well?

PPBS drives you into considerations of this kind. Sometimes it doesn't produce easy answers. But program budgeting in most instances does not even go as far as I have indicated. It ends up as an accounting system, a means of categorizing expenditures.

I think that the people who have advocated program budgeting have always assumed that it would at least identify level of activity and unit costs. But often it doesn't even do that.

Chairman PROXMIRE. That is a very helpful statement.

I would like to ask each of you gentlemen this final question.

Do you have problems in defining goals?

Governor Daley?

Mr. DALEY. Yes. I think in the past we have had a great deal of problems in defining goals. And then once we came up with the idea that we had defined our goal, our next set of problems was, how do we set up the guidelines that are going to carry this program through to reach the goal that we have defined.

And I think too many times in the past that once we arrived at something we thought was worthwhile and would bring us along the road to success, that we gave very little consideration to alternative plans.

We were just too ready to accept the first answer and to go along with it.

Chairman PROXMIRE. Let me be a little more specific. You have trouble, for instance, in defining highway safety goals. You have trouble in defining health goals.

Did you try to do that kind of thing? Do you try to determine that you are going to achieve a certain level—well, maybe it is in terms of the reduction of fatalities on the highway, maybe it is in terms of the number of people who engage in highway safety programs. You do have difficulty under those circumstances in determining which goal to aim at, and what it should be?

Mr. DALEY. Yes, we do.

Chairman PROXMIRE. Let me just interrupt once again by saying, you are the one member of the panel who is an elected official. And I think you may also be conscious of the political dangers of goals. If you develop a whole series of goals—I am all for it, I think it is the best thing you can do in the public interest, but you have to recognize that if we develop, for example, a series of goals on housing, and we already have some on unemployment—on income, on the number of people who are still poverty stricken, and so forth, you could defeat an administration, you could defeat a party, because they haven't achieved their goals. You could make a terrific campaign on that basis alone—these are the goals that they established, and they haven't achieved any of them. And goals by and large are not always achievable.

But I think it would be terrifically helpful in organizing your finances and carrying on your campaigns that you specify goals, but at the same time they are fraught with political danger.

Mr. DALEY. What you say is very true. But I think with the system here that you have a better chance of recognizing the possibility of reaching your goals, and how much time it is going to take to do it, and I think also you can find other methods of achieving your goal. And then a decision has to be made as to which is the best possible area to work in.

And I think that really what we are doing here is broadening the scope of thinking where problems of government are concerned. I think that we can look to the past and find that we did not have this breadth in our basic thinking.

Now we are about to—some of us are already entering into it, and some of us are coming along—we are going to find that there are other ways. And by arranging it so one State can talk with another State,

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or one city with another city—because with this system we are going to be using the same English, the same terms—I think that we are going to have a better chance of looking at another State, taking the way that they saw their problem, and applying it to problems that we have within our own State.

And I think one of the outstanding points here this morning, at least from what I have been able to gather, is that this system means something different to the people in the government of the State of Vermont than it does to Wisconsin, or to the city of New York.

Yet I thoroughly understand exactly what each of my two friends here on my right were talking about. And I think I have already made the remark to Mr. Hayes that I got a great deal out of his dissertation here, because I can see some good that I can delve into from what he has brought out here.

Now, I think a few years ago, or even a shorter time than that, that we wouldn't have been able to do it here.

I think we are beginning to recognize, it is almost as if we were entering into a new era of thinking within the concept of government.

Chairman PROXMIRE. Mr. Hayes?

Mr. HAYES. I would like to make a couple of points on goals.

I think that, first, we kid ourselves on our ability to state goals initially, that we oversimplify problems, that, in fact, goals do not emerge until you attempt to measure results against goals.

What measures results against that goal?

What kind of visible evidence is going to say that we have achieved that goal? And how do we go about it?

And this is where the strain begins to develop.

Next, we have, in resource allocation, all kinds of conflicting goals that really don't emerge until you start looking at specific problems. Let me give you a couple of examples.

In the urban renewal and housing area, the Housing Act of 1949 states its objective as, "A decent home and decent living environment for every American family." But it authorizes an urban renewal program that permits you to clear slums and build college campuses, or the New York coliseum or low rent housing, or industrial parks.

If the objective is the ultimate welfare of the inhabitants of the city, some very interesting problems arise. You may, for example, have an opportunity to create jobs at the expense of not creating housing.

But I think it gets even more complicated. I have a favorite example. We like to talk about housing the poor, and at the same time advancing racial integration. I think most of us who have been in this recognize that in terms of creating a community integration is a valid objective. But at the same time, when you rebuild housing within the ghettos itself, generally speaking it has to be low-rent or low-income housing in order to meet the income levels of the people who live there. And it is very difficult to obtain integration as a practical matter.

Chairman PROXMIRE. That is one of the things that makes it difficult, the fact that the goals clash.

Mr. HAYES. That is a fact. But on the other hand, you could take the same money and build a housing project for middle-income groups. And as Lake Meadows and Michael Reese demonstrated in Chicago, it is easier to get effective integration there.

And you get it at the cost of not housing low-income families but the middle or higher income family.

And this goes all through the system, in my opinion, and every single problem that you get. And the good thing that PPBS produces is, not a good initial statement of goals, but rather, as you work with it, a clarification of goals and some indication of the extent of conflict on individual cases, and a statement of tradeoffs.

You know, I can't tell you from PPBS, and I don't think anyone else can or is going to, whether it is better for the City of New York, in the field of urban renewal, to rebuild an area to provide a thousand jobs which you otherwise wouldn't have, or instead to build a thousand low-rent public housing units that otherwise would not be built.

But we can put the things in the form where the decisionmaker—the mayor in this case—and the council and the board of estimate, can see alternatives. And you may end up saying we really want both as goals, but, for one reason or another, we place a higher current priority on one of them.

Chairman PROXMIRE. Unfortunately, Mr. Exo, the vote buzzer rang 5 minutes ago, so I have just got 1 minute. And I regret that you have to be limited.

If you would like to supplement your answer you can put it in the record.

Mr. EXO. I would say that we do have difficulty in defining goals. I think part of the problem is defining what you mean by goals. And what we are working on as one aspect of this is to distinguish between goals, objectives, policies, and plans, and to define what we mean by each of these, so that the tradeoffs Mr. Hayes talked about can be dealt with on the right level.

Chairman PROXMIRE. Very good.

Well, thank you, gentlemen. This has been a wonderful panel. And you have done a superlative job. I am deeply grateful. All of you men have contributed greatly to my understanding, and I am sure to the committee's.

Thank you very much.

The subcommittee will be in recess until tomorrow morning at 10 o'clock in this room.

(Whereupon, at 12:25 p.m., the subcommittee recessed, to reconvene at 10 a.m., Wednesday, September 20, 1967.)

THE PLANNING-PROGRAMING-BUDGETING SYSTEM: PROGRESS AND POTENTIALS

WEDNESDAY, SEPTEMBER 20, 1967

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON ECONOMY IN GOVERNMENT
OF THE JOINT ECONOMIC COMMITTEE,
Washington, D.C.

The subcommittee met, pursuant to recess, at 10 a.m., in room S-407, the Capitol, Hon. William Proxmire (chairman of the subcommittee) presiding.

Present: Senator Proxmire; and Representatives Rumsfeld and Moorhead.

Also present: John R. Stark, executive director; Daniel J. Edwards, consulting economist; and George Iden, staff economist.

Chairman PROXMIRE. The subcommittee will come to order.

The subcommittee resumes its hearings on the planning-programing-budgeting system today with testimony on the vital issue of interest rate guidelines for Federal decisionmaking.

One of the most significant contributions of PPBS has been to present budget alternatives over a span of years, most frequently five, instead of only a single year. As interest rates are the means by which we determine the cost of capital, they play a crucial part in determining the total real cost of alternative investments over a number of years. With multiyear budgets, analysts could explicitly or implicitly use interest rates to select program alternatives.

We are most fortunate to have three particularly outstanding witnesses to discuss the role which interest rates can play in PPBS.

Our first witness is Jacob Stockfisch, senior research associate, at the Institute for Defense Analyses. Prior to joining the staff of IDA, Dr. Stockfisch has had extensive experience in program evaluation in the positions he has held with the Treasury and Defense Departments, with the RAND Corp. and with the Planning Research Corp.

We have as our second witness, Morton Kamien, professor at the Graduate School of Industrial Administration, Carnegie Mellon University.

Our third witness is William Baumol, professor of economics at Princeton University. Dr. Baumol is very well known for his outstanding work in operations research and capital theory.

Gentlemen, we are very pleased with your presence here this morning.

Dr. Stockfisch, you might go ahead.

I might say to all of you gentlemen that to the extent that—I see that the first statement is a brief statement, and I haven't had a chance to look at the others, but to the extent that any of you gentlemen want to abbreviate your statement, the entire statement will be

printed in the record, including exhibits. So you handle it any way you see fit.

Dr. Stockfisch, I see you have a very brief statement, so you may go ahead.

STATEMENT OF JACOB STOCKFISCH, SENIOR RESEARCH ASSOCIATE, INSTITUTE FOR DEFENSE ANALYSES

Mr. STOCKFISCH. Mr. Chairman, to offset that very brief statement I have a somewhat longer paper.

Chairman PROXMIRE. How long is it?

Mr. STOCKFISCH. About 30 pages.

Chairman PROXMIRE. Would you like to have in inserted in the record?

Mr. STOCKFISCH. Yes, sir.

Chairman PROXMIRE. It will be inserted in the record in full.

Mr. STOCKFISCH. I would like to emphasize—your opening remarks emphasized it, Senator—that what we are addressing here is what the program-planning-budgeting system is all about; namely, PPBS is a mechansim or an administrative device which permits cost benefit analysis or cost effectiveness analysis to be much more extensively employed in Government decisionmaking.

Specifically when we talk about the interest rate, or discount rate, we are treating the cost side of cost benefit or cost effectiveness.

In certain areas it may not be possible to estimate the dollar benefit of a program, such as in certain aspects of national defense. Even here, however, one often has opportunities for alternatives as to how the profile of the spending program may look.

For example, one can invest in highly sophisticated systems, which provide savings in annual operating cost. The necessary increment of of investment can be viewed much like an investment that a businessman would make in sophisticated plant and equipment. Hence, a discount rate is necessary in order to determine whether the additional investment in the program is worth it.

So one way of looking at this subject is that we are seeking a measure of capital costs, even though we can discount benefits when the benefit can be equated with dollars. But the inability to equate benefits with dollars will still often necessitate a recourse to a discount rate explicitly or implicitly if only to compare the relative merits of different ways of undertaking an operation.

I wish to emphasize that there is a great deal of substitutability in the conduct of operations in the sense of being able to trade off a larger initial investment for lower annual operating costs. And it is here where a discount rate calculus is necessary.

I haven't addressed it in my paper, and I don't know whether it is addressed in some of the other papers. But I would also like to emphasize that there is a need, a dire need, to establish consistently throughout the Government the policy and procedure for using discount rates. There is great variety here. Much of it is implicit or is a result of Government practice. But even where explicit rates are employed, there is wide divergence between different Government agencies.

Recently the Department of the Army has announced that a 10-percent rate would be employed for some programs, but a 5-percent rate for others.

The supersonic transport program is going to be adjudged a commercial success or economically viable if it yields the Government a 6-percent rate of return plus recovering the initial investment.

The Bureau of Reclamation, I understand, uses something that is close to a 3½-percent rate, which is really a 15- or 20-year moving average of the yields on long-term Government bonds.

And at one time, so far as I recall, the Corps of Engineers employed something on the order of a 4- or a 4½-percent rate, or the current rate on long-term Government bonds.

In many, many areas a zero rate is employed. In other areas, often because a program is only looked at in terms of a 5-year lifespan, when the equipment or the program may in fact have a 10- or 15-year lifespan, the decisionmakers may be implicitly using a 10- or 20-percent rate, which may or may not be the correct one.

This kind of behavior, incidentally, would be similar to the Congress giving explicitly varying subsidies for the wages that different agencies and bureaus would pay.

So I would urge at a minimum, whatever the rate should be, steps should be taken to insure that consistency be achieved throughout the Government. Such consistency cannot be achieved unless it is enforced by the Budget Bureau—at least from that level. Perhaps even Congress should establish the rule.

This is not the sort of thing that can be left up to individual bureau heads and agencies, because there are all sorts of diverse motives that operate that cause bureau heads to try frequently to employ lower interest rates; in some cases even negative interest rates.

Now, for the level of the interest rate itself, which is the main topic we are here to discuss, I would advocate that the level of the interest rate that is employed in evaluating Government programs be a rate that equals what we call the opportunity rate of return on investment in the private sector of the economy.

Moreover, this should be a rate of return that prevails beofre corporation taxes, and perhaps even local property taxes.

Essentially advocating this position is a way of posing the following question: A billion dollars of investment is undertaken in the private sector of the economy, to be distributed in some way that reflects the flow of investment in the private sector of the economy. What is the permanent increase in the net national product and the national income? If the rate of return in the private sector of the economy is in the neighborhood of 15 percent—and there is a fair amount of evidence to suggest that it is at this level—then a billion dollars of additional investment in the private sector of the economy will add a permanent $150 million a year to the net national product.

The Government, incidentally, will recoup about half of that amount through the existence of its tax system, the major tax being the corporate income tax.

Stated another way, then, if the Government causes a billion dollars of investment to take place, then investment is being displaced in the private sector of the economy, not necessarily for the full billion dollars, but at least current consumption plus some investment is being displaced. If the Government project does not in some way contribute to the welfare of the population by an equal amount, then the Government is causing an inefficient allocation of investable resources in our economy. And I am assuming here that this whole subject about

programing and budgeting and the whole general area that we are discussing has to do with efficiency, the efficiency and the utilization of resources.

This, then, is the position that I advocate. Namely, that the rate of return be that which prevails in the private sector of the economy before taxation.

If such a rate were employed, incidentally, there would probably be a marked change in the allocation of Government spending. Many projects, particularly the reclamation and water projects, and rivers and harbors projects, simply do not meet this test. Failure to meet this test indicates that we are overinvested in these activities, and perhaps not investing enough in education and other activities.

There is one school of thought, however, that rejects the application of this equalization principle. It may be called a social time preference school of thought. I would like to make a few remarks about it, because the view seems to prevail in the economic literature at this particular time.

Essentially, this school of thought rejects the equalization principle that I am advocating on the ground that the private rate of return revealed in the private sector of the economy reflects something called a high rate of "time preference" on the part of private individuals. It is asserted that this rate may be "too high" because it reflects inadequate saving and investment by the private sector. The behavior that is responsible for this, it is alleged, is that the present generation likes to consume too much, and isn't taking proper cognizance of the welfare of future generations. Therefore investment is too low, and because investment is too low, the private rate of return is too high. Thus the rate is not an optimal rate in some broad social sense.

To the extent that there is any cogency to this argument, it is really an argument advocating that the gross national product and the national income of the future be larger than it would otherwise be. It is simply an argument that there be more investment. And if that is the objective one wishes to achieve, investment should be stimulated in all sectors of the economy, private as well as public. And it is simply inefficient (even if one agrees, that social rate of time preference should be 4 percent instead of the 15 percent revealed in the economy) to undertake investment in Government projects which only yield 4 percent when there still exists investment opportunities which yield 15 percent.

In other words, the equalization principle should nevertheless be adhered to. But if one feels that the private rate of return in the private sector of the economy is too high, then one should undertake an array of monetary and fiscal policy devices to force down the overall rate of return, or to stimulate capital investment. And, of course, the most effective way to start doing that would be to lower monetary interest rates, reduce tax on corporate profits, and a number of other things, all of which would stimulate private investment.

The next question is, if one accepts the equalization principle that is advocated here, how does one measure the rate? There are a number of measurement problems here, problems which are probably no worse or no better than what one encounters when one tries to measure national income and gross national product, for example.

I have made an attempt to measure it.

These data, and the estimating method, are presented in the paper which I submitted.

This concludes my statement.

(The prepared statement of Mr. Stockfisch follows:)

PREPARED STATEMENT OF JACOB A. STOCKFISCH*

THE INTEREST RATE APPLICABLE TO GOVERNMENT INVESTMENT PROJECTS

This paper seeks do demonstrate that decision makers should apply to Government investment projects an interest rate that equals the opportunity return on investment in the private sector of the economy. Moreover, it should be the rate of return that prevails *before* corporate taxes. Presently this rate is between 10 and 15 percent.

The use of a rate as high as 15 percent, as contrasted with one in the neighborhood of from 4 to 6 percent, is profound. Arnold Harberger, for example, stated that a majority of 53 Bureau of Reclamation and Corps of Engineers projects which he examined would have been rejected at a 10 percent rate.[1] Hirshleifer, DeHaven, and Milliman show that California's Feather River Project would be uneconomical at a 6 percent rate.[2] To employ a 15 percent rate would therefore radically change Government practices and operations. Current thinking in the Government suggests that the proposed Supersonic Transport Program will be regarded a financial success or economically viable if the Government can recover its outlay plus 6 percent. If a rate in the neighborhood of 15 percent is valid, it appears that present Government investment decision making is extremely inefficient.

This paper consists of two parts. Part I develops the principle of why the opportunity rate of return on investment in the private sector should be used as the measure of capital cost in the public sector. Part II and Appendix A presents a method to estimate that opportunity rate of return.

I. THE PRINCIPLE

A. The Postive Statement

Most resource using activities permit substitution between different kinds of resources. Often, it is possible to substitute larger initial investment outlays for smaller annual or periodic outlays, or vice versa, to achieve the given objective. For example, a large investment in spare parts can reduce the periodic maintenance and transportation costs necessary to support a weapon system during its life span. Or a law enforcement agency may acquire electronic data processing equipment in order to dispense with file clerks and thus reduce annual operating expenses. Possibilities such as these require that some interest rate be explicitly employed to make rational decisions.

There is a class of Government resource-using activities which serve private ends by providing individuals instrumental services or products. For these activities it is often possible to identify the individuals or groups who benefit from the Government operation. Government enterprises such as the Post Office Department, reclamation, conservation, and power projects are examples of such activities. It is also often possible for the Government to employ prices to ration the service and to finance the operation. To determine the appropriate price, it is necessary to employ a cost of capital. The Government may or may not use the price mechanism to ration the benefits or services the activity provides. To the extent that it does not price the service to cover the *full cost* of the project, including an appropriate interest cost, it provides private users a "subsidy in kind." Whether a subsidy should be provided is not a point at issue in a discussion of what the interest rate should be. An appropriate interest rate should nevertheless be applied to the project if only to determine the magnitude of the subsidy itself.

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*The author is a Senior Research Associate in the Institute for Defense Analyses. This paper had its origin in a study undertaken for Planning Research Corporation, Los Angeles, in the spring of 1960, on behalf of the Bureau of Supplies and Accounts, Department of the Navy, under contract No. NOnr -2713(00). The study received additional support through a research grant from the Division of Research of the UCLA Graduate School of Business Administration during the summer of 1960. Support from the Institute for Defense Analyses facilitated the final stage of gestation.

None of the above named institutions necessarily endorse or accept the views advanced in this paper.

[1] Arnold C. Harberger, "The Interest Rate in Cost-Benefit Analysis," *Federal Expenditure Policy for Economic Growth and Stability*, U.S. Govt. Printing Office, 1957, p. 241.

[2] Jack Hirshleifer, James C. DeHaven, and W. M. Milliman, *Water Supply: Economics, Technology, and Policy*, Chicago: 1960. pp. 341–346.

We may elaborate upon these points by an example which treats hypothetical alternative missile systems:

[In millions of dollars]

System	Initial investment cost	Annual operating cost
A	500	20
B	300	70
System life (years)	5	----------

For simplification we can assume that both systems have the same "kill potential."

It is unnecessary to be concerned with the question of whether the "product" is "worth" the cost of either system; this judgment may be a political-military one, not an economic one.[1] We may assume that the Strategic Air Command requires either system. Given agreement on this point the procurement decision can be approached in the same fashion as businessmen would evaluate two machine tools.

In the example of missile systems "A" and "B", one evaluation approach would be as follows: System "A" requires an incremental investment, as compared with System "B", of $200 million. System A relative to System B saves $50 million a year for five years. System A therefore enables the Government to acquire a five-year annuity of $50 million a year. The internal rate return on the incremental $200 million investment is therefore 7.9%.

If the interest rate applicable to Government investment projects is 15 percent, the Government should not buy System A, since the incremental investment of $200 million in System A does not meet the 15 percent test, and System B is the preferred one. Stated another way, if the present costs of both systems were determined by applying a 15 percent discount rate, System B would be less costly: The present cost of System B is $534.6 million; System A's cost, $567 million.

Not to employ the same appropriate discount rate in the public sector that is encountered in the private sector can lead to many anomolies. A low discount rate "justifies" or signals the use of "capital intensive" production methods. As such, it would mean, for example, that a fork lift truck in a government warehouse or machine tools in a government arsenal would be more expensive and durable than are used in identical private operations. Government office buildings would be longer-lived than those in the private sector. More expensive automobiles, which would afford lower annual operation cost, would be called for. There appears to be no rational justification to promulgate such behavior.[2]

It should be noted that the level of the interest rate applicable to government operations has nothing to do with whether the total amount of government goods and services, or the magnitude of government activity as applied to meeting purely government ends, be large or small relative to the private sector of the economy. As exemplified by our weapon system example, the use of a 15 percent rate does not affect the decision of whether the government should procure a large or small quantity of weapons. Nor does it imply one way or the other whether we should have more "public goods" such as education, national parks, space probes and ballistic missiles and fewer consumer goods, or vice versa. This issue is still to be determined by essentially political processes, to be hammered out by the liberal and conservative spenders. To follow the equalization principle is simply a means of maximizing the combined amount of both private and collective goods over whatever foreseeable future for which the appropriate rate of return will hold.

B. The Social Time Preference School of Thought

The "equalization principle" advocated here is not accepted by many students. Rather, they hold that the government employ some "social" rate of "time prefer-

[1] It is possible, however, to address by analytical methods the question of whether the capability provided by either system is worth the cost. But this point takes us into other aspects of cost- effectiveness analysis, particularly the problem of identifying and measuring benefits. These problems should not be intertwined or confused with those of cost, which is what the discount rate treats.

[2] However, the point discussed above can help one understand the behavior of government agency and bureau heads to the extent that they do advocate the more "capital intensive" methods. To employ a less capital intensive technique necessitates higher annual outlays to maintain a given level of operations. Annual outlays can be (and are) controlled through the annual budget cycle. A capital intensive method, therefore, provides the agency a larger measure of protection against possible future control by higher decision makers, including Congress.

ence" for purposes of evaluating its investment projects. The main argument adopted by this group seems to run as follows: Investment decision-making in the private sector is governed by "time preference," which reflects the relative value that private individuals attach to present versus future consumption. The rate of return in the private sector reveals the "time preference" of private individuals who control resources. But there is no necessary reason, however, why the government should use the same rate. The private rate of time preference may be "too high" because private individuals are apt to be afflicted with "myopia," or possess a "defective telescopic facility," which causes them to save and invest less. The government should take a "longer view" since it has an obligation to promote the welfare of unborn generations. The appropriate social rate of time preference, therefore, should be lower than the "myopic" market rate.[1]

Such a line of argument is another way of saying that a larger capital stock is better than a smaller capital stock. The "optimum social rate of time preference" is therefore the opportunity return on the margin of investment that is consistent with some desired and larger total output goal. The assertion that the private rate of time preference is "too high" is therefore an assertion that the rate of capital formation will not be rapid enough, which is also an assertion that the national output at some future point in time should be higher than would result from spontaneous private investment and saving. The issue therefore becomes one of determining the rate of economic growth and net capital formation which assures that future generations will enjoy some policy-determined level of income.[2]

Even if we grant that the over-all rate of growth of the economy and the rate of investment spending should be higher than what it would otherwise be, it does not follow that the government should employ, for evaluating its projects, an interest rate that is lower than the rate of return prevailing in the private sector of the economy. To the extent that a more rapid rate of capital accumulation promotes a higher rate of economic growth, it is simply sufficient that investment *per se* be increased, whether it be in the private sector of the economy or in government projects. In order to achieve a given growth objective most efficiently, we should still adhere to the equalization principle. By means of tax and subsidy devices, monetary policy, and possibly through other techniques, the opportunity return on *all* investment could be forced down from 15 percent to 10 percent, or even 3 percent. Whatever the rate of return might be, the same rate should also be employed for evaluating government projects. If the rates in the two sectors are not equalized, the policy of employing a lower rate for evaluating government projects will be an inefficient way of attaining the growth objective. It will also change the composition of output available to future generations. Moreover, it changes the product mix in an extremely inefficient manner. Let us demonstrate these points in connection with reclamation projects.

Let us assume that the going rate of return (before taxes) in the private sector of the economy is 15 percent. A proposed reclamation project that will provide water to irrigate land that can grow tomatoes is subjected to a cost benefit study. The study reveals that the internal rate of return on the tomato land reclamation project is 5 percent. In the cause of offsetting the "myopia" of the private sector of the economy, government policy-makers employ a 4 percent "social time preference" rate in their cost benefit analysis. On this basis the tomato-land reclamation project is undertaken. What are its consequences, and how does it benefit future generations?

Let us assume that the tomato land reclamation project costs $100,000,000. In the cause of enhancing the welfare of future generations, steps are taken to insure that the resources diverted to the reclamation project come only out of private consumption. In this case future generations would enjoy a higher gross national product of $4,000,000 annually—the increment consisting solely of tomatoes.

[1] See, e.g., Otto Eckstein, "A Survey of the Theory of Public Expenditure Criteria," *Public Finances: Needs, Sources and Utilization*, Princeton, 1961, p. 10; Stephen A. Marglin, "The Social Rate of Discount and the Optimal Rate of Investment," *The Quarterly Journal of Economics*, (February 1963), pp. 95–111 This line of thinking has its intellectual foundation in the work of A. C. Pigou. See his *The Economics of Welfare*, 4th Ed. (London, 1949), p. 24. It was first published in 1912.

[2] At this point we must recognize that the "optimum" interest rate could be zero or even negative. For example, a per capita personal income of $50,000 a year by the year 2,000 might be attainable by utilizing all investment opportunities which at that time could offer any positive rate of return. Under such a condition the opportunity return would be zero. On the other hand, if we thought the per capita personal income should be $100,000 a year at that same point in time, an investment program that results in a negative opportunity return would have to be undertaken. Such a program, since all projects yielding positive returns would be exploited, would require that goods be stored for future generations. The cost of storing and deterioration would be responsible for the negative rate.

Should, however, $26.7 million of the resources required for the reclamation project be displaced from private investment, the future gross national product would be at the same level it would be if there had been no government project, although future generations would have more tomatoes but less consumer durables, entertainment, and other items normally produced in the private sector. Any larger displacement of resources from private investment into the tomato-land project would reduce the gross national product. For example, should the $100,000,000 project displace $40 million from private investment the future GNP will be $2 million less. Each year future generations would have $4 million more a year of tomatoes, but $6 million a year less of other goods. Thus the growth objective is defeated. For this happy outcome the present generation in addition sacrifices $60 million of consumption.

The operation is also an expensive way of getting additional tomatoes. If increasing tomato output is an important public goal, a more efficient way to attain it would be to subsidize tomato growing in the private sector of the economy that would cause some capital resources, which on the margin are yielding 15 percent, to be reallocated to tomato production and diverted from the production of other privately produced commodities.

C. Summary of The Equalization Principle

When we recognize that the government can attain any desired product mix by the use of selected excise taxes and subsidies, the use of an interest rate on government projects that supply private goods that is lower than the opportunity return in the private sector is an inefficient way of changing the composition of output. The use of a lower rate also leads to irrational decision-making within the government sector itself. For example, with the use of a zero rate, a $3 billion freeway system for a large metropolitan area, would appear to have an annual opportunity cost of zero. At a 15 percent rate, the annual cost is $450 million. If we explicitly recognize the $450 million annual cost, the investment of say $1 billion in a rapid transit system with an annual operating subsidy of $100 million a year and only $2 billion in freeways might provide an overall more effective urban transportation system. The use of low interest rates, or a zero rate, for evaluating government investments therefore seems almost certain to insure that the public goods and services we do get are likely to be the wrong kind.

Critics of the qualization principle (who generally are "low" interest rate advocates) usually criticize the position on the ground that it assumes that the level and structure of rates revealed in the private sector of the economy are optimal. They then correctly assert that optimality has not been proven. Therefore, the equalization principle should be rejected. Rejection of the equalization principle for this reason is a palpable *non sequiter*.

To invest resources purposefully in activities where the return is lower than the highest attainable is simply wasteful and inefficient, whether the highest rate of return is "optimal" or not. If we wish to attain a given growth objective, resources should be invested where the return is highest. If we want to change the composition of private goods, whether produced by government or private firms, the most efficient investment channels should be directed to that end by means of excise taxes and subsidies. If we want a given amount of government goods that meet "collective" wants, the investment policy that provides the highest GNP is the best means to get it. Even those who decry our nation's alleged "imbalance" between public and private goods (to say nothing of those who fly bombers or man submarines, or who teach school or supervise the national parks) can be motivated by offering them command over productive power, which includes the services of privately-created investment goods. If there is more such productive power, as contrasted with less, the burden of taxation or the inflationary incidence of deficit spending is less. The government can therefore proceed to divert more resources from the private sector to attain collective goals than it could if it caused resources to be invested in less productive channels. Thus, the assumption that the private opportunity rate of return is "optimal," in terms of some desired rate of economic growth, is not necessary to support the principle that the rates of return in the government and private sectors of investment be equalized.

II. ESTIMATING THE RATE OF RETURN

Ideally, we need a measure of the "marginal efficiency of investment." Moreover, it should be the rate of return before corporate and property taxes. Such a measure would enable us to address the following question: given an increment of new investment in the economy, what will be the resulting and permanent

increase in the net national income and product? The reason we want the rate of return before taxes is because the government shares in the yield from private investment. This point is particularly germane with regard to treating government investment projects because the government experiences a loss of tax yields if it causes resources to be diverted from investment in the private sector. For example, an increment of private investment of, say, $100 million may increase the net national product by $15 million annually. With a 50 percent profit tax, the government is able to extract $7.5 million of that increment. The overall social benefit of the private investment is thus 15 percent, and this should be the rate of return used to evaluate government investment projects.[1]

Such a rate of return concept also implies an equilibrium in the sense that rates of return are equal in all lines of activity. Actually, no such equality exists. The lack of equality between rates available on different margins of investment may be due to the fact that at any given time the economy is not in equilibrium.[2] It may also be due to the fact that investors have "tastes" for the differences in risk encountered with various types of physical assets. One is therefore forced to employ some average of marginal rates of return in order to get an overall measure of the social benefits of private investment.

Table 1 shows the average rates of return attributed to physical assets in major sectors of the American economy for selected periods. Column 1 shows total "earning assets" in 1965, to provide the reader a feeling for the relative importance of these sectors. Columns 2 and 3 show the average annual rates of return for the periods stated in Column 2. Column 5 presents the average annual rates of return for the period 1961–65.

Before treating the behavior shown in Table 1, it is useful to describe the basis upon which the rates of return estimates were made.

TABLE 1.—SUMMARY OF RATE OF RETURN BEHAVIOR FOR SELECTED MAJOR SECTORS[1]

Sector	Total earning assets, 1965 (billions of dollars)	Period	Annual average rate of return (percent)	Annual average rate of return 1961–65 (percent)
Manufacturing	274,574	1949–65	17.7	15.4
Electric utilities	53,534	1949–65	8.9	9.3
Gas pipelines	8,782	1955–65	8.5	8.6
Telephone	31,429	1949–65	10.6	11.9
Railroads	25,203	1956–65	4.8	4.1
Motor carriers	1,293	1958–64	13.0	[2] 14.7
Oil pipelines	2,793	1956–65	14.4	15.6
Airlines	4,384	1959–65	6.1	8.2

[1] Further detail, by year, is provided in appendix tables A-1 through A-8.
[2] Average of 1961–64 only.

Source: See appendix tables A-1 through A-8.

"Earning assets" in these calculations include inventory, net plant and equipment, and accounts receivable. Excluded from the asset base were cash and other short term liquid assets, and securities and long term debt that a company may hold as an investment. These adjustments warrant explanation.

From a firm's point of view, cash is necessary to provide liquidity. But, from the point of view of the overall economy, cash is not a "productive" resource. It yields no service or product in the same sense that workers or physical equipment create products. It is only a paper or legal claim against the government or a bank. The marginal cost of cash to society is zero, since the supply of money can be increased or decreased by bookeeping transactions and banking operations. As such, cash

[1] The overall impact of taxes on the earnings from all wealth—if one recognizes property, and corporate and personal income taxes—has been estimated by Arnold Harberger to be slightly under 50 percent, although the effective tax rates vary considerably as between sectors and activities. See Arnold Harberger, "Efficiency Effects of Taxes on Income From Capital," in *Effects of Corporation Income Tax*, ed. by Marian Krzyzaniak, (Detroit, 1966) p. 110. Harberger's estimate is based on 1953–59 behavior, which may be mitigated somewhat by the Revenue Acts of 1962 and 1964. On the other hand, increases since that period in state income taxes and local property taxes will have worked in the opposite direction.

[2] However, there is nevertheless a strong tendency toward an equilibrium. See George J. Stigler, *Capital and Rates of Return In Manufacturing Industries*, (Princeton, 1963), for a demonstration of this point.

is not an asset the existence of which causes a displacement of real resources from the point of view of the economy as a whole, nor does cash create any real product in the economic system.

Other legal claims such as bonds and stocks are not physical, real resources; rather, they are claims against physical resources. Their creation, and their existence, therefore, do not involve the displacement of physical resources. Moreover, to the extent that a manufacturing or other operating enterprise owns them, that company is functioning as a portfolio investor, rather than a producer of economic goods and services. For these reasons such assets should not be considered part of the assets associated with the operations for which its physical investment is undertaken.[1]

The exclusion of these items from the estimate of a capital base, particularly the exclusion of cash and other short term financial assets, will cause the asset base to be smaller, and the derived rate of return to be higher, than those encountered in normal financial calculations.

In line with the same asset base, asset earnings were calculated to derive earnings before payment of interest on debt a company owes, before corporate taxes, and to exclude income not derived from operations, such as dividends or interest received from stocks or debt that a company owns.[2]

Table 1 indicates that in manufacturing the rate of return is around 15 percent; in the preponderance of the regulated sector it is around 10 percent, with the notable exception of the railroads. Examination of Appendix Tables A–1 through A–8 indicates that in manufacturing the rate of return has held fairly constant at around 15 percent after a leveling off from the Korean War induced highs. In the regulated sector, from the early and middle 1950's, the rate of return has tended to rise, to level off at around 10 percent. Railroads, however, have consistently done poorly, which reflects basic structural changes in our transportation sector. Until the last few years, airlines also fared poorly. However, since 1962 they have picked up dramatically, both in terms of rate of return performance as well as the absolute and relative allocation of investment to that sector.[3] Thus, a rate of return of 10 percent in the regulated sector and 15 percent in manufacturing—attributable to earning assets as defined above—appears to be a reasonable estimate of the opportunity cost of private investment in those sectors.

One may go a step further to ascertain the relative importance to attach to these rates. Table 2 shows the allocation of business investment on plant and equipment, by year, during the five year period of 1961–65. According to these data, about 70 percent of the total flows into the unregulated sector of manufacturing, mining, and commercial;[4] the remaining predominately regulated sector absorbs 30 percent. If we assume that the revealed 15 percent rate of return in manufacturing would also apply to the mining and commercial sectors, on the ground that competition within the unregulated sector would tend to promote equality in the rates of return, one could weight the 15 and 10 percent rates of return at the ratios of 70 and 30 percent, respectively. The overall rate of return is thus 13.5 percent.

[1] Accounts receivable are also legal claims, rather than physical assets; and one might contend that they, too, should not be part of the physical asset base. However, they constitute part of the "stock in trade" necessary for the conduct of business operations. They reflect displaced physical resources. They may be viewed as a "lending" or "renting" of goods or services for some specified period of time, with the firm receiving its earnings on its investment in the form of higher prices to its customers

[2] Further detail on the calculating methodology, including some discussion of the data sources, is presented in the Technical Notes in Appendix 1.

[3] The performance shown in Appendix Table A–8 for airlines has continued into 1966 when the rate of return was 12.5 percent, and the earning assets increased to $5.6 billion.

[4] The "commercial and other" category shown in Table 2 absorbs a large portion (24 percent) of the total. It includes trade and services. The preponderance of unincorporated businesses will be found in this sector, although it also contains large corporate activities—e.g., hotels, retail trade. Because of the diversity of activities and the importance of non-corporate firms in this sector, good data on investment and asset earnings is not readily available. For a discussion of some of the analytical and measurement problems of treating unincorporated businesses, see Stigler, *op. cit.*, pp. 114–118.

TABLE 2.—ALLOCATION OF BUSINESS INVESTMENT SPENDING ON PLANT AND EQUIPMENT, 1960–65

[Billions of dollars]

	1961	1962	1963	1964	1965	5-year total	Percent
All industries	34.37	37.31	39.22	44.90	51.96	207.76	100
Manufacturing	13.68	14.68	15.69	18.58	22.45	85.08	41
Mining	.98	1.08	1.04	1.19	1.30	5.59	3
Commercial and other	8.46	9.52	10.03	10.83	11.79	50.63	24
Public utilities	5.25	5.48	5.65	6.22	6.94	29.54	14
Communications	3.22	3.63	3.79	4.30	4.94	19.88	10
Railroads	.67	.85	1.10	1.40	1.73	5.75	3
Transportation, other than railroads	1.85	2.07	1.92	2.38	2.18	11.03	5

Source: "Survey of Current Business", Apr. 1964, p. S-2; and Jan. 1967, p. S-2.

Appendix A

TABLE A-1.—MANUFACTURING EARNING ASSETS, EARNINGS AND RATE OF RETURN (BEFORE FEDERAL INCOME TAXES), 1949–65. (EARNINGS AND ASSETS IN MILLIONS OF DOLLARS)

Year	Earning assets	Operating profit [1]	Interest [2]	Earnings [3]	Rate of return
1949	79,723	14,319	344	14,663	18.4
1950	84,061	22,651	340	22,992	27.4
1951	102,045	25,365	442	25,807	25.3
1952	122,780	22,456	624	23,080	18.8
1953	129,616	24,004	702	24,706	19.1
1954	132,092	20,541	663	21,204	16.1
1955	139,144	27,655	703	28,358	20.4
1956	159,043	28,742	932	29,674	18.7
1957	170,701	27,379	1,111	28,490	16.7
1958	175,341	21,926	1,173	23,099	13.2
1959	185,819	28,699	1,350	30,049	16.2
1960	198,713	26,486	1,538	28,024	14.1
1961	208,518	26,454	1,624	28,078	13.5
1962	222,624	30,819	1,822	32,641	14.7
1963	233,604	33,777	1,887	35,664	15.3
1964	248,896	38,416	2,143	40,559	16.3
1965	274,574	45,630	2,545	48,175	17.5

[1] Net operating profit as reported in source below.
[2] Estimated by method discussed below.
[3] Sum of "operating profit" and estimated "interest" costs.

Source: Quarterly financial report for manufacturing corporations, Federal Trade Commission, Securities Exchange Commission, 1949–66.

TABLE A-2.—RATE OF RETURN, TOTAL AND SELECTED ASSETS, PRIVATELY OWNED ELECTRIC UTILITIES IN THE UNITED STATES, 1949–65 (ASSETS AND EARNINGS IN MILLIONS OF DOLLARS)

Year	Earning assets	Earnings	Rate of return on earning assets (percent)
1949	16,475	1,323	8.0
1950	18,150	1,519	8.4
1951	19,887	1,724	8.7
1952	21,954	1,985	9.0
1953	24,517	2,183	8.9
1954	26,716	2,371	8.9
1955	28,776	2,681	9.3
1956	31,127	2,888	9.3
1957	34,136	3,012	8.8
1958	37,012	3,212	8.7
1959	39,710	3,567	9.0
1960	42,241	3,828	9.1
1961	44,401	4,058	9.1
1962	46,403	4,372	9.4
1963	48,539	4,585	9.4
1964	50,770	4,753	9.4
1965	53,534	4,995	9.3

Source: "Statistics of Electric Utilities in the United States, Privately Owned," 1959 and 1965 volumes, Federal Power Commission.

TABLE A-3.—NATURAL GAS PIPELINE COMPANY EARNING ASSETS, EARNINGS (BEFORE FEDERAL INCOME TAXES) AND RATE OF RETURN, 1955-65

[Assets and earnings in millions of dollars]

Year	Earning assets	Earnings	Rate of return (percent)
1955	5,232	323	9.2
1956	5,789	359	9.0
1957	6,697	395	8.0
1958	7,270	427	8.0
1959	7,990	474	7.9
1960	8,718	549	8.6
1961	8,876	560	9.0
1962	9,356	605	8.6
1963	9,522	616	8.9
1964	9,397	586	8.3
1965	9,673	603	8.2

Source: "Statistics for Interstate Natural Gas Pipeline Companies," 1965, Federal Power Commission.

TABLE A-4.—TELEPHONE COMMUNICATIONS EARNING ASSETS, INCOME, AND RATE OF RETURN (BEFORE FEDERAL INCOME TAXES), 1949-65

[Assets and earnings in millions of dollars]

Year	Earning assets	Earnings	Rate of return (percent)
1949	7,635	453	5.9
1950	8,239	709	8.6
1951	8,938	817	9.1
1952	9,801	915	9.3
1953	10,789	1,052	9.8
1954	11,729	1,184	10.0
1955	12,933	1,424	11.0
1956	14,685	1,572	10.7
1957	16,590	1,725	10.4
1958	18,015	2,085	11.6
1959	19,455	2,404	12.4
1960	21,108	2,601	12.3
1961	22,966	2,800	12.2
1962	24,861	3,030	12.2
1963	26,796	3,273	12.2
1964	28,964	3,377	11.7
1965	31,429	3,602	11.5

Source: "Statistics of Communications Common Carriers," Federal Communications Commission (annual reports).

TABLE A-5.—RAILROAD EARNING ASSETS, EARNINGS, AND RATE OF RETURN (BEFORE FEDERAL INCOME TAXES), 1956-65

[Assets and earnings in millions of dollars]

Year	Earning assets	Earnings	Rate of return (percent)
1956	23,756	1,713	7.2
1957	24,034	1,515	6.3
1958	24,479	1,304	5.3
1959	24,469	1,340	5.4
1960	24,613	787	3.2
1961	24,496	1,167	4.7
1962	24,538	885	3.6
1963	24,593	970	3.9
1964	24,240	956	3.9
1965	25,203	1,126	4.5

Source: Transport Statistics in the United States (annual reports), pt. I, "Railroads," Bureau of Accounts, Interstate Commerce Commission.

TABLE A-6.—OIL PIPELINES, EARNING ASSETS, INCOME, AND RATE OF RETURN (BEFORE FEDERAL INCOME, TAXES), 1956-65

[Assets and earnings in millions of dollars]

Year	Earning assets	Earnings	Rate of return (percent)
1956	1,990	328	16.5
1957	2,048	291	14.2
1958	2,094	246	11.7
1959	2,253	259	11.5
1960	2,267	269	11.9
1961	2,316	326	14.1
1962	2,316	342	14.8
1963	2,718	358	13.2
1964	2,739	476	17.4
1965	2,793	521	18.7

Source: Transport Statistics in the United States (annual reports), pt. 6, "Oil Pipelines." Bureau of Accounts, Interstate Commerce Commission.

TABLE A-7.—INTERCITY MOTOR CARRIER EARNING ASSETS, EARNINGS, AND RATE OF RETURN (BEFORE FEDERAL INCOME TAXES), 1958-64

[Assets and earnings in millions of dollars]

Year	Earning assets	Earnings	Rate of return (percent)
1958	844	95	11.2
1959	956	141	14.5
1960	991	66	6.7
1961	1,020	142	13.9
1962	1,104	164	14.9
1963	1,188	166	13.9
1964	1,293	208	16.1

Source: "Transport Statistics in the United States," (annual reports) "Part 7: Motor Carriers." Bureau of Accounts Interstate Commerce Commission.

TABLE A-8.—AIRLINES (CERTIFICATED AIR ROUTE CARRIERS) EARNING ASSETS, EARNINGS, AND RATE OF RETURN (BEFORE FEDERAL INCOME TAXES AND SUBSIDIES), 1959-65

[Earnings and assets in millions of dollars]

Year	Earning assets	Earnings	Rate of return (percent)
1959	2,114	75	3.5
1960	2,663	22	8
1961	3,072	−58	----------
1962	3,249	107	3.2
1963	3,236	197	6.0
1964	3,804	388	10.1
1965	4,384	593	13.5

Source: "Civil Aeronautics Board, Air Carrier Financial Statistics." (So-called Yellow Book, issued quarterly.)

Technical Notes on Tables A-1 Through A-8

I. DERIVATION OF EARNING ASSET ESTIMATES

A. Annual versus Quarterly Asset Values

For all sectors, except manufacturing, asset values were end of year (December 31) magnitudes. For manufacturing, the average of end of quarter magnitudes was employed. To the extent that an industry is growing, this difference will tend to cause the asset base to be larger when the end of year value is used than when the average of the quarters is employed, with an opposite effect on the rate of return calculation. Thus the rates of return developed in this study on the regulated industries will be slightly understated relative to those shown for manufacturing.

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B. Elements of the Asset Base

1. *Manufacturing.*—The items in the *Quarterly Financial Report* (FTC–SEC) "Total Receivables," "Inventories" and "Total Property, Plant, and Equipment (net)," were summed.

2. *Electric Utilities.*—The accounts labeled "net total utility plant," "notes and accounts receivable less accumulated provisions for uncollected accounts" and "materials and supplies" were summed.[1]

3. *Natural Gas Pipelines.*—"Net gas utility plant," "gas stored underground—non-current" accounts were summed to derive long-term assets; "notes and accounts receivable, less accumulated provision for uncollected accounts," "materials and supplies" and "gas stored underground—current" constituted short term earning assets.

4. *Telephone Communications.*—"Total communications plant—net," "materials and supplies" and "accounts receivable from customers, agents and others" were summed.

5. *Railroads.*—"Total Properties less recorded depreciation and amortization," "materials and supplies," "net balance receivable from agents and conductors," "miscellaneous accounts receivable," and "accrued accounts receivable" were summed.

6. *Oil Pipelines.*—Only selected balance sheet data are provided in ICC reports treating this industry. Earning assets were estimated as follows: "carrier property" less the sum of "accrued depreciation—property" and "accrued amortization—property" constituted estimate of physical plant. "Total current assets" less "cash" served as an estimate of receivables and inventory or supplies. This method undoubtedly overestimates "earning assets" as defined in this study, and will cause a slight underestimate of the rate of return.

7. *Motor Carriers.*—"Net carrier operating property" plus 50 percent of "Current assets—total" were summed. The 50 percent factor was derived from examination of more detailed statistics for a subsample of the industry.

8. *Airlines.*—"Net value of operating equipment," "materials," "net value of spare parts" and "accounts receivable" were summed. For the years 1959 and 1960, the above short term asset accounts could not be clearly identified; hence, 50 percent of total short term assets was employed.

II. EARNINGS

A. For each of the regulated industries, annual operating income (before fixed charges, particularly interest) and major tax components (including federal income taxes) were readily identifiable. For airlines, federal subsidies (which mainly accrue to selected local route carriers) were *subtracted* from aggregate industry profits to derive before tax earnings. (In 1965, for example, the federal subsidy was $79 million.) It is possible that mail revenues may contain a subsidy element; however, we had no way of estimating this for a fact.

B. *Manufacturing.*—The FTC–SEC definition of "Net profit from operations" *excludes* interest charges. That is, cost and expenses include interest on debt and bonds. Thus the "profit" figure (which compares with what corporate stockholders normally focus on) would understate asset earnings by the amount of interest payments. (The FTC–SEC reports, incidentally, follow the pattern employed in the Department of Commerce national income accounting methodology.) Nor do the FTC–SEC Quarterly Reports provide a separate interest cost component. It was therefore necessary to estimate interest charges. (This estimate is shown by year in Table A–1.)

The estimating method for interest was as follows: The FTC–SEC reports do provide balance sheet data on "short term loans from banks," (maturity of one year or less), "installments, due in one year or less, on long term debt," and "long term debt due in more than one year." For each year the quarterly average of these items was determined, the short term item and the sum of the two long term items were multiplied by an appropriate interest rate. The sum of these products contsitutes the estimated "interest" item shown in Table A–1.

The derivation of the interest rates was as follows: For long term debt, a 10 year moving average of Moody's composite yield on industrial bonds. For short term debt the arithmetic mean, for each year, of the rate on short term bank loans and the rate on 4 to 6 month prime paper. These rates are shown in Appendix Table A.

[1] See references cited in Tables for source documents.

APPENDIX TABLE A.—INTEREST RATES EMPLOYED TO ESTIMATE INTEREST COMPONENT OF MANUFACTURING ASSET EARNINGS, 1949-65

Year	Short-term rates			Moody's composite yield on industrial bonds (10-year moving average)
	Short-term bank loans	Prime commercial paper, 4-6 months	Average	
1949	2.68	1.49	2.08	2.82
1950	2.69	1.45	2.07	2.78
1951	3.11	2.16	2.63	2.77
1952	3.49	2.33	2.91	2.77
1953	3.69	2.52	3.10	2.82
1954	3.61	1.58	2.59	2.85
1955	3.70	2.18	2.94	2.90
1956	4.20	3.31	3.75	2.99
1957	4.62	3.81	4.21	3.13
1958	4.34	2.46	3.40	3.25
1959	[1] 5.00	3.97	4.48	3.42
1960	5.16	3.85	4.50	3.62
1961	4.97	2.97	3.97	3.78
1962	5.00	3.26	4.13	3.93
1963	5.01	3.55	4.28	4.04
1964	4.99	3.97	4.48	4.18
1965	5.06	4.38	4.72	4.33

[1] Beginning 1959, series revised to exclude loans to nonbank financial institutions.

Source: Short-term rates: Economic Report of the President, January 1967, p. 272. Long-term rate: Moody's Industrial Manual, 1965, p. a21.

Chairman PROXMIRE. Thank you very much, Mr. Stockfisch.

The next witness is Prof. Morton Kamien, of the Graduate School of Industrial Administration of Carnegie-Mellon University.

Go ahead, Professor Kamien.

STATEMENT OF MORTON KAMIEN, ASSOCIATE PROFESSOR OF ECONOMICS, GRADUATE SCHOOL OF INDUSTRIAL ADMINISTRATION, CARNEGIE-MELLON UNIVERSITY, PITTSBURGH, PA.

Mr. KAMIEN. I have submitted a written statement which I would like to have put in the record.

Chairman PROXMIRE. Yes, indeed, that will be done.

Mr. KAMIEN. I will summarize it briefly now.

As Mr. Stockfisch has indicated, the choice of an interest rate critically affects the attractiveness of a Government project. That is, if the interest rate selected for discounting in a cost-benefit analysis is high, the project will look less attractive; if it is selected low, the project will look more attractive.

He has also stated the central issue; namely, what is the opportunity cost of taking funds out of the private sector and putting them into the public sector.

Now, I think that to the extent there is disagreement among economists about the proper rate of interest to use, that the disagreement revolves around, what is the true reflection of opportunity costs. If we had an idealized economy; that is, one in which all markets worked perfectly this question wouldn't arise. There would be a single interest rate, both in the private and in the public sector. Obviously, we would then just use that rate.

Unfortunately we do not have an idealized economy. And so we in fact observe in the market a multiplicity of interest rates.

The question that arises is why? A part of the answer, although not the complete answer, is due to the uncertainty of the outcome of present actions in the future. That is to say, if I make an investment

today I cannot be sure what the outcome of that investment will be 5 years from now, 2 years from now, or over whatever period I am concerned with.

Now, we can distinguish two types of uncertainty. If I am the lender of funds to someone else who is in fact doing the investing in the actual project, the risk or uncertainty that I bear is that he may not repay the interest on the loan, or he may not repay the loan itself. The second type of uncertainty relates to the outcome of the project itself.

If the success of the project that the borrower undertakes determines whether he pays me back or not, then he and I bear precisely the same risk, or it is as if I were myself undertaking the project. On the other hand, once he puts up collateral, he and I no longer bear the same risk, for even if the project doesn't succeed, I will be repaid something. That is the purpose of having collateral put up. Put another way, if we take the same project and let General Motors undertake it, it will be able to finance that project at a lower cost than a small investor because its ability to repay the loan is better.

What this signifies is that much of the risk has, in terms of the lender, little to do with the merit of the project per se, but more with the ability of the borrower to repay. It is this difference in the borrower's ability to repay which I think accounts for a multiplicity of interest rates.

It might be possible to insure against the possibility that the borrower will not repay. If you buy Government bonds you insure against this. The risk of the project is diffused among all the taxpayers. The Government will repay its loans short of national catastrophe, regardless of the outcome of the project because of its taxing power.

What this amounts to is that we have to try to establish the true opportunity cost of a project and at the same time take into account the uncertainties that are inherent in the project.

Mr. Stockfisch has espoused one point of view; namely, that you take uncertainty into account—although I am slightly paraphrasing what he has said—by looking at projects in the private sector which appear to have the same riskiness, and seeing what kind of rate of return they require, and then applying that rate of return to discounting a Government project.

An alternative to this is to take the uncertainty of the project into account in the estimation of the cost and benefits. That is to say, if we undertake a project, several things may happen. We might enumerate all the things that could happen, and associate with them the likelihood of each event occurring.

We could then take a weighted sum of these outcomes, where the weights would refer to the likelihood of occurrence of that event. We would then have the most likely outcome or, in other words, the most likely benefits to accrue from this project. Likewise we could do the same with costs. In this way adjustment would be made for uncertainty as to the outcome of the project. The interest rate to be used, then, in discounting would be the rate that the Government could borrow, presently about 4½ to 5 percent.

Let me touch also upon the other issue that Mr. Stockfisch raised, and which is dealt with in the written document; namely, the question regarding the private rate of discount versus the social rate of discount.

If it is true that collectively we have different preferences regarding

present sacrifice versus future benefits than we do individually—and this is a question of fact—then the Government should, via monetary and fiscal policy, drive down the overall rate of interest. For if collectively we prefer future benefits more than we do individually, then presumably we would prefer them regardless of their source, whether they come from the private sector or from the public sector. The argument then would be, of course, that we should not give special treatment to Government projects, but should treat all projects alike.

I likewise agree with Mr. Stockfisch that a before tax adjustment in the interest rate be made, and then some adjustment be made for inflation. The latter adjustment is called for because the nominal rate at which the Government borrows partly reflects anticipations of lenders as to the value of the dollar in the future.

I think that about covers my summary.

(The prepared statement of Mr. Kamien follows:)

PREPARED STATEMENT OF MORTON I. KAMIEN

Interest Rate Guidelines for Federal Decisionmaking

The intention in this testimony is to present and appraise current thinking among economists about the proper interest rate to be used for discounting future benefits and costs of government projects. The choice of an interest rate for discounting is a crucial part of the cost-benefit analyses of long term projects, since the appraisal of a project is critically related to the interest rate used. If a relatively high interest rate is used the project may look bad, while a relatively low interest rate will make the project look good. Thus, the key questions posed are:

1. Is the appropriate rate of interest the one that the government must pay to borrow or is it the interest rate that private enterprises must offer in order to borrow?
2. Should the evaluation of present versus future benefits reflect individual preferences or should it reflect collective preferences?

The discussion of interest rates will be confined to the context of these two questions and a few closely related issues. No attention will be paid to the use of the interest rate as an instrument for redistributing income or promoting full employment.

While subsequent statements will be couched in monetary terms, dollars, it should be constantly remembered that what is of concern is the allocation of real resources—labor, land, and machines—between providing for the present and providing for the future, and between private allocation and public allocation for these needs. In other words, there is a twofold problem: (i) what portion of resources that can provide present benefits should be sacrificed for future benefits, and (ii) how should the resources devoted to provision of future benefits be divided between the public and the private sector? These questions are simply restatements, in terms of allocation of resources, of the questions posed above. The manner in which these questions are actually resolved will determine the level of satisfaction or well being that will be derived from our resources by both present and future generations. The answers to these questions are directly related to the choice of an interest rate. What is sought is that answer, and consequently that interest rate, which will maximize the total satisfaction of both present and future generations.

My own conclusion is that the appropriate rate of interest to be used in cost-benefit analyses is the rate paid on newly issued long-term government bonds. The maturity of the bond should correspond to the projected lifetime of the project under consideration. Uncertainty regarding future benefits and costs of the project should be reflected in the estimation of benefits and costs, not in the discount rate. Furthermore, no special adjustment should be made in the discount rate used for evaluating government projects to take account of collective preferences regarding present sacrifice for future gain. However, adjustments should be made in cost-benefit studies to take account of present tax structure. Again, this should be done by calculating both benefits and costs after taxes rather than before taxes. Finally, a downward adjustment in the nominal interest rate may be required to make up for anticipated future inflation.

These conclusions, particularly in reference to the treatment of uncertainty, call for careful scrutiny of cost-benefit studies. This may sometimes require duplication of the study, which can be very costly. Yet, relative to the amounts of money being invested in the project, even a complete replication of a cost-benefit analysis will appear cheap. Naturally, an independent agency would be in the best position to scrutinize proposed government projects.

To make clear how these conclusions were reached, it is necessary to make a few remarks regarding the formation of interest rates, the role of interest rates in allocating real resources between present and future benefits and between the public and private sectors, the nature and types of uncertainties that must be taken into account, and the relationship between collective and individual preferences. The formation of interest rates will be dealt with first.

The explanation of how interest rates are formed usually begins in the context of an idealized economy and then proceeds to a discussion of the real world. The same route will be followed here.

As understood by economists, the interest rate results from the simultaneous interaction of two factors: individuals' valuations of future benefits versus current benefits (this is affected by individuals' wealth, age, and tastes, among other things) and the physical possibilities for transforming resources into desired end products. (This is affected by the present state of technology and the amount of resources on hand, among other things). The resulting interest rate serves two purposes: insofar as it reflects the desires of individuals regarding present sacrifice for future gain, it makes the present and future benefits commensurable: insofar as it reflects the productivity of existing resources, it provides a measure for comparison of alternative projects. Thus, at least in theory, this interest rate provides the best answers to the questions posed. Investment, both private and public, should be carried on up to a level beyond which further investment will not yield a return equal to the rate of interest. Pushing investment above this level will violate the preferences of individuals for present over future benefits. Stopping short of this point will mean that worthwhile investments will not be undertaken and maximum satisfaction will not be achieved. As to the balance between private and public investment, it follows that each should be pushed to the level at which any further investment will not yield a return equal to the rate of interest. This can be seen from the elementary notion that if at given levels of investment the yield in the private sector is less than that in the public sector, then a withdrawal of resources from the private sector and an addition of resources to the public sector will raise the overall yield. Obviously, if the situation is reversed then the opposite flow of resources is called for.

If the private sector is competitive, the forces of competition will insure that the aforementioned level of investment is undertaken. Lack of competition, naturally, may impede the attainment of this goal. The proper role for government in that instance is to enhance competition through anti-trust legislation and its other regulatory powers. The forces of competition, however, are not operative in the public sector. While, in the private sector, entrepreneurs must bid against each other in securing funds, and thereby command over productive resources, the government can raise money, not only by selling securities, but by taxation or even printing money. Indeed, the source of most government funds is taxes. Consequently, there is a danger that the proper balance between private and public investment will not be achieved. It is this concern that justified and calls for the Planning-Programing-Budgeting approach to the undertaking of government projects.

The above discussion of the formation of the interest rate is in substantial agreement with the view of most, if not all, economists. It also relates to an ideal, hypothetical economy. This economy is ideal because all the interacting parts work perfectly, it is hypothetical because no such economy has ever been observed. Thus, for example, while in the above discussion the existence of a single rate of interest was implied, even a casual glimpse at reality reveals the simultaneous presence of many different interest rates. Different rates are paid by savings banks on deposits, by cities on municipal bonds, by the government on long-term government bonds, by mutual funds, to mention only a few. It is the presence of a multiplicity of interest rates that poses the dilemma, and consequent disagreement among economists, about which interest rate to use in discounting government projects. Clearly, if there were only one interest rate, as in the idealized economy, this question would never arise.

Why is there a multiplicity of rates? The answer is, because there is uncertainty about the future outcome of action taken today and this uncertainty cannot be completely insured against. This answer deserves some clarification. What do we

mean by uncertainty? Two types of uncertainty can be distinguished. The first type is the lender's uncertainty regarding the borrower's ability and willingness to pay the interest on the loan or even repay the principal. A consequence of this type of uncertainty is that the borrower must put up collateral against a loan. The more collateral the borrower can present, the lower will be the interest rate on a given size loan to him, or the larger will be the amount he can borrow at the given rate or both. It is essentially for this reason that a large corporation, say United States Steel, can borrow at a lower rate of interest than the neighborhood grocer or druggist. Put another way, the lender bears the risk of default.

The second type of uncertainty is borrower's uncertainty. It relates to the pay-off from the project undertaken by the borrower. If a manufacturer decides to introduce a new product, he cannot be sure that it will find a market of sufficient size to generate a profit, or that a rival will not simultaneously introduce a superior product. It is this type of uncertainty that prompts corporations to employ market research staffs. In relation to government projects this type of uncertainty arises in connection with the actual costs of the project and the magnitude and timing of the benefits. Technological advances, which might permit the achievement of the same results at lower cost, also cannot be foreseen perfectly. These are some of the risks borne by the actual undertaker of a project, whether a small private enterprise, a large one, or a government body. Of course, larger corporations with better research staffs may be more able to assess these uncertainties and perhaps avoid some of them. Ford's experience with the Edsel, however, shows that even large corporations can make mistakes.

How are the risks borne by the borrower and those borne by the lender related? If the borrower's ability to repay the lender depends entirely on the outcome of the specific project for which the money was borrowed, then the risks borne by the borrower and lender, respectively, are identical. It is as if the lender were undertaking the project himself. This is the case when a project is financed by the personal savings of the individual undertaking the project. The lender can reduce his risk by providing funds only to a large corporation whose ability to repay does not rest solely on the success of a single project. Put another way he might choose to lend only to a corporation which has several sources of revenue, so that the likelihood of all of them drying up simultaneously is very small. In so doing, the lender diffuses the risk of default among many projects. Another way he may achieve the same end is to spread out his loans among several alternatives of varying degrees of riskiness. One purpose of mutual funds is to provide this option. Whichever alternative he chooses, the lender's purpose is to insure against the possibility of default.

To the extent that the lender cannot insure against the risk of default he will demand a higher rate of interest than he would otherwise. The lender may be unable to obtain this total insurance because it may be unavailable in general or unavailable to him in particular. Two consequences stem from this phenomenon. First, there will be a multiplicity of interest rates corresponding to different degrees of uncertainty regarding the borrower's ability to repay. Second, borrowers will be forced to undertake only those projects whose anticipated returns are high enough to meet the interest payments as well as the repayment of the principal.

There is a way for the lender to completely avoid the risk of default, namely by lending to the Federal Government. For the government, though perhaps no more capable of predicting the outcome of a venture than a corporation, can eliminate the risk of default through its power to tax. Short of national catastrophe, the return on a government bond is absolutely certain.

However, the government, just like a corporation, must bear the risk of the borrower. A corporation attempts to minimize this type of risk by looking at the most likely outcome of a venture and not at the best possible outcome. Indeed, a corporation may be even more conservative than this. It will scrutinize each new project very carefully. For even if the corporation can avoid the consequences of not paying the premiums or repaying the loan, its overall profitability will decline if it undertakes an unsuccessful venture. It is well known that a corporation's stockholders do not look favorably on a decline in profits.

The proper procedure for government to follow is the same, namely, incorporation of adjustments for uncertainty into its estimation of costs and benefits. It should then use the interest rate on government bonds, of maturity equal to the expected duration of the project, for discounting costs and benefits. If the government does not take uncertainty into account, but naively relies on its taxing power to repay the loan and interest, it will be misallocating resources. Moreover, if taxpayers do not eventually see appreciable benefits from government projects, then that government might find it difficult to remain in office.

While our earlier discussion relating to an idealized economy would find almost unanimous agreement among economists, the latter discussion of the real world and the prescriptions derived therefrom, would not. The disagreement among economists revolves around the manner in which uncertainty should be taken into account in cost-benefit analyses, and with some factual questions. The different viewpoints can conveniently be categorized into three different schools of thought.

The first school of thought, to which I ascribe, is that uncertainty should be handled in the estimation of future benefits and costs of the project. The advantage of this approach is that it focuses attention on the appropriate type of uncertainty, namely the uncertainty about the level at which the benefits will materialize. The fact that the same level of security against default cannot be attained in the private sector as in the public sector indicates either that capital markets are imperfect, that insurance against default is too costly, or both. In either eventuality, it does not call for the government handicapping itself unnecessarily. Moreover, the additional premium required above the interest on government bonds by lenders to private enterprise reflects the lender's risk of default more than the actual riskiness of the project.

The second school of thought argues that the riskiness of a government project be compensated by discounting future costs and benefits by an interest rate that would have to be paid by a private enterprise undertaking an equally risky venture. Thus, proponents of this procedure nominate the rate of return on a mutual fund, or on a private utility bond (if the government project is in the utilities area), as possible candidates. The basis for this argument is that firms will only undertake projects whose rate of return is high enough to cover the cost of borrowing. Since the cost of borrowing is higher to business than to the Federal Government, the possibility exists that firms will be undertaking projects with a higher return than government projects. As mentioned earlier, this would imply that a redistribution of productive resources from the public sector to the private sector would increase the overall return of our productive resources. This fear is, of course, legitimate. The fact that the government can borrow at a lower cost than corporations does not give it license to undertake projects from which the benefits are negligible or nonexistent. Indeed, the government must be especially careful to avoid such temptations. However, it does not follow from these considerations that the only way, or the best way, for the government to avoid this possibility is to penalize itself by using a higher rate of interest or discount than the rate at which it can borrow. As has been mentioned earlier, the difference between the government's cost of borrowing and private cost reflects more of the lender's risk of not being repaid than the actual uncertainty regarding the outcome of the project. Moreover, the difference in interest rates is not an inherent feature of a private enterprise economy. Instead, this difference mirrors our present institutions and laws, (e.g. the 52% corporate profits tax). Methods could be devised whereby a private firm could borrow at the same rate of interest as the government.

The third school of thought contends that neither the interest rate the government or a private enterprise must pay to borrow are appropriate for discounting in cost-benefit analysis. The former rate is too low, this group argues, because it does not take into account the uncertainties attached to the project. The latter rate is too high because it reflects not only the lender's risk, or lack of total insurability, but also the discriminatory practices in the capital markets. The latter contention is a question of fact, which can be resolved only by presentation of empirical evidence. I have never found compelling evidence to deny or confirm this allegation. This group, in any case, goes on to advocate that the source of the funds used to finance a particular project, most often taxes, be traced back to its origin, and the return on the alternative uses of these funds to be calculated. The resulting rate of return should be used for discounting in cost benefit analyses. The origin of the funds would be taxpayers in different income brackets, and so the resultant rate of return would be an average of several rates. The reasoning behind this proposal is very much the same as the basis for the second school of thought, including the belief that discriminatory practices exist in the capital markets on a large scale. As stated earlier, we do not know how much discrimination actually exists, or how important a distortion it creates. The question of fact is critical to this argument, as the adjustment procedure is very difficult to carry out. It seems that further research into the workings of the capital markets is required before this proposal can be seriously contemplated.

The discussion till now has been directed mainly toward answering the first question posed at the beginning of this paper. The underlying issues were outlined and several different proposals regarding the proper rate of interest to be used in

cost-benefit analyses were presented and appraised. On that basis it was concluded that the appropriate rate of interest was the rate on long-term government bonds and that the uncertainty associated with the project be accounted for in the estimation of future benefits and costs. In particular, what this means in practice is that all possible eventualities relating to future benefits be considered. The likelihood of each eventuality should then be estimated. The expected, or most likely, benefits would be calculated by taking a weighted sum of the possible outcomes, where each outcome is weighted by its probability of occurrence. Further adjustments could be made to take account of the variability of the most likely outcome, say by dividing the expected outcome by its variability.

Let us now turn briefly to the second question raised earlier. Some economists argue that, even if the economy were of the idealized type described above, no single interest rate determined by market forces would be the correct one to use for discounting purposes. Recall that, in an idealized economy, the government and private enterprises would have to pay exactly the same amount to borrow funds. The reason it is inappropriate is that the market determined rate of interest reflects the evaluation of present sacrifice for future gain of individuals acting indepen-d ently of one another. If they were to act collectively, the argument continues, they would place a higher value on future benefits, and a correspondingly lower value on present sacrifice than when they act separately. The conclusion reached is that account should be made of this by using a lower rate of interest than that on long-term government bonds for discounting in cost-benefit analyses. Again, the validity of this argument rests on a question of fact, namely, the existence of a discrepancy between our collective evaluation of present and future benefits and our individual evaluations. The evidence is not yet conclusive, at this time. However, even if this theory turns out to be true, it does not follow that a special lower rate of interest should be used for government projects. If we value future benefits collectively higher than we do individually, then this is so regardless of whether the benefits derive from the private sector or the public sector. The appropriate policy for the government to follow in this eventuality is to lower the rate of interest in both sectors of the economy, via expansive monetary and fiscal policy.

Before we conclude, two further issues deserve mention. The first pertains to the fact that corporations usually do not finance projects entirely with borrowed funds. A portion of a private project is financed out of equity capital. Because tax laws treat equity and debt financing differently, a private corporation may have to realize a higher before-tax return on a project than is needed to pay the interest on the borrowed funds. The public sector is not affected by this circumstance. This gives rise to an additional possibility that the return on investments may be higher in the private than in the public sector. Unless allowance is made for the difference between before-tax and after-tax returns in evaluating government projects, the overall yield on productive resources will not be maximized. The adjustment called for can be made either by raising the interest rate used for discounting or by calculating benefits after taxes. The latter alternative seems preferable, because it focuses attention on who the recipients of the benefits will be. The after-tax adjustment of benefits and costs can then be made in principle in accordance with the tax brackets into which the beneficiaries fall.

A final point deals with the question of how to take account of inflation in cost-benefit analyses. Since in a cost-benefit analysis costs and benefits are calculated in terms of current dollars, a corresponding adjustment should be made in the discount rate. Put another way, the nominal interest rate that must be paid on long-term government bonds partially reflects lenders' anticipations of the future value of a dollar. To obtain the real rate, a downward revision of the nominal discount rate is necessary. The precise manner in which this revision should be made is a technical matter. Various techniques of forecasting the rate of inflation are available; not all economists agree on a single best procedure. Nevertheless, there is no disagreement in principal that some adjustment should be made.

Chairman PROXMIRE. Thank you very much, Mr. Kamien.

And our last witness this morning is Prof. William Baumol of Princeton University.

Dr. Baumol, we are delighted to have you. Congressman Rumsfeld, the distinguished Republican Representative on this committee this morning, is a fellow Princetonian. So that is most appropriate.

STATEMENT OF WILLIAM BAUMOL, PROFESSOR OF ECONOMICS, PRINCETON UNIVERSITY

Mr. BAUMOL. I am always delighted to meet some of my compatriots.

And I am also delighted with the opportunity to appear before you.

I do not propose to follow verbatim my original statement.

Chairman PROXMIRE. Your original statment will be printed in the record, then.

Mr. BAUMOL. Thank you very much.

May I proceed?

Chairman PROXMIRE. Yes, indeed.

Mr. BAUMOL. Despite their differences in detail, to me the preceding witnesses have illustrated the essential unity of the economics profession on some of the pertinent practical issues.

In the evaluation of a proposed project there is a very great temptation for its proponents to utilize a very low discount rate figure, because in the benefit-cost calcualtion in which it is utilized, such a low figure makes it easy to secure the project's approval.

Such a low rate may, for example, be arrived at on the basis of some rule-of-thumb calculation that may, to illustrate, be an average of coupon rates on bonds which, when issued, were of long duration.

Whatever their differences in the area, economists are, I think, virtually unanimous in rejecting such a procedure.

The basis for that is essentially contained in the statements which you have just heard, that is, economists in their anlaysis are unanimous in the view that a discount rate should be determined exclusively on the basis of opportunity cost.

What this means is that whenever one decides on a new project, one must recognize that the resources with which to carry out that project must be taken from elsewhere in the economy. This new project is desirable if and only if the resources which it utilizes will offer a greater return to society than they would have yielded had they remained where they were originally.

If resources are employed in the construction of a dam or improvement in our defense system, those resources must come from some other place in the economy. Normally, they must be taken out of the hands of consumers, or out of the hands of the business sector of the economy, because those are the two places from which resources can be derived.

Once one recognizes these two alternatives, it becomes a simple matter at least to set a lower limit on the pertinent rate of discount. That is to say, one can ask what would those resources have provided to the economy had they been permitted to remain in the hands of the corporations or the other types of firms which would have utilized them, or had the resources remained in the hands of the consumers.

In the case of firms, the answer is essentially simple, for our present purposes. While there are some differences in the profession, as has just been brought out, or how precisely the yields of these resources are to be evaluated, it is clear that the returns of resources in business firms overall are easily above the bond rate of interest to be obtained on Government securities.

So whatever is true, the bond rate of interest is at least a floor, a lower limit on any reasonable estimate of the opportunity cost of resources derived from the business sector of the economy.

What about resources taken from consumers? There again we have a very similar lower limit, and for reasons that are easily explained.

For a consumer it is not quite so clear what the opportunity cost represents, because there is no discernible earning on resources utilized by a consumer for his own purposes. And yet one can find out what those earnings are by indirection. If a consumer chooses to invest some portion of his funds in Government securities, it is clear that the rate of return he gets for those funds for his own purposes must approximate the rate of return which the Government securities yield to him. Because if the rate of return from his own consumption were lower than what he can get for Government securities, clearly it would pay him to take even more of his money than he does and turn it into Government securities.

That is to say, if by buying Government bonds he were to get, for example, 5 percent, and he chooses to invest, say, $10,000 in Government bonds, clearly the reason he does not invest $20,000 is because that additional $10,000 in his private consumption is worth at least as much to him as the 5 percent which the Government funds would offer.

Similarly, a consumer who does not buy any Government bonds if he does so after a considered judgment of the matter, must do so because these resources are worth more to him than the illustrative 5 percent which the Government securities will yield.

We see, therefore, that both in the business sector and in the consumption sector, the rate of return yielded by resources must at the very least be as high as the rate of return on Government securities. And this means that whatever discount rate on utilizes, a discount rate lower than the current yield on Government securities, I think, would be rejected by the economics profession with virtual unanimity, not as a matter of prejudice or preconception, but on the basis of the analysis of the very logic of the process.

Now, what happens if one calculates a rate of discount on the basis of coupon yields?

Coupon yields really have nothing to do with the rate of return which an investor, a consumer, can obtain by the purchase of Government securities. To take an extreme and fictitious illustration, suppose the Government were to issue a $100 bond at a face value of $100, which nominally offered a return of 1 percent. If those bonds on the open market immediately fell to $20, while the coupon yield would indeed be 1 percent, what, in fact, would be the case is that consumers would be getting 5 percent on their money. It would be nonsense, it would be a fiction to claim on that basis that the relevant discount rate is 1 percent.

Of course, in practice the differences are not that extreme. But the dangers in such a miscalculation are no less serious. And, in fact, if one finds that discount rates are calculated not only on the basis of coupon rates, but on the basis of coupon rate applying to a period of 15 years ago, so that many of these rates are at what is now a matter of ancient history, a rate of perhaps 2½ percent, what this constitutes is an open invitation to a misuse of resources, because what it means is that we are inviting the inauguration of projects which return, perhaps, as little as 3 percent, and the devotion to that purpose of resources which could be earning elsewhere in the economy a rate of return considerably in excess of that amount.

For similar reasons, we must agree that the pertinent bond rates must be those for bonds corresponding in life to the duration of the projects.

Long-lived projects must be evaluated in terms of long-term bonds. But long-term bonds are not bonds that were long term at the date they were issued. A security which was issued for 20 years and has 2 months to run is not a 20-year bond, it is a 2-month bond, because its purchaser gets his money back not 20 years later, but 2 months in the future.

That means that if one is to take one's discount rate calculation on the basis of an averaging of long-term rates of interest, then the pertinent average must be based not on the rate of return on bonds which are long term when originally issued, but on the basis of bonds which still have a long time to run today.

Thus, coupon rate and original life of bonds are completely irrelevant to the calculation of a rational rate of discount. If they lead to a discount rate figure in the vicinity of 3 or 3½ percent, they constitute an open invitation to a wasteful use of society's resources. They will take resources from uses where their yields are far higher and transfer them to employments providing much smaller benefits.

This is surely a curious distortion of any benefit-cost criteria.

Thank you very much.

(The prepared statement of Mr. Baumol is as follows:)

PREPARED STATEMENT OF WILLIAM J. BAUMOL

On the Appropriate Discount Rate for Evaluation of Public Projects

1. SIGNIFICANCE OF THE DISCOUNT RATE

It is generally recognized that the discount rate is a critical datum for the evaluation of any proposed government project. Even where there is little basic disagreement about the investment's prospective costs and benefits the choice of discount rate figure may make the difference between acceptance and rejection. A project which seems to yield substantial net benefits when evaluated at a 3 percent rate may well appear extremely wasteful if the rate is 5 percent.

Yet despite the critical nature of this parameter, in some calculations it is assigned a value almost cavalierly, with little attempt to show that the selected figure is not chosen arbitrarily and capriciously. In part this occurs because the choice of discount rate is a rather technical matter of economic analysis and it is not widely understood among nonspecialists. As a result, custom and convention become substitutes for careful analysis, and one sometimes encounters discount figures in cost-benefit calculations whose sole justification seems to be that similar figures were used in the past. Of course that can never be an acceptable argument, first because the earlier figure may have had as little justification as the one presently employed and, second, because changing circumstances produce modifications in the appropriate value of the discount rate, as will be shown below.

At stake in the choice of an acceptable discount rate is no less than the allocation of resources between the private and the public sectors of the economy. The discount rate, by indicating what government projects should be undertaken, can determine the proportion of the economy's activity that is operated by governmental agencies, and hence, the proportion that remains in the hands of private enterprise. With so much at issue it is well worth the effort to explore in some detail the principles that should be employed in arriving at a discount figure, and the rationale that underlies those principles. This paper undertakes to describe these principles extensively and carefully without heavy reliance on the jargon of technical economics.

2. THE BASIC CRITERION: OPPORTUNITY COST

The role of the discount rate as arbiter of the allocation of resources between private and public enterprise is critical. It serves to explain the grounds for our concern with the subject. This observation also proves to be the key to the

principles which underly the choice of an acceptable discount figure. The right discount rate becomes that number which indicates correctly when resources should be transferred from one sector to another.

More specifically, suppose one is considering the construction of a dam which will employ x manhours of labor, y tons of cement and z kilowatt hours of electricity. In an economy in which the level of employment is high, if those resources are made available to the government they must be transferred out of the private sector. Just as in the guns vs. butter case, each item added to the public sector involves some corresponding reduction in the volume of resources in private hands.[1]

We may now establish a rather obvious criterion to test the desirability of the proposed resource transfer. If the resources in question produce a rate of return in the private sector which society evaluates at r percent, then the resources should be transferred to the public project if that project yields a return greater than r percent. They should be left in private hands if their potential earnings in the proposed government investment is less than r percent. The logic of this criterion is self evident. It states no more than the minimal dictate of efficiency: Never take resources out of a use where they bring in (say) 9 percent in order to utilize them in a manner which yields only 6 percent!

The standard that has just been described is the concept economists call *opportunity cost.* (This is the only bit of jargon in which we shall indulge ourselves). We have stated, in effect, that the proper standard on which to judge the desirability of a governmental project, from the point of view of the general welfare, is the value of the opportunities which the private sector must pass by when the resources are withdrawn from that sector. A government project is desirable if and only if the value of the net benefits which it promises exceeds the cost of the lost productive opportunities which that investment causes

We are now in a position to define the standards for a correct discount rate figure to be used in evaluating government projects. *The correct discount rate is the percentage rate of return that the resources utilized would otherwise provide in the private sector.* That is, the correct discount rate is the opportunity cost potential rate of return on the resources that would be utilized by the project. An example will readily show why this must be so. Suppose these resources are capable of returning our hypothetical 9 percent in the private sector. Consider three proposed government projects: Project A which offers an average rate of return of 12 percent, Project B whose expected return is 9 percent and Project C whose anticipated yield is 7 percent. It should be obvious that if we discount the returns of Project C at the opportunity rate of 9 percent we will end up with a negative net present value figure (i.e., seven percent discounted at 9 percent comes out to less than the principal invested). If we discount Project B's expected returns at 9 percent we will obtain a zero figure for the present value of net benefits (the returns will just cover the cost of the investment). Only project A when discounted at 9 percent will receive a positive net benefit figure. Thus the discount rate calculated at the opportunity rate works just as it should: it passes projects whose yield is greater than its resources could earn in the private sector and turns down projects whose benefits are not equal to the earnings the resources could provide in private hands.

The same illustration also shows immediately how an incorrect choice of discount figure—one not equal to the opportunity rate—can result in decisions harmful to the general welfare. For example, consider two extreme possibilities in terms of our hypothetical figures—a discount rate that is much too high (say, 15 percent) and one that is much too low (say, 5 percent). At the excessive 15 percent figure the usual cost-benefit criterion would reject all three projects, even Project A. The government would then fail to undertake an investment that clearly represents an efficient use of society's resources. On the other hand, a 5 percent discount rate would, on a cost-benefit criterion, lead to the construction of all three projects. Thus even investment C would be undertaken even though it uses resources that should better be left in private hands. For it takes resources from employments in which they return 9 percent and puts them into an occupation in which they bring in only 7 percent, a palpable two percent net loss to the community.

The upshot is perfectly clear. Any discount rate that is clearly above or clearly below the opportunity cost rate is indefensible because either of these will lead to decisions that reduce the general welfare. We must turn therefore to an investigation of the opportunity cost rate of resources, for once we have determined this

[1] On the other hand, if any resources used by the government project would otherwise be totally unemployed, now and in the future, their use ovbiously incurs no opportunity cost in the private sector. In an economy such as that of the United States since World War II employment of resources has usually been so high that this consideration is quite irrelevant to the facts of the matter.

we will have the requisite information for the choice of discount rate to be used in the evaluation of government projects.

3. THE OPPORTUNITY COST OF CONSUMER RESOURCES

When a government project withdraws resources from the private sector it must take them either from consumers or from business firms. A bag of cement used in constructing a dam might otherwise have been used to build a factory or in paving Sam Jones' driveway. The two sources need not always incur equal opportunity costs and they will therefore have to be examined sparately. It will be seen presently that the opportunity cost of resources withdrawn from industry is relatively easy to explain and so, to get the more difficult matter out of the way first, we begin with the opportunity cost of consumer resources.

Since consumers' goods do not provide a rate of return that is measurable directly it is necessary to find some indirect means by which the opportunity cost can be inferred. Fortunately there is a straightforward way in which this can be done. When a consumer voluntarily purchases a bond which returns, say, 6 percent, he is indicating that this rate of return compensates him for giving up a dollar's worth of present consumption and hence deferring the consumption to the future. Put another way, if this consumption were worth more than 6 percent to him he would not buy the bond, while if the consumption were worth less than 6 percent to him he would purchase more bonds than he does. Thus without any conscious calculation on his part a consumer's security purchases reveal something about the rate of return his present consumption is worth to him—the opportunity cost incurred when a dollar's worth of consumption goods is prevented from going to him and is transferred to a government investment project. We can learn about this opportunity cost by observing the consumer's behavior exactly as in the physical sciences one learns about pressure, temperature, etc., by observation of items which themselves have knowledge of these magnitudes.

What about consumers who do not buy any bonds? It follows from the preceding discussion that their opportunity cost must be at least as high and probably higher than it is for bonds purchasers. To a man who chooses *not* to purchase bonds at 6 percent, the consumption for which he uses his money must by definition be worth more than 6 percent. This is no less true for a man who fails to purchase bonds because "he cannot afford them". That phrase merely implies that his consumption dollar means a great deal to him—perhaps even survival itself, and is therefore certainly more valuable than 6 percent.

We may summarize by saying that the opportunity cost of present consumption to non-bondholders must be at least as great as the figure for bondholders and that to bondholders the opportunity cost of consumption is indicated by the rate of return on their bondholdings.

Here we are referring to the net rate of return after making allowance for risk. An 8 percent rate of return on a highly risky bond may be no greater than a 6 percent rate of return on a safe security because the additional two percent of the more speculative bond simply compensates the purchaser for the added risk it requires him to undertake. That two percent "risk premium" is therefore only a payment for the risk involved in holding an unsafe security and has nothing to do with the basic opportunity cost of deferred consumption which is incurred when resources are transferred from the consumer to the government. The criterion of bondholder's opportunity cost therefore is the rate of return on a riskless bond. For all practical purposes a government bond can be considered to be such a riskless security.

Moreover, what is relevant for this purpose is not the rate of return on short-term securities but the yield of long-term bonds. When cement is put into a dam that is expected to last for 50 years, these resources are taken out of the hands of consumers for such a long period, and the opportunity cost is the rate of return consumers expect when they voluntarily give up resources for a similar period, i.e., when they acquire long-term bonds.

We can now readily draw our conclusion about the opportunity cost of resources derived from consumers. Since in recent years government bonds with longer maturities have been returning between 4.75 and 5 percent one can be certain that the opportunity cost rate for consumers is at no lower than the smaller of these figures. For bondholders it may be taken to be somewhere in the 4.75 to 5 percent range while for individuals who do not purchase bonds deprivation of resources will incur an even higher opportunity cost. Hence on resources obtained from consumers there is no reason to utilize any discount rate lower than approximately 4.75 percent.

4. THE DISCOUNT RATE ON RESOURCES FROM THE BUSINESS SECTOR

Next we consider the opportunity cost of resources derived from business firms. Recent hearings on rate of return to various public utilities have suggested clearly that these are expected to provide a rate of return ranging from perhaps 5½ to 8½ percent *after taxes*. That is, the productivity of resources used by such companies is sufficient to return this much to company stockholders. Even those who have argued before the regulatory commissions for relatively low profit ceilings for such companies have not proposed that earnings be driven below this range. But with a corporation tax rate in the vicinity of 50 percent, in order to return say 6 percent to stockholders, the company must produce a product for which consumers are willing to pay approximately 12 percent! That is, one can state with some confidence that the resources used by firms in the private sector characteristically produce returns in terms of value of output ranging from 11 to 17 percent. There is no need to enter here into the discussion of the proportion of this amount that should be ignored because of risk. The indisputable fact is that on any criterion the rate of return on resources transferred from business firms to government projects, i.e., their opportunity cost rate, is well in excess of the 4.75 to 5 percent that constitutes the minimum discount figure applicable to resources transferred from consumers to government projects.[2]

The upshot of the discussion is clear. No absolute and final figure has been suggested for the appropriate discount rate on government projects. However, it has been shown that on any standards, a figure below 4.75 percent is certainly too low and will lead to the wasteful transfer of resources from the private to the public sectors. For we have seen that for some resources (those transferred from consumer bondholders) the opportunity cost rate is at least 4.75 percent, while on resources which are kept from non-bondholding consumers or from business firms the opportunity cost is higher—probably in many cases by a considerable amount.

5. CHANGES IN RATES ON GOVERNMENT BONDS

This completes the basic analysis of the determination of the appropriate rate of discount for use in a cost-benefit evaluation of government projects However, a number of misconceptions have sometimes arisen in this area and it is therefore desirable to face up to them squarely. The next few sections address themselves to issues of this variety.

Thus, the preceding discussion may give rise to misunderstanding about the consequences of changes in the rates of interest which the federal government chooses to offer on its securities. Suppose the rate of interest on long-term bonds is initially five percent and the government decides to issue some bonds bearing a coupon of 4.5 percent. One may be tempted to question whether this automatically affects the desirability of a proposed government project. The answer is that this change *by itself* will have no such effect. For the real rate of return on government bonds is not necessarily equal to its coupon rate—the nominal percentage payment which the treasury decides to assign to them; rather the real rate of return will be determined by the opportunity cost of money to bond purchasers. Suppose, for example, that the opportunity rate to consumers were 5 percent (and to take a ridiculous example for the sake of ease of arithmetic) the treasury decided to issue (perpetual) bonds offering only 2½ percent. The consequences would follow almost at once. Bonds with a face value of $100 could be sold for a market price of only $50 because no one would be willing to pay more for them.[3] And at that price the

[2] A few remarks on the issue of risk may, however, be illuminating. It is true that in many firms new investments are highly risky—we cannot anticipate what future demands for their outputs will be. On the other hand, a government investment is also risky. For example, many abandoned canals were no doubt built in the anticipation that their use would continue much longer than it did in fact. Thus it cannot be argued that, e.g., a 9 percent return on a government project is perhaps the equivalent of a 15 percent return on a corporate investment, because both of them are subject to considerable risk. The treatment of risk has been the subject of considerable discussion by economists. Some highly reputable economists (e.g., Prof. P. A. Samuelson of the Mass. Institute of Technology and Prof. Kenneth Arrow of Stanford University) have argued that because there are so many investment projects undertaken in the economy overall they incur no risk on the same statistical principle (the law of large numbers) which largely eliminates the risk of life insurance companies who do not know when any individual policyholder is going to die. In any event it is quite certain that no economist of any substantial reputation, whatever his views of the risk issue in the calculation of the opportunity cost of resources transferred from private firms, would argue that this opportunity cost rate is below 4.75 percent.

[3] An obvious exception is represented by the case of "E" and "H" bonds whose prices are fixed and yet continue to be sold when market rates of interest rise. However, the purchasers of these bonds are small investors who are not always fully informed of the alternative investment opportunities available to them and whole bond purchases are in part a response to patriotic appeals. The terms on which these securities are bought are therefore only distantly related to the opportunity cost of consumer resources.

investor who put $100 into government bonds would obtain *two* bonds of face value of $100 for his money, bonds that would return to him $2.50 each, so that on his investment he would still obtain 5 percent. Hence the treasury decision to issue 2½ percent bonds would not in the slightest way change the fact that the effective yield on government bonds (and hence the opportunity cost of resources drawn from bondholding consumers) is 5 percent.

While the numbers in the preceding illustration are exaggerated, the situation it describes is very real. The effective yield on government bonds if often quite different from their nominal return. That is precisely what goes on whenever the price of such a security changes—its effective yield is affected by the market and investors' valuation of their money, even though the rate of return promised by the face value of the bond does not change.

It is true that the government can change the real rates of yields on bonds. It does so when it goes from an easy money policy to one involving tight money. But this it must accomplish through the use of much more powerful measures that do influence the opportunity cost of money itself.

Only by influencing GNP, or the supply of money or the supply of bonds, all of which affect the valuation which consumers place on their money, can the government institute a change in the real yields of its securities and really make it stick. Thus, when government policy does succeed in producing a change in the *effective* bond rate, the new bond rate does become a valid indicator of the correct rate of discount on government projects.

6. CALCULATION OF THE RATE OF RETURN ON LONG-TERM BONDS

The discussion of the preceding section has some clear implications about the manner on which the long-run bond rate of return should be calculated if it is to be used for the process of evaluation of the discount rate on government projects. There are two basic rules both fundamental and inviolable:

1. *The rate of discount should utilize in its calculation the market yield on government bonds not their fictitious coupon rate of return.* Consider again our previous example: a bond issue nominally designed to offer a (perpetual) return of 2½ percent (it yields a return of $2.50 and bears a face value of $100). If the market price of that bond falls to $50 the effective market rate will be five and not 2½ percent and it would be absurd to call the rate of interest anything but five percent.[4]

2. Suppose, for the sake of illustration, it is decided to call bonds "long term" only if the period they involve is in excess of ten years. *Then if a bond was originally issued for twenty years but currently has only one year left before it reaches maturity it must be considered a short-term (one year) bond and its interest rate must not be used in calculating an average rate of interest on long-term securities.* The reason for this rule should be clear on a moment's reflection. If I hold a bond which matures in one year, it makes no difference to me today whether it was originally issued for one or twenty or one hundred years. What is of importance to me (except as a matter of historical curiosity) is that the bond will return to me its face value in one year and pay me a certain amount in interest in the meantime. For precisely that reason the market prices of new one year bonds and of 20 year bonds with one year to run would behave in precisely the same way provided their terms were the same—they would be priced to produce an identical effective rate of interest rate (yield to maturity), and hence both their interest rates would be *short-term* rates, irrelevant for the calculation of a long-term discount rate.

If it is true then, as I have been informed, that the rate of discount currently utilized in some cost-benefit calculations is obtained by averaging the *coupon rates* on all securities *whose original maturities was in excess of 15 years* one can only comment that the resulting figure has absolutely no relevance for the appropriate discount rate on public projects.

7. SUBSIDY FOR THE FUTURE?

Despite the firm economic grounds for our basic conclusion that there is no justification for a discount rate below the rate of interest on long-term government

[4] This calculation and that in the previous section are somewhat oversimplified for purposes of exposition. The arithmetic is precisely accurate only for a perpetual bond such as the British consols in which no repayment of the principal is ever contemplated. If a bond matures in, say, 20 years the drop in current price does not affect its redemption value and this complicates the arithmetic slightly. The figure that is required in this case is what is called the yield to maturity which takes into account the present value of the amount the holder will receive when the security matures as well as the interest payments he receives in the interim.

bonds, there may remain some who are tempted to argue for low rates of discount on what may be described as sentimental grounds. Such a view might rest its case on an appeal to the prospects for the nation's future—the argument that increased investment today is a contribution to the nation's welfare tomorrow. It would appear that this purpose can be served by a lower discount rate which would lead to approval of a larger number of governmental investment projects. The greater the number of investment projects that are put into effect the greater is the contribution to the nation's posterity.

Though such a position is likely to have considerable superficial appeal it can readily be shown to rest on a number of fallacies. First of all, there is no basis for the presumption that a transfer of resources from the private to the public sector will necessarily produce a net increase in the amount of investment undertaken by the economy. The increase in the amount of governmental capital construction is very likely to be offset, at least in part, by a decline in private investments in plant and equipment.

Surely, if the nation's investment for the future is considered to be inadequate the appropriate remedy is to institute simultaneous inducements to both private and public capital formation.[5] As we have seen, an arbitrarily low discount rate on public projects certainly is not the instrument for that purpose. While it encourages government projects it discourages private investment by drawing resources away from industry and by providing disparate assistance to the competitors of those private firms who rely on no help from the government sector. Moreover, such arbitrarily low discount rates on public projects introduce serious inefficiencies into the investment process, by causing the withdrawal of resources from areas of use in which their yield is high and leading to their transfer to areas in which their return is low. This is a most peculiar way to encourage more effective investment for the future!

In any event, those who maintain that there is inadequate provision for the future draw incorrect general inferences from irrelevant particular cases. It is difficult to dispute the valid conservationist argument that the destruction of irreplaceable natural resources does indeed impose a heavy cost on our posterity. The destruction of a portion of a canyon, the extinction of a species of wildlife, the erosion of the soil all are matters of serious concern because once done they cannot be undone, and this is precisely the legitimate ground on which conservationists urge increased care in avoiding depletion of our natural resources.

But it is not legitimate to jump from the valid point that one generation has no right to use up wastefully the resources that cannot be replaced by its successors, to the groundless conclusion that each generation is constrained to engage in overall efforts to support its posterity beyond the level that is indicated by the free market. For that is precisely what is involved in a program of low discount rates or any other program of special inducements to investment. Any of these are, effectively, programs of subsidy in which society is committed to provide special assistance to governmental and other investment projects. And it is a commonplace of economic analysis that any act of real investment constitutes the transfer of resources from the present to the future. The construction of a durable dam amounts to the tying up of resources many of whose benefits will only become available to the community many years in the future.

The basic issue, then, is whether it is desirable to subsidize in this way the commitment to the future of resources which could otherwise serve society today. Considerable real investment is provided by the workings of free enterprise together with the program of government projects which can pass the standard cost-benefit test utilizing the discount rate that has already been described. Is there any justification for a program of subsidies designed to produce an even greater overall commitment of resources to the future?

A little thought shows that the grounds for such a program are highly tenuous at best. Our economy is characterized by a long run rate of growth of GNP of the order of 3 to 4 percent per year, compounded, and in recent years the growth rate has been even greater. Per capita income has risen persistently throughout our history and there is every reason to expect the rise to continue. We are therefore wealthier than our predecessors and it can quite safely be predicted that our

[5] There are of course important cases where it is considered socially desirable to stimulate governmenta- output of goods and services which cannot be provided effectively by the private sector. Education, elimi ination of pollution and national defense are all services whose supply, it is generally felt, should not be left exclusively in the hands of the private sector. In such cases government subsidy and, in some cases complete governmental financing, is entirely appropriate. But this does not justify a particularly low *discount rate* on the government projects which would distort the allocation of resources between short- and long-term investment. If we need more expenditure on education now—better books and better teachers—a reduction in the discount rate would not provide them. It would only stimulate the construction of durable school buildings, the long-term investment portion of educational expenditure.

successors will be richer than we. In effect, then, the artificial subsidization of a program of added investment amounts to an inducement for the transfer of additional resources from the poor to the rich. It would take inputs whose product would be available for consumption today and make them available tomorrow when the supply of consumer goods is likely to be so much more abundant than it is at present.

We see that there is no basis for the inference that because society should avoid the vandalism involved in the spoilation of irreplaceable resources, it should also subsidize the increased provision of resources of all sorts to future generations who are, even without this, so likely to be wealthier than we.

To summarize, there is no basis in terms of the welfare of society for a level of discount rate on government projects below the opportunity cost rate. A decision to utilize a low discount rate will, as we have seen, lead to three unfortunate consequences, all of them inimical to the welfare of the community.

First, insofar as it produces a net increase in investment by the economy, it will transfer resources from present consumption to future consumption even though future consumers are likely to be better supplied than those of today. Second, since such a low discount rate provides encouragement only to government investment, it will lead to the transfer of resources from the private to the public sectors of the economy and hence, very likely to a decrease in the level of investment undertaken by private enterprise as a whole. Third, and this is the most immediate issue, a low discount rate on government projects must lead to wasteful employment of these resources—it must induce their transfer from sectors of the economy in which their yield is high to other sectors in which their return is low, for that is precisely what is implied by a discount figure below the opportunity cost rate.

8. CONCLUDING COMMENTS: THE CONSENSUS OF PROFESSIONAL ECONOMISTS

The determination of the rate of discount is too important a matter to be left to casual calculation or the fortuitous practices that have developed over time. The literature of economics agrees both on the importance of a correct choice of discount rate and on the basic criterion which should be used in its determination. The logic of the issue dictates that opportunity cost is the relevant criterion and this conclusion is universally accepted by the profession.

It would, however, be misleading to pretend that economists are in complete agreement as to the precise magnitude this requires for the discount rate. Differences relating to the role of risk, the proportion of the relevant resources derived from consumers and from other business firms and other similar matters have led to divergences in the estimates of the appropriate discount rate figure. Precisely for that reason this paper has made no attempt to provide any single figure which purports to represent a uniquely correct rate of discount for government projects. A public forum has no special interest in the views of any single witness unless they have behind them the full weight of professional judgment and analysis.

But the writings of the leading authorities in the field do confirm the basic contention of this report, that there is no justification for the use in present circumstances of any discount figure significantly lower than 4.75 percent. By and large discussion in the literature centers about the amount by which the correct discount rate *exceeds* this order of magnitude. The reason is straightforward. We have seen that 4.75 percent is the lowest opportunity cost rate for any group from whom resources might be transferred to a government project. All that remains as a matter for further investigation is the proportion of these resources that would be drawn from other groups whose opportunity cost rate is higher. If, for example, the bulk of such resources is normally transferred from the corporate sector where they can earn far more than 4.75 percent it is obvious that a discount rate substantially higher than this figure would be required.

There can also be no doubt that no well-known economist would see any merit in a long-term discount rate on government projects obtained by averaging *coupon rates* on securities having more than 15 years to run *at time of issue*. For it is generally agreed among economists that it is the effective market yield and not the coupon rate than has any relevance for consumer's discount rates, and it is also agreed that a security with six months to run is a short-term security whether it was originally issued for 9 months or 90 years.

Therefore, while there is not complete unanimity among economists on the precise number that should be used in discounting it would be misleading to infer that there is any disagreement on the basic point at issue. The profession

speaks with one voice in asserting that a discount figure of 3.5 or 4 percent is too low in present circumstances, and warns us clearly of the misallocation of resources and inefficiencies that are likely to result from the use of such unjustifiable figures.

Chairman PROXMIRE. Thank you, gentlemen, for what I think is a fascinating analysis of something that has involved an enormous amount of Government spending.

I want to get around, as soon as we can, to how this applies to planning, programing, budgeting systems.

But before I do that, I would like to start with you, Dr. Baumol, and your last point.

You say that economists agree throughout the profession—and I would like Mr. Kamien and Mr. Stockfisch to comment on this, too, if there is any disagreement all all—that 4.75 is the minimum level of interest that should be applied, say, in reclamation projects, in determining and discounting future benefits, and in determining the cost?

Mr. BAUMOL. No. The specific interest rate figure is an inference. I have not spoken to economists as a group and said, "Would you pick 4.68 or 4.75?"

The basis for my inference is a simple one. I know of no economist who would argue for a rate below current long-term yields.

Speaking to a number of economists who specialize in the area, I have gotten no one of them to come up with a figure lower than 4.75.

Chairman PROXMIRE. What is the present rate that is used now by the Department of the Interior? You say 3⅛ to 3½, Dr. Stockfisch?

Mr. STOCKFISCH. I understand it is in that neighborhood.

Mr. BAUMOL. It is 3⅛, so I am informed.

Chairman PROXMIRE. What this means, then, is that if you are discounting future benefits at 3⅛, you enormously exaggerate the benefits the first 50 years, and in a hundred more years it is still further exaggerated. You could have a 2 to 1, or even a 2½-to-1 cost-benefit ratio, which actually would be far below unity if you used the 4.75, for instance, and you could make an argument perhaps that in some cases it ought to be more than 4.75. And 4.75 is the minimum you say the profession would agree to.

Mr. BAUMOL. Yes.

Chairman PROXMIRE. Is this your view, too, Mr. Kamien?

Mr. KAMIEN. Yes. Except that I would not like to have a figure pinpointed now—that is to say, a year from now that figure might be higher.

Chairman PROXMIRE. I understand. But what you are talking about is the current yield. In other words, the Government now makes a judgment as to whether or not, in view of the way the market views investments, the 4.75—let's assume that this is their judgment—under these circumstances we should use this in determining whether or not we should go ahead with the reclamation projects or various enormously expensive projects that we are engaged in.

Mr. KAMIEN. Yes, I agree.

Chairman PROXMIRE. Dr. Stockfisch.

Mr. STOCKFISCH. Just to make the record clear, I would say that the rate should be a minimum of at least 10 percent, and more likely closer to 15 percent.

Chairman PROXMIRE. That means we can just forget about the reclamation projects for a while.

Mr. STOCKFISCH. Yes, sir. If one wants to measure the opportunity cost on investment, the evidence seems to indicate that in most large industries, indeed, in many small ones, management does not undertake a project until it has a prospect of yielding about 20 percent before taxes. Now, in the regulated industries, it is somewhat lower than that. But any examination of average rates of return indicate that it is in this neighborhood.

So you can indeed forget a lot of these projects.

Chairman PROXMIRE. Yes. But don't you place any reliance on the very interesting distinction that Mr. Kamien made when he talked about the difference in interest in the first place, where you have a small business borrower with no collateral, without any experience, on the one hand, where the risk is great, and where the return would have to be correspondingly greater; and then, No. 2, if the small business borrower has collateral; and, No. 3, where you have a very large business, like General Motors; and, No. 4, where you have a local government involved; and, No. 5, where you have the Federal Government involved, where you have virtually no risk, but you have a discount factor in terms of the present value of a future dollar.

Mr. STOCKFISCH. Do you wish me to address that question?

Chairman PROXMIRE. Yes.

Mr. STOCKFISCH. I have a somewhat different approach to the risk problem that others do, I think. I would say that the revealed rates of return in the private sector of the economy, to the extent that they are in the neighborhood of 10 to 15 percent, are what they are—it is essentially a behavioristic measure. That return constitutes a reward for risks taken, for not consuming, for a lot of things. We don't try to differentiate in a person's wage how much is a reward for bearing some sort of risk, or whether he dislikes working, or whatever it might be. I would simply assert, just as a fact, the amount of capital resources in our economy relative to our technology, and labor supply, is such that when an increment of investment is made in the economy on some sort of spreadout basis, it averages about 10 to 15 percent.

Some investments are sheer flops; others yield maybe as much as 100 percent. And some average of this overall revealed behavior is a measure of the opportunity rate of return.

Now, private investors figure out all sorts of ways to separate out between themselves the risk element of it. The bondholder is as much an investor in the utility corporation as a stockholder is. But he just happens to be an investor that has a preference for avoiding risk whereas the stockholder has a stronger preference for taking it.

But it all sort of washes out. So that in a broad sense, this rate of return that I mentioned seems to be the rate. And that is the opportunity cost of displaced resources, which is what we are after.

Chairman PROXMIRE. You would not go down below 10 percent, and probably you think that 15 percent is close to the——

Mr. STOCKFISCH. The latter number is perhaps on the high side, but I would be quite happy to settle for 10 percent. In fact, when you get above 10 percent, the difference in long-lived projects, and how they would be valued, becomes rather slight.

Chairman PROXMIRE. Does it shake you at all that this would probably terminate the Government investment reclamation projects?

Mr. STOCKFISCH. No, sir; not one bit. I think we probably are investing relatively too much in water.

Chairman PROXMIRE. Not relatively too much. This would just end it, wouldn't it? I don't know of any project that would have the kind of a benefit-cost ratio with 3⅛, which would suggest that they would be probably better than a unit cost-benefit ratio if it is 15 percent. Maybe there are some, but they are very few.

Mr. STOCKFISCH. I have not looked at water. And I might add, if there were more rational pricing of water, there might be.

Chairman PROXMIRE. I am not arguing with you, because, in general, I agree. I think we have enormously wasted Federal funds in going into this program. And I am very encouraged to see this unanimity of view among professional economists who have no ax to grind, and are trying to do this on the basis of the most scholarly and objective approach they can get.

What do you suggest we can do to bring this to the attention of the Congress in an effective way? Has the American Economic Association, or any group in the American Economic Association, or any group of specialists who are particularly conversant in this area, made any kind of assertion or declaration in any way that we can organize this to bring this to the attention of the Congress?

Of course, there is an enormous pressure on Congress to go ahead with these projects. The Congressmen and Senators from these States have this as a mission, and they are dedicated to it, and they are very effective.

And the Presidents, of course, are concerned about this kind of thing, too. These States have electoral votes that are involved. So that we ought to have some way to view this realistically to overcome this great political power, so that this can be brought to the attention of Congress. We ought to have some way of counteracting this with what I think is a very rational and thoughtful view.

Mr. BAUMOL. If I may comment, first of all——

Chairman PROXMIRE. Let me just interrupt before you do, Dr. Baumol, to say that I realize that both you and Mr. Kamien do not necessarily accept the 15 percent. And we don't have to have that, even if you just restrict it to the 4¾, you are pretty much in agreement on the waste that is involved, although, of course, there is a substantial difference.

Mr. BAUMOL. I would say, on the contrary, that I would tend to agree on, say, something on the order of magnitude of 10 percent. I was arguing in terms of a lower limit only because I felt that the view of the entire profession was more pertinent than my personal position on the matter.

However, if I may comment on this risk issue, a number of prominent economists have addressed themselves to the matter, and have pointed out that the differential risks applying to individual firms engaged in the production of commodities is not really of direct relevance to the matter. That is to say, society here is in the position of a huge insurance company. When a life insurance company issues a policy to any particular person, it is taking an enormous risk, because it has no idea when that man will die, and how much it will have collected from him at that point. Yet the operations of the insurance company as a whole are virtually riskless, and the company can say that it is virtually guaranteed the average rate of return per policyholder.

And exactly the same thing happens from the point of view of society, because society obtains the returns from many thousands of investments, and some will do better than expected, and some will do worse than expected; but on the whole, the risk incurred by any one individual project is no more pertinent to the overall returns expected by society than the risks incurred by one particular policyholder are pertinent to the overall returns of the insurance company.

For that reason, what is relevant, it seems to me, and I think it seems so to a number of other economists that have some reputation, what is relevant is the average rate of return obtained by industry from those resources, with no special account taken of the individual risk of the investors in that particular company. The investors in that particular company may end up losing money on that investment. But on balance, society will lose on some and gain on others, and come out on the average.

One other point; you mentioned the American Economic Association and asked whether it had come up with any statement on the matter. I am currently a vice president of the American Economic Association. But I must speak for myself on these matters, of course. The fact is that the American Economic Association, by the nature of its constitution, cannot take a public position on specific issues. It is an organization devoted to the stimulation of work in the profession rather than a group devoted to taking positions on public matters.

However, I think if one were to poll, for example, the current and past officers of the American Economic Association for the past 10 or 20 years, you would find the unanimity which I described in my statement. I think you would find that, without a single exception, they would agree that something like the figure I have mentioned is a minimum for the pertinent discount rate, and would agree, therefore, that there is nothing shocking about the fact that very few water resource projects would pass a cost-benefit test if carried out on a rational basis.

Chairman PROXMIRE. My time is up. And I am going to yield to Congressman Rumsfeld.

I understand, of course, that the American Economic Association as a unit cannot take this position. We are all aware of the fact that 260 of the 12,000 members agreed with Walter Heller that we should have a tax increase, and they seem to have shaken Congress and the country into the notion that the whole profession is crying for it. I just wonder if any number of economists might do this. And apparently your answer is that in your view, if we poll the leaders or the former officers, or whatever, we might get an interesting unanimity of support for this position.

Congressman Rumsfeld?

Representative RUMSFELD. Dr. Stockfisch, would you explain this paragraph in your prepared statement referring to the tomato land reclamation project? I am having a little trouble understanding it, particularly the middle portion of that paragraph.

Mr. STOCKFISCH. This is the tomato land reclamation project?

Representative RUMSFELD. Right. You indicate that "although future generations would have more tomatoes, but less consumer durables, entertainment, and other items normally produced in the private sector."

Mr. STOCKFISCH. Yes.

Representative RUMSFELD. Wouldn't that last portion of the sentence also be applicable regardless of which way it were done? You would have the offsetting factor either way, wouldn't you?

Mr. STOCKFISCH. No, I don't believe so. What has happened here is that if in creating the $100 million reclamation project, it should be financed in such a way that some $26.7 million worth of private investment is preempted, where the rate of return is assumed to be 15 percent, then 26.7 times 15 percent is equal to $4 million.

Now, society, then, gets $4 million worth of that unique product associated with the reclamation project. But that decision itself caused less investment to be undertaken in other activities, like automobile plants, food processing, and what have you.

Representative RUMSFELD. Right. If you reverse that, and if that decision had been made to the contrary, wouldn't you have a similar offsetting factor?

Mr. STOCKFISCH. I am not sure I understand your question. If things had followed their natural course, and there had been $26.7 million worth of investment additional in the private sector, there would have been $4 million worth of private products. But we would not have to forgo in current consumption the difference between that $26.7 million of preempted private investment and the $100 million which the Government project cost.

In other words, what we are doing here is taking some resources out of investment where they yield 15 percent and putting them into an activity where they yield only 4. And this is simply an unhappy trade, no matter how you look at it.

Representative RUMSFELD. Chairman Proxmire asked the question about how this matter could be brought to the attention of Congress. I would be curious to know from a legislative standpoint what sort of language you would recommend. I didn't see anything specific in any of the three papers. It was suggested, I believe, by you, Dr. Stockfisch, that it would have to be either by Congress or by the Bureau of the Budget.

I think there was also a suggestion that it would not be a fixed figure; it would vary at different points in time, and it would vary for different projects or activities. How would you formulate this whether it would be legislated, or promulgated by the Bureau of the Budget?

Mr. STOCKFISCH. I think there are a number of ways. One way might be to specify that some good measure—you have to give some study as to what would be a good measure of the private opportunity return in the private sector is. For example, some measure which is based on a weighting of one-third on long-term private bonds, and two-thirds on the before-tax yield on the aggregate of Moody's common stocks might give you something up to about 10 percent. And to the extent that there were variations in the private sector under changing business conditions, this would change up or down. This is just one possible method.

You could start out and specify a rate of 10 percent, just straightaway, particularly if you feel, as I feel, that that is probably on the low side compared to the opportunity return. But 10 percent is far better than 3 or 4.

Representative RUMSFELD. Do either of the other two witnesses have a comment?

Mr. BAUMOL. To comment briefly, in accordance with Senate Document 97 of 1962, the discount rate is "based upon the average rate of interest payable by the Treasury on interest bearing marketable securities of the United States outstanding at the end of the fiscal year preceding such computation, which, upon original issue, had terms to maturity of 15 years or more."

Now, it seems to me that there are at least two obvious ways in which this can be changed. Number one, the phrase "rate of interest," could usefully be changed to "rate of yield."

And, second, instead of "upon original issue," I would think that economists prefer to have appear there "currently." One could then say that the discount rate should at the very least equal this amount differing from it on the basis of other evidence on current opportunity costs. In other words, the general instruction——

Representative RUMSFELD. Explain the third point. I followed you through the first two. But the last one——

Mr. BAUMOL. Yes. Instead of beginning the statement to the effect that the discount figure should be based on the average of these rates, I would be much happier if it were to say that it should be at least equal to the average of these rates, and then at its end the statement said that the discount rate figure should exceed this average by an amount based on some reasonable calculation of the opportunity cost of funds in the economy.

This immediately allows for changes in the rates with changing circumstances, and does, therefore, give the required flexibility, but does take into account the pertinent considerations which I think we have been raising.

Chairman PROXMIRE. Mr. Kamien wants to comment.

Representative RUMSFELD. Yes.

Mr. KAMIEN. I agree with my colleagues about the level of the interest rate. But I am also concerned with another issue; namely, that the benefits in the benefit-cost calculations be scrutinized much more carefully. We can hike up the rate at which we discount but if the other side hikes up their estimates of benefits, we are back to where we started.

Now, this involves two points. First is accurate forecasting of benefits. Secondly, it seems to me that the question that should always be raised in cost-benefit studies is, Why is the Government doing it in the first place? Could the private sector provide the same benefits? Presumably—and I think all economists would agree—the justification for Government undertaking certain kinds of projects is that the private sector could not appropriate all the benefits from the project. Some of them are not recoverable by a private firm though they are recoverable by us collectively.

I think that there should be the test, a demonstration, so to speak, that in fact a private enterprise, borrowing at the same rate of interest as the Government, whatever interest rate that may be, be it 4 percent, 5 percent, or 10 percent, would not undertake such a project. That is, that a firm in calculating benefits, its benefits being profits, would not justify undertaking such a project. If it did, then there is the immediate question, why is the Government doing this? If new legislation were written, I think that this test should certainly be incorporated.

Representative RUMSFELD. Of course, one of the problems is that the Government is doing a lot of things that the private sector could do. In some cases, the Government is doing them not because the private sector could not do them, but because it is not doing them. This is not to say that a test like this is not appropriate. It is my view that it is. And it would possibly improve the communications sufficiently that things would be done.

Mr. KAMIEN. I agree. Although I think that the proper response to that would be dissemination of information.

Representative RUMSFELD. Which this would do, a test like this.

Mr. KAMIEN. Precisely.

Representative RUMSFELD. I suppose one of the answers to Senator Proxmire's question as to how to bring this to the attention of Congress might be that by developing a formula on the benefit test soon would, regardless of whether it were enforced, or affected the decision, at least be available on decision being made by Government. This, at least, would begin the education process.

Chairman PROXMIRE. If you would yield for a minute, it might be interesting if we could do so, if we could take every one of the programs and calculate them on the basis of the 4.75, and also on the basis of the 10 or 15, and indicate what a difference it is, every time we could make our point.

Representative RUMSFELD. That is what I was thinking. If you went back and compared it for, say, a period of 2 years, you could use that to highlight the reason for considering it on each project as they come up in the future. And over a period of time—I don't know that it would eliminate all the political problems that Senator Proxmire mentioned, but nonetheless, it would certainly build some support.

My time is up. Thank you.

Chairman PROXMIRE. Congressman Moorhead?

Representative MOORHEAD. Thank you very much, Mr. Chairman.

I would like to welcome all of you gentlemen here, but particularly Professor Kamien, of Carnegie-Mellon University, located in my congressional district. I feel very pleased that I didn't stumble over the new name that Carnegie Institute has. We certainly do welcome you.

Mr. Baumol, in your testimony, you have very, very effectively destroyed the argument for the coupon rate of yield and for the use of historical long-term bonds in this connection—to such a degree, I would say to you, that nobody could be using that measure, could they?

And then you referred to Document 97. Do you interpret Document 97 to mean that coupon yield and historical interest are used to determine whether a bond was long when it was originally issued? Is this your understanding?

Mr. BAUMOL. That is correct. And I may say that when I first came across this several months ago, I mentioned it without comment to several economists to get their reaction. They were completely incredulous. They just could not believe that such a procedure was employed anywhere.

I may also say that I understand—I don't know how good the evidence is—that there is considerable opposition to this procedure

on the part of the Treasury and the Bureau of the Budget, who were equally shocked by the use of such devices.

Representative MOORHEAD. I would say that it is not often that we have unanimity of economic witnesses before this committee. But am I correct in assuming that all three of you agree that even while we don't yet know just what the figure is, we all agree that the procedure as described in this Document No. 97 is wrong?

Mr. BAUMOL. Certainly.

Mr. KAMIEN. Yes.

Mr. STOCKFISCH. Yes.

Representative MOORHEAD. All of the witnesses indicate assent. I just wanted to get that on the record.

Professor Kamien, I take it that while Mr. Stockfisch and Mr. Baumol think that the proper figure to use is somewhere in the range of 10 percent, not limiting anybody to any exact figure, that you would differ from your colleagues at this point, you opt for the Government rate as the approximate measure?

Mr. KAMIEN. That is correct, except that it should be adjusted for the present tax structure, which might bring it up to the neighborhood of 10 percent.

What I had in mind was the following: Within the economics profession, there are two controversies, regarding the choice of a discount rate. The essential controversy, to which I was addressing myself, is how one takes account of uncertainty about the benefits from the project materializing. What I said was that this should be taken into account in evaluating benefits and costs. That is, by calculating what is the expected return on the project, not what is the best possible return we could conceive of.

I didn't want that risk to be accounted for by an interest rate adjustment. However, it should be adjusted up to account for the present tax structure. Another way of doing the same thing is, of course, by adjusting the benefits; calculating the benefits after taxes instead of before taxes.

Representative MOORHEAD. Let me see if I understand this properly. Are you saying that we have to allow for the taxes because if the private enterprise went into this venture, they would not only have the earnings, but they would pay, let us say, 50 percent to the Government?

Mr. KAMIEN. Precisely, because they finance, not totally out of debt, but partly out of equity capital as well, and the return on that is taxed at the corporate income tax rate. Consequently, they need a higher return.

Mr. BAUMOL. If I may put it another way, if the current rate of interest is 5 percent, and assuming that equity had no risk at all, so that an equity holder would be perfectly happy to invest at 5 percent, the company to get 5 percent would have to produce a yield of 10 percent out of its productive process, since 50 percent of its earnings go into taxes.

As a result, any resources withdrawn from the corporate sector would involve a loss of a 10-percent earnings in the productive sense, earnings of goods produced for society, and, therefore, the resources should only be reinvested in a Government project if there they could produce 10 percent.

Representative MOORHEAD. I see. So where I thought there was considerable difference among the three of you on the actual rate—Mr. Kamien, when you allow for the tax factor you are getting pretty close to it?

Mr. KAMIEN. Precisely.

Mr. BAUMOL. This is my main reason for my support of the 10 percent, not the risk element, although we may differ very slightly on that matter. But I think the really critical element and the real reason for the tremendous difference between rate of return of the corporate sector and Government securities is the corporate income tax.

Representative MOORHEAD. Mr. Kamien, if I understood your testimony correctly, you would put in another factor pushing downward, from, let us say, the arbitrary 10 percent, which you call the inflation factor, am I correct in that?

Mr. KAMIEN. Right. That would be done for the following reason: Costs and benefits are ordinarily calculated in terms of present dollars, not in terms of future dollars. Consequently, the same adjustment has to be made in the nominal interest rate.

If I buy a $100 bond and get 5 percent, part of that interest rate is to take account of the fact that a year from now, that $5 will not be worth, if inflation occurs, as much as it is today; it may only be worth $4.50. If, in fact, I want 5 real dollars, I am going to ask or a higher rate of interest. This fact, I think, should be taken into account by a downward adjustment in the discount rate.

This is true in an absolute sense. In a relative sense, if the same calculation occurs in private industry, then of course, we are just talking about opportunity cost, and no adjustment should be made. The question is how is it done in private industry and how is it done in the Government? If the same type of calculation is done in both, then no adjustment need be made.

Representative MOORHEAD. I see that we are probably never going to get the Congress to agree on this upper figure that we are discussing. But would I be correct in saying that it is your opinion that no responsible economist would urge the use of a figure below the long-term current Government bond yield?

Mr. BAUMOL. I have heard of no such economist.

Representative MOORHEAD. Would this be a unanimous opinion in the economic fraternity?

Mr. STOCKFISCH. I would like to insert here that I would be delighted to agree with my colleague here, but there has been a surge of literature on this social time preference notion which I address in my paper—maybe I am strafing dead horses. And I am not sure that there would be this universal agreement on this point, even though I think applying the low-interest rate to Government projects along these lines is quite irrational, quite apart from what is cogent about the broader aspect of the argument.

I don't want to air all this linen regarding the profession on this score. But it was my impression that there were some people who did advocate a much lower rate, although they never came out with a number. I might add, incidentally, it is possible to come up with a negative number.

Mr. BAUMOL. I think we are confusing the issue unnecessarily. I have just recently, for other reasons, before I was involved in preparing

this testimony, gone over the literature fairly carefully. And, of course, as you know, it does involve many differences. Those are of two types as far as we are concerned here. No. 1, there are the differences between those who would advocate something in the neighborhood of Government security rates, and those advocating rates considerably above those.

Second, there are the differences between those who say that the overall rate of interest is too high, and those who say it is not. There are those who say that all rates should be brought down, a possibility both other witnesses have considered. If one lowers the rate of return in the private sector as well as in the Government sector, no misallocation of resources need necessarily result.

However, let me point out here that the argument that the overall rate of interest is too high is a curious one, too. There may be temporary reasons why it may be too high. For example, there may be problems of unemployment at some given time, and one may want to stimulate the economy. Then clearly, I think we would all agree that a low-interest rate is a good thing. But there is also the argument that we ought to provide more for our posterity, that we ought to sacrifice more of our current goods and provide a better life for our heirs.

Now, this is a very curious argument, considering how rapidly per capita income has been rising and is likely to continue to rise.

I think we do have to make sacrifices for others. But these ought to be sacrifices for the people in the ghettos today, and for people who are having terrible difficulties existing in rural areas today, not for a posterity which is likely to be far, far wealthier than any of us are today. That does not mean that one must not make some sacrifices for the future. There are certain resources which if destroyed just cannot be replaced. If we destroy the Grand Canyon, it is a tragedy, because no matter how wealthy our posterity is, they cannot rebuild it.

However, it is one matter to say that one should preserve various types of irreplaceable resources, and another to say we have to subsidize generally the far wealthier future generations of tomorrow.

And on those grounds, a number of people in recent years have seriously questioned the argument for an overall lowering of discount rates. However, I think it has no direct pertinence to the present discussion, which is not to me a question of what the absolute level of the rates ought to be, but of how they ought to be determined for a Government project in comparison with the rates in the private sector.

Representative MOORHEAD. Thank you, Mr. Chairman.

Chairman PROXMIRE. I would like to ask you gentlemen—first, I want to make sure that I understood Mr. Baumol. Did you say that the Treasury and the Bureau of the Budget has taken any position on this?

Mr BAUMOL. Not a public position, but I have seen some correspondence indicating this.

Chairman PROXMIRE. Obviously, the Bureau of the Budget must acquiesce in the present 3⅛, because they have to give approval to each of these projects, they are asked specifically, and it is true that they may have reservations, but they do formally approve, on the basis of the interest rates that we have been talking about.

Mr. BAUMOL. Certainly, because they act on the basis of a directive which tells them to calculate interest rates in a certain way. But I

have, for example, seen documents accompanying such a calculation in which the person who conducted it said in effect, "We transmit the following figure under instructions. However, we think it is nonsense." That is a paraphrase, but it is essentially what it said.

Chairman PROXMIRE. Now, conceivably—I admit it is not very likely, but conceivably, we could have another return to extraordinarily low interest rates, the kind we had during the thirties and during World War II. The historical record, I guess, indicates that long-term interest rates were well below 3⅛ percent for a while. Do I understand, Mr. Kamien, that your position is the same as Dr. Baumol's and Dr. Stockfisch's, that you also agree that opportunity costs should be the principal criteria; in other words, that it should be something in the area of 10 to 15 percent, rather than the 4¾ percent at the present time?

Mr. KAMIEN. Yes, sir.

Chairman PROXMIRE. So that this really would not shake your basic position, even if the rate should go down to an extraordinarily low rate, you would still—you might have a much sharper discrepancy than you have now, between the longterm current rate and the opportunity?

Mr. BAUMOL. No, the difference might not be all that sharp. Because, if the interest rates on Government securities went down to 2½ percent, I would expect that the rate of return in the private sector would go down correspondingly.

Chairman PROXMIRE. Well, you would expect that. But it would not necessarily be true?

Mr. BAUMOL. It would not necessarily.

Chairman PROXMIRE. It would depend on the kind of monetary policy that we decided to follow.

Mr. BAUMOL. Precisely. But I think in order to implement it—

Chairman PROXMIRE. We had a situation during World War II where we had, for example, very low interest rates, for various reasons, and terrific opportunity costs probably in various parts of the private sector.

Mr. BAUMOL. Absolutely.

Chairman PROXMIRE. Let me ask this question, though I ask it pretty late in the day now. How does the interest rate apply to PPB's in comparison to the benefit-cost analysis we have been spending so much time on? This is my fault. My questions have been directed in this area. But PPB specifically is, as we all know, a relatively new form of efficiency system which has been incorporated in the various agencies in the last 2 years, since, I guess, 1965, when President Johnson provided the first directive, and it is a relatively new concept. We have been talking about—of course, the heart of it—as you gentlemen point out—is the cost-benefit analysis.

But I am afraid we are going a little bit afield. Would you, Mr. Stockfisch, bring us back a little bit and point out just where this can be most helpful in applying PPB analysis, not in the longer range reclamation projects, but in the analysis of other governmental programs, perhaps in defense, and programs in health, education, and welfare, and so forth. And maybe the interest rates would not be as relevant in those areas.

Mr. STOCKFISCH. No, sir; I think they are relevant in any area where there is a choice of investing a lot of resources today as an

alternative to incurring larger annual operating costs. For example, the whole area of inventory management in support of military systems. It is certainly relevant here. It would be relevant, for example, in getting a better measure of what the whole structure of postal rates should be, since the Post Office Department requires and absorbs large amounts of capital. And yet for all practical purposes, the postal services are priced without taking into account any capital cost.

Indeed, I think it has very wide application. It has application in the extent to which you establish sophisticated maintenance systems, even in the design of Government buildings. My observation is that most Government buildings are much more "capital intensive" than similar private buildings.

There are all sorts of anomalies like this. So the relevance of the discount rate has almost universal application, as I see it.

I would like to emphasize one part of the problem, however, that is very serious. Even if Congress or the Bureau of the Budget should promulgate a rate, until there is a fairly universal and commonly applied set of decision rules that get out to all the decisionmakers in the Government—and I mean people down at relatively low levels, the various staffs who do the staff work and make the studies and estimates of costs—until there is a fairly standard format and methodology for conducting and applying cost-benefit analysis, there are still going to be many problems. This problem, as much as anything, has sociological, political, and deep institutional roots, so to speak. It is not an easy process of making the transformation, as the experience in the Defense Department has well illustrated.

And this is germane to the remark which was made earlier by Mr. Kamien about the whole problem of measuring the benefits. That is a separate problem, but they are closely intertwined.

Chairman PROXMIRE. There is another limitation here. One of the most important and one of the most expensive investments we are making has been in education.

Mr. STOCKFISCH. Yes, sir.

Chairman PROXMIRE. And in other intangible areas. Now, it is clear that you have some objective basis that is reasonably accurate, perhaps, or can be, for measuring the benefit you are going to receive from a tangible, physical construction project.

How can you do this though, with an investment in education? How can you do this in an antipoverty program? How can you do this in areas of this kind in which the benefits are so much less tangible and over such a long period of time, and our experiences are so limited? Is it likely to be useful here?

Mr. STOCKFISCH. Yes, sir; I think it is. But I might also add that we have just really begun to develop the techniques for analyzing benefits. I don't have much patience with the assertion that is made by many people that somehow we cannot measure the benefits. Whenever I hear a person make that statement, I am usually suspicious that either the effort has not been made or that that person is simply asking for a license to spend public resources because of his judgment or his authority, or whatever it might be.

I think, for example, in education that there are ways of getting a handle on this. Some studies have already been made. A lot can be

done by way of experimentation, with alternative educational techniques. It may take some time, but experimentation can be undertaken.

Chairman PROXMIRE. A lot of this information is not available now. Maybe the PPB's will help us to get that information.

Mr. STOCKFISCH. Yes, sir.

Chairman PROXMIRE. Take Head Start, which some of us feel is a marvelous program, and perhaps the most attractive and politically salable aspect of the antipoverty program, it will be years before we really know whether Head Start has really paid off in terms of enabling those young people to stay in school and progress in school in the future, or whether the Head Start efforts evaporate in a family atmosphere, which is bad.

Mr. STOCKFISCH. Germane to that is the point that we have scarcely begun to spend the resources necessary to gain the information. It is a major effort, for example, to get the Treasury Department and the Internal Revenue Service to spend an extra couple of million dollars to understand, by gathering basic data, some of the behavioral aspects of the tax system. However, we don't hesitate to spend hundreds of millions to buy information and knowledge in technical areas connected with military problems.

So I think there are prospects and hopes here.

Let me just add one final point. Even in areas where it may be impossible to estimate the benefits of a program, like in particular the military areas, there still remains an option as to whether this program is conducted by means of a heavy initial investment outlay as contrasted with a smaller one, but trading off in terms of the annual operating cost. And here you can still apply the appropriate discount rate.

Chairman PROXMIRE. Let me ask you gentlemen, what about the situation where you have resources underutilized, where we have unemployment, where we have a situation where the Federal Government—the assumption has been made here that the Federal Government goes ahead with a $100 million project. That would be $100 million less that could be used in the private sector of the economy. Is this realistic on the basis of the last 30 years' experience in American society, where we have had most of the periods with unemployment, and idle resources, where we have even now at the crest of the boom 15 percent of our factory capacity not utilized, 3 million people out of work, and people working the shortest workweek, roughly, that they have in 6 years; under these circumstances, to say that we should not go ahead with Government projects that have some benefit, because you are absorbing resources that private industry should use? How realistic really is this? It is realistic, obviously, in an all-out war situation, but under other circumstances, is it? And does this shake your position at all?

Mr. Kamien, do you want to start on that?

Mr. KAMIEN. It does not shake my position with regard to the interest rate that should be applied.

The appropriate place for taking account of resources which are idle is in the estimation of costs of the project. That is to say, there is a difference between what we call social costs and private costs.

If resources are not utilized, the social cost of using them is zero. The private cost is higher than that because if you want to take a man

who is unemployed and employ him privately you must pay—that is, a private firm does not get him free.

Chairman PROXMIRE. You say this would not affect the kind of interest rate you would use. Why wouldn't it? Isn't the 15 percent—let us take that level—isn't that on the assumption of a virtually full utilization of resources, or not?

Mr. KAMIEN. Not necessarily. As I said earlier, with regard to using a higher interest rate, and then letting the other party also upgrade the benefits, thus getting us back to the same position, you can justify a project by using a lower discount rate, or using higher benefits, or using lower costs.

Chairman PROXMIRE. Doesn't this somewhat vitiate the thrust of our position, because we don't use lower costs?

Perhaps we could use social costs from a social standpoint. What we do, however, is use the same costs in evaluating this as the private sector would use. We recognize that you have to have certain labor cost, construction cost, material cost, and so forth, and this is the way we operate. Now, doesn't this counterbalance to a certain extent the balance that you have in the interest rate?

Mr. KAMIEN. It does, but sort of in the wrong direction.

Chairman PROXMIRE. In the wrong place. Well, in the right direction, but it may be the wrong degree.

Mr. KAMIEN. Right.

Chairman PROXMIRE. Mr. Baumol.

Mr. BAUMOL. First of all, I would say in fact that if you did have substantial unemployment, I would advocate a lower discount rate, but I would also advocate a lower interest rate to the private sector, that is to say, I think it is then advantageous to increase employment, but not necessarily to increase it only on the part of the Government. And this is precisely the reason why one advocates low-interest rates during a depression.

Chairman PROXMIRE. I see.

Mr. BAUMOL. But this does not in any way affect the relative advisability of the employment of resources by the one sector or the other.

Chairman PROXMIRE. What you are saying is that this might persuade us to follow a fiscal policy that would encourage the whole economy to move, but not necessarily to say that therefore the Federal sector of the economy or the governmental sector of economy must take up all the slack?

Mr. BAUMOL. That is right. I would like to see the Federal sector take up some of it, but not all of it, not to produce distortions in their relationship.

There is a second reason why——

Chairman PROXMIRE. Let me interrupt at that point to say, isn't it true also that you have a bad—you have an improper basis for investing your Federal resources, instead of investing them, perhaps, in training and education and various other programs, that you invest them in public works programs that would have a lesser payoff throughout the years, because you are doing it on the basis of an interest rate which is not accurate or honest?

Mr. BAUMOL. You have anticipated the second point I was going to make, and I can only agree with you.

Chairman PROXMIRE. Mr. Moorhead, do you want to ask some questions?

Representative MOORHEAD. Just following up on this. If we keep current; that is, look at the current yield, as opposed to taking a historical rate of interest, which would compensate for this—in other words, as the economy went up, as more people were employed, interest rates tend to be higher, it would be a discouraging factor for going into a particular project, whereas as the economy turned down, and as interest rates declined, if we kept current in our opportunity cost, we would be more likely to invest in projects, which is just what we should be doing.

Mr. BAUMOL. Precisely. Precisely what is being done by ignoring that possibility is to counteract the rationale of monetary policy. Monetary policy presumably involves the increase in interest rates during boom periods, and the lowering of interest rates during periods of recession for just those purposes. And its immediate objective is to encourage investment in all sectors during the recession, and to discourage it in all sectors during a boom period. And that is precisely what you are not doing by ignoring those changes in interest rates in a discount rate calculation.

Chairman PROXMIRE. If you would yield at that point, on that particular point, today, September 1967, is a superlative case in point. The Government is very anxious to discourage—rather, to slow down the economy and prevent inflationary pressures, prevent overinvestment, which for the time being, for the next year or two may have inflationary effects.

And yet we are going ahead with the public works projects based on the 3⅛-percent figure, a discount figure, which means that the Government itself is investing in projects that utilize scarce resources, and tend to impose this inflationary pressure.

Mr. BAUMOL. Exactly.

Mr. MOORHEAD. Which is another reason for getting rid of the ground rules, the erroneous ground rules that we have laid down in the past.

Let me see if I understand the social problems, the education, the Job Corps, Head Start.

Are you saying that if we could measure the benefit in economic terms we could use, then, the same discount rate and make it—the only problem is that we don't know the technique for measuring the benefits, is that correct?

Mr. BAUMOL. That is correct.

And there is another complication. These projects are Government projects for a very special reason. Here I am just expanding on what my colleagues have implied. The benefits of these projects are not made up only of direct benefits accruing to the recipients, that is to say, by improving the education of slumdwellers, not only are they better off, but I am better off as well. The relevant benefits are not just the increase in lifetime earnings of the slumdweller, but the improvement in my position and your position and everyone else's.

So that the reason that is more difficult to evaluate these benefits is because they are so much more diffuse than those derived from industrial production, and we have to go so many more places to locate them.

But this doesn't mean that we can never find out what they are, it just means that it is a harder job. And it means that such projects may be justified even though the benefits to the immediate recipients do not equal the immediate costs, because the overall social benefits may far exceed the benefits received by the parties directly affected.

Mr. MOORHEAD. But until we get these ways of measuring benefits on the social programs, the Congress is just going to have to justify it by a feeling of the need and the urgency rather than on strictly economic grounds?

Mr. BAUMOL. That is correct.

And yet one must also keep the principle in mind, that is to say, one clearly cannot prevent action and say we must hold everything until perfectly acceptable measurements are made.

But on the other hand, one can often recognize cases where expenditures would be wasteful, or would be totally unjustified, and yet which appear at first blush to make sense if we simply compare the principles with the known facts of the matter.

So while I would say the Congress must act on these matters on the basis of its judgment, I think it should be an informed judgment, recognizing both what little is know about these matters and the relevant criteria.

Mr. MOORHEAD. Where we really have some experience in measuring benefits, even though they are not of course totally accurate, and again be judged one way or the other, we are particularly talking about what are generally thought of public works projects, that is really where we know we are making a mistake today; is that correct?

Mr. BAUMOL. Exactly.

Mr. MOORHEAD. Thank you, Mr. Chairman.

Chairman PROXMIRE. What is the rationale of the waste and even the negative element in GNP involving the private sector?

To some extent advertising for cigarettes increases the GNP. If you have an increased crime rate and have to fight it by increasing the police force, this increases the GNP. Making napalm to burn people in Vietnam increases the GNP. Some of these examples are just sensational examples that have been used in speeches. But what concerns me more than that is the fact that there is an irrational, selfish element—perhaps Galbraith in his *Affluent Society* expresses it best—suggesting that the public sector has been neglected and the private sector has been extravagant and wasteful, and that we should be aware of this social contrast, and that the thoughtful, deliberate decision made on a social basis by the city council and State legislature and Congress and the President is likely to have greater social benefits than just letting laissez-faire take over, and making the assumption that the private economy is always going to be at least equal in benefit to our society to the social sector.

What is the answer to that?

Mr. BAUMOL. Clearly, there are wasteful expenditures from the point of view of society. Incidentally, it is interesting that some of those that you listed were expenditures by Government and not just by the private sector.

Chairman PROXMIRE. That is true. All I am saying is, when I mentioned some of the arms expenditures and police expenditures, the Government expenditures, of course, they just suggest that the

GNP itself isn't a satisfactory means of measuring whether we are making progress or whether it is for the good of society, and so on.

Mr. BAUMOL. Right.

And I agree with Galbraith that in many areas we are spending far too little for social purposes. But the nature of the required outlays is determined not by mechanical calculation of what and an outlay contributes to the published GNP figure, but by calculating precisely the indirect benefits which we were discussing before. A very clear case in point, I think, is expenditure on urban problems, where there is just no doubt in present circumstances that the benefits of a well-designed program are enormous for society as a whole. And the reason one has underinvested in them just from the point of view of economic calculations—of course, they are also much more serious political problems involved—is that one tends to think only in terms of the direct benefits one gets without taking into account all the side benefits for the economy as a whole.

But these of course are real benefits, these are not merely increased earnings that, say, an advertising agency derives from these expenditures.

Chairman PROXMIRE. I take it one answer might be that if we just have a more rational way of ordering the Federal Government's priorities, that you would make a great improvement.

Mr. BAUMOL. Yes.

Chairman PROXMIRE. It is not necessarily in your argument that the Federal Government should reduce its overall expenditures.

Mr. BAUMOL. Absolutely not.

Chairman PROXMIRE. But it is an argument that we should have a more rational way of determining where the expenditures go, and that PPB, the cost benefit, is one way of achieving it.

Mr. BAUMOL. I think again we would agree on that point.

Mr. KAMIEN. Yes.

Chairman PROXMIRE. Let me ask two final questions:

The subcommittee is interested in two things in these hearings, and although they are not directly put to you, I would like your guidance.

One, what are the alternatives to PPB for budget decisionmaking?

Is there anything that is available, Mr. Stockfisch, that you would like to comment on?

Mr. STOCKFISCH. Sir, the alternative is the way program evaluation and decisionmaking has been conducted for the past 200 years. It is characterized by a large element of capriciousness, and power politics. I equate politics in this sense with the manipulation of power, in a bureaucratic context where the real objectives of the participants are often not explicitly stated. Whatever the powerful people at a particular time feel they want, they get it.

So I have great hopes for the cost-benefit approach.

Chairman PROXMIRE. You have had a lot of experience with it at the Pentagon in the Defense Department?

Mr. STOCKFISCH. Yes, sir.

Chairman PROXMIRE. Would you care to take a minute or two to tell us what effect it has had in that area?

Mr. STOCKFISCH. Well, I think it has had a very great, worthwhile effect. But I also think the surface has only been scratched thus far. Because as soon as you introduce a method for rational decisionmaking, particularly the requirement that objectives be stated

explicitly, this in itself becomes a powerful device for decisionmaking; and the status quo between different decisionmakers is bound to change. And this has by no means entirely settled down yet.

So that the going is very difficult.

Chairman PROXMIRE. Let me ask, because I know that you have a great interest in this, and are expert in the area, how would you then take this expertise and then apply it, say, to the reform of our tax structure?

Mr. STOCKFISCH. Sir, I think one of the first steps that is necessary in the tax area is to get much better understanding on how the tax system operates. That is, to apply operations research techniques to the behavior of the tax system much like it has been applied to things like the queing problem on the Holland Tunnel, or an inventory problem. We need better knowledge.

Some progress is being made here. The Treasury has made a great deal over the past 7 or 8 years.

Chairman PROXMIRE. Specifically in what area? For example, with the investment credit, does this get results in encouraging investment? Of course, it is hard to measure this, because so many things are changing all the time.

Mr. STOCKFISCH. Right.

Of course, this is primary. Let me give you a more specific example.

We went through it in the Treasury. When the depreciation guidelines were changed, and the reserve ratio test was introduced as a means of handling the depreciation problems, it became apparent in the Treasury that there had been, prior to the introduction of reserve ration tests, extreme variation in the actual depreciation practices as between different taxpayers. This was a result of different decision rules that the local agents employed on a case-by-case basis. Often these decision rules were very poorly articulated.

What the reserve ratio test did was introduce a fairly standard decision rule that could be stated and was understood by the taxpayer. It also gave more rational treatment as between different taxpayers. That is, the effective tax rates that different taxpayers were paying would end up being more comparable.

Whether this was purposely thought through as the end objective of the reserve ratio test is beside the point.

But I think here was a case that, by promulgating a decision rule that was based on fairly sound rationale, it was possible to introduce more standardization for the way the tax system would operate.

However, we need a better understanding of how many other features of the tax system operate. For example, who benefits from the interest deduction for homeownership, rich people or poor people? We really don't know, partly because it is very difficult and costly to get good data and information.

Chairman PROXMIRE. I think it would be easy to secure these funds if you could show that they would increase your yield.

But when you go to the point where you would want to make a social judgment of the kind you have indicated this is harder to do.

If you can show it will increase your yield, very often you can show that an investment of a dollar will give you a hundred dollars, and an increased yield would get more than what you are doing.

Mr. STOCKFISCH. This shouldn't be the relevant criteria. If we were really interested in having an equitable, well-designed-type

system, we should first know how that particular feature of a tax law is operating, particularly in combination with a lot of other tax features. As it stands, however, when anyone seeks by way of reform to broaden the base, for example, to modify that feature, assertions simply abound.

Chairman PROXMIRE. There is probably no place where it is more necessary in the political process, because there is such intensive political pressure to preserve tax advantage, tax privilege.

Mr. STOCKFISCH. Right.

Chairman PROXMIRE. And unless you get some kind of overwhelming support on the basis of equity which can be supported by information, you can't make progress.

Mr. STOCKFISCH. Right.

And the main point I want to conclude with here is that the cost-benefit approach, the extensive use of operation research approach techniques, do constitute knowledge. To the extent that knowledge is used to ventilate these subjects, there is less sheer capriciousness in decisionmaking. And hopefully, then, intelligent men, even though they may differ on certain objectives, can more effectively agree in many of these areas.

It takes a lot more resources, however, that need to be invested by way of buying knowledge about the behavior of complex systems.

Chairman PROXMIRE. What do you mean a lot more?

For instance, with $10 or $15 million you can get a terrific improvement, can't you?

Mr. STOCKFISCH. That is correct. In fact, in the tax area the U.S. Government operates a $120 billion a year tax system. You can look at this as a system. As far as I can tell, the Treasury had a staff of about 40 professionals, a quarter of whom spent more of their time answering letters and mail than anything else. About $5 million a year is spent on the statistics of income program. So roughly maybe the Treasury was spending about $6 million a year to try to gain knowledge on the operation of the tax system. In the military business we don't hesitate to spend hundreds of millions of dollars to develop a new reconnaissance system to gain information for the conduct of operations. So we have been thinking very small in many of these areas.

You are quite right, if you allocate $15 million to study the tax system, that would be a threefold increase in the present level of esearch that is going on in this area.

Chairman PROXMIRE. My last question—Mr. Kamien and Mr. Baumol may want to comment on this—what should Congress itself consider using of PPB technique, as distinct from the executive branch?

How can we use this PPB technique most effectively, in your view?

Mr. KAMIEN. My colleague, Professor Davis, who is going to address you tomorrow, has more to say about that. But I won't anticipate his entire statement.

I think that Congress can use it by having the Appropriations Committees, through their own staffs, evaluate the incoming projects. This is, of course, very difficult to do.

Chairman PROXMIRE. You say it isn't or is?

Mr. KAMIEN. It is.

Chairman PROXMIRE. You see, the staff of the Senate Appropriations Committee has on the average one man assigned to each appropriations bill, and there is one bill for the whole agricultural appropriation, one man for State, Justice, and appropriation all of which is one bill, maybe two, for Defense.

So you see we are much better than we used to be, where we had one or two people for the entire appropriation field, but when you have one man for these enormous budgets, we can't do much on PPB with that, can we?

Mr. KAMIEN. No.

Chairman PROXMIRE. Assuming we can use the expertise in the executive branch, what we need is people who understand the PPB, and can ask the right questions and evaluate it on the staff.

But on this basis we still would need more than one man. What would you suggest?

Mr. KAMIEN. Three or four, perhaps, with a large supporting staff.

A lot of work that has to be done doesn't require professional expertise, but is fairly routine stuff. If several people were available to do the routine work, the professionals could then be utilized much more effectively.

But I really don't know whether it should be five, 10—that is just very hard to say. But I do know that it would be very difficult to duplicate properly a cost-benefit analysis done elsewhere, and in many cases that might be required.

Mr. BAUMOL. I would say that your suggestion that the congressional staff really cannot undertake its own cost-benefit analysis—its own PPB investigations is perfectly right. The more effective thing to do is to be more demanding in what you expect in the way of this sort of analysis in support of proposals coming to you. That is, I would certainly favor a small staff which looked very critically at the cost-benefit analysis work which was conducted by the executive branch and which asked for this sort of work more consistently on the part of the executive branch. And I think that such standards, once set up and demanded tend to support themselves.

Once people learn that a slipshod piece of work, or the absence of this sort of evidence is looked on with disfavor, they will soon learn to do them up much more carefully and more effectively.

Chairman PROXMIRE. We would have to better staff to do this in an effective way, wouldn't we?

Mr. BAUMOL. Yes. But you would not need the size of staff that is required to do the complete study over again.

Mr. STOCKFISCH. And you can also use contract support in some of these areas.

Chairman PROXMIRE. Yes. I think on a spot basis this might be a very good idea. Why we couldn't obviously begin to do this in every area of every one of the cost-benefit analyses, we could pick out a few and have competent people come and do them.

Did you want to make a further statement?

Mr. STOCKFISCH. Just that if you do go this route, and you choose two and three areas, then it is really important, however, that you follow through on it. Because then the signals that are sent out to other agencies become very important. I think that is in line with Professor Baumol's observation as well; don't go at it halfway, pick several important areas, or even just one, but then follow it through

with great determination. What often happens is that a lot of cost-benefit studies are undertaken. But if the answers do not conform to prior decisions, the study is just buried somewhere. And that makes the game a farce. It is not being played consistently.

Chairman PROXMIRE. Well, gentlemen, thank you for a very fine morning. It has been most helpful to us. We will conclude the hearing on PPBS tomorrow with four witnesses who will discuss the future applications of PPBS. We will meet at 10 a.m. in the New Senate Office Building, room 1202.

(Whereupon, at 12:05 p.m., the subcommittee adjourned, to reconvene on Thursday, September 21, 1967, at 10 a.m.)

THE PLANNING-PROGRAMING-BUDGETING SYSTEM: PROGRESS AND POTENTIALS

THURSDAY, SEPTEMBER 21, 1967

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON ECONOMY IN GOVERNMENT
OF THE JOINT ECONOMIC COMMITTEE,
Washington, D.C.

The subcommittee met, pursuant to recess, at 10 a.m., in room 1202, New Senate Office Building, Hon. William Proxmire (chairman of the subcommittee) presiding.

Present: Senator Proxmire; and Representatives Rumsfeld and Moorhead.

Also present: John R. Stark, executive director; Daniel J. Edwards, economic consultant; and George Iden, staff economist.

Chairman PROXMIRE. The Subcommittee on Economy in Government of the Joint Economic Committee will come to order.

Today we conclude this particular set of hearings on the planning-programing-budgeting system.

This subcommittee is especially interested in gaining insight into at least two questions about the future applications of PPB.

One: What are the alternatives to PPBS-for budget decisionmaking?

Two: How can Congress use PPB type techniques?

We have four very well qualified witnesses today.

Harry Rowen, the president of the RAND Corp., was the Assistant Director of the Bureau of the Budget when the civilian branches started applying these techniques. Mr. Rowen has also been with the Defense Department where PPB first gained fame.

John Haldi was the first director of the Budget Bureau's program evaluation staff, with the responsibility for application of PPB.

Prof. Toby Davis, from Carnegie-Mellon University, is a joint author of "A Theory of the Budgetary Process."

And we have Mr. Frank H. Weitzel, Assistant Comptroller General, who will represent the Office of the Comptroller this morning.

We are happy to have this distinguished panel.

Mr. Rowen, will you start off?

I might say, incidentally, that some of you gentlemen have detailed statements, and some very short statements. But you can be assured that the entire statement will be printed in the record. We would appreciate it if you can confine your opening remarks to 15 minutes or so. And, as I say, everything you have here will appear in the record.

STATEMENT OF HENRY ROWEN, PRESIDENT, RAND CORP.

Mr. ROWEN. Thank you, Mr. Chairman.

I am happy to have this opportunity to discuss with the subcommittee the subject of planning-programing-budgeting, having been involved to some extent in the promulgation of this particular approach to improving decisionmaking.

The essential aspects familiar to you I shall state very briefly: careful specification and a systematic analysis of objectives of government; a search for relevant alternatives, different ways of achieving objectives; an estimate of the total costs of the alternatives, both the direct and indirect costs, the initial ones and those to which the alternative commits us for future years; both dollar costs and those that cannot be measured in dollar terms; an estimate of the effectiveness of each alternative, and of how close it comes to satisfying the objective; and, finally, a comparison and analysis of the alternatives, to try and devise the alternative which is the best one among those available.

This is all rather abstract summary. We can say a number of things that PPB is not. Clearly, it is not a substitute for experience and intuition. It is only a partial answer.

It is not to be the sole basis for decision in any area that I am familiar with. Especially, it is not decisionmaking by computer, a notion which seems to have gotten around which has no foundation in fact. Although computers can be helpful from time to time, they are about as helpful as slide rule and pencil and paper. They are useful, but by no means should they dominate, nor do they dominate, the PPB operation in any part of the Government.

Certainly, PPB, and more broadly, systematic analysis, is not limited to cost accounting, or even to economic considerations in the narrower sense. There are many factors to be taken into account in decisionmaking in public policy areas. And while measurement of those things that can be measured is very important, naive attempts to measure that which is unmeasurable, or to distort true objectives by quantification of a naive sort, is not a good idea.

Let me make a few comments on the analytic aspects of PPB. It is the thinking, the systematic analysis rather than the more mechanical accounting aspects that are really of greater importance, but if this effort led to nothing more than each agency's doing a better job of reexamining those objectives and programing, then this would be a very useful effort.

Objectives of Government programs are often stated in such vague and nonoperational terms as to be little more than home-and-mother platitudes.

At the other extreme, one sees people in agencies behaving in ways that are very traditional, very conventional, they keep doing the same sorts of things that they have done for years. Often they are inclined to rule out relevant alternatives.

For example, it is not an objective, I would assert, of our intercity highway program simply to lay concrete. There must be something else we had in mind, although one often finds that whatever it is has got lost, and we are imbued with the idea that we have to meet that schedule in pouring concrete.

And one can find many examples of having the responsibility of getting certain programs done, and confusing the means to the end.

It is not the objective, for example, of educational programs to obtain a given pupil-teacher ratio. There must be something deeper that we have in mind in our educational system.

It is not the objective of our health programs to attain a certain number of hospital beds for each thousand population, even though that particular measure often assumes an importance out of all proportion.

These are objectives that need to be gotten behind, and need to be scrutinized carefully. I don't mean to suggest that this is an easy thing to do. It is often very difficult. It is all very easy for me to say the objectives of our hospital programs are not simply the building and maintenance of a certain number of beds per thousand population, or keeping patients' daily costs at a certain level, or taking so many chest X-rays a year. But if it is not simply these objectives, what is it? It is very difficult to get adequate measures of what it is we are trying to accomplish.

For example, in the field of health care, there are crude measures which are widely used, such as longevity and morbidity of various diseases. And these are important objectives. They are also intangibles involving a sense of good health and well-being, and are a very hard thing indeed to measure. Getting at these requires good work, good people, and time.

There is always a danger that poor work will tend to reduce the multiple, often incommensurable, and conflicting goals to a single objective that admits of easy measurement. And this is something to be resisted.

Now, if it is difficult, complex, and very important to do these things, what should we be trying to do? A beginning has been made, but only a beginning.

I think we need to do several things. I think we need to push ahead, taking seriously the need for systematic analysis, not just at the Federal executive level, but also, as has been suggested by this committee, in Congress. And I think it is at least as important that the needs of State and local governments be recognized. Because, after all, most of the government—the role of government in this country is local. States and city governments have at least as much need as the Federal Government does for good analyses, good planning, as any other part.

But we have a very serious problem in the shortage of talent. There is not all that much to go around. The people at this table can testify, and in Washington as well, that there is a rather substantial number of Government agencies scrambling for a rather limited supply of talent.

And we need to expand that pool. We need to expand the supply of people who can think through, think behind the more conventional objectives that are often available to develop alternatives to accomplish the given objective, or possibly in some cases, different objectives. There are many examples that I could cite—I won't at this time—that are contained in my printed statement.

I would like to stress that of the greatest importance, really, in considering alternatives is not merely comparing, evaluating those that happen to be around, predigested ones, but inventing new ones. This is about as far as it could be from the accounting interpretation of PPB as one can imagine. It is not merely a matter of trying to compare

and evaluate the course of actions that are well ahead and well known to everyone. It is much more a matter of trying to think of some new courses of action.

Be ingenious. Be inventive. Design around some problems. I think a good deal of the effort up to now has dealt largely with questions of format and structure and the phasing of procedures into the budgetary cycle. I think this has been a necessary step.

But in the future, the effort should be devoted increasingly to better analysis, to being more inventive, and more imaginative, and designing useful alternatives that will achieve the goals of our programs.

Of course, we are interested in costs. And here we have a very tricky problem of what are the relevant costs. They are not always to be found in the budget. What are the costs of a supersonic transport program? Maybe it is the sonic boom that shakes up the countryside. That is certainly a social cost that won't be found in the budget. And one can find many examples of this sort that decisionmakers should take into account, or that systems analysts should take into account in doing their analyses.

And because these costs are so often not to be found in the budget, they are often neglected. And it is quite often that those costs in the broadest sense which are not to be found in the programs are more important than those that are.

Finally, there is the very difficult problem of estimating benefits. I have suggested in the field of health how hard it is to measure good health. The sense of being well, feeling well, and not being sick is more than not having a collection of diseases. It is obviously more than that. This is very difficult.

And the same is true in education. And it is true in transportation, and it is true in virtually all of the activities of Government that there are. But measuring effectiveness of programs, of the manpower training program, is a very complex thing. It is difficult to measure benefits well, particularly in the case of new and untried programs. I think that honesty and humility on the part of those who are engaged in running programs and analyzing them is very much in order.

On the other hand, measurements can help, can tell us a great deal. The mortality rates, and school dropout rates, and real income levels, and unemployment figures do convey information. They don't tell the whole story, but they help give us useful information. And this is very valuable to help us press ahead.

Chairman PROXMIRE. Mr. Rowen, this is an excellent presentation. But I would appreciate it if you could summarize or abbreviate your reamining remarks, because we would like to distribute the time among the other panel members, and then have an opportunity for questioning.

Mr. ROWEN. I have some examples in various areas which I will not attempt to summarize. I think that the essential points I have stated. I think more needs to be done than has been done.

You are quite right in raising the question of what all this means to the Congress. And I have no specific suggestions to make in that connection. Perhaps other members will, and it might come out in the discussion.

(Mr. Rowen's prepared statement is as follows:)

PREPARED STATEMENT OF HENRY S. ROWEN

Mr. Chairman and members of the subcommittee, I am happy to have an opportunity to discuss with the subcommittee the subject of the Planning-Programming Budgeting (PPB) system, and, in particular, the matter of possible future applications and future developments in this system.

The essential aspects of PPB are—

A careful specification and a systematic analysis of objectives;

A search for the relevant alternatives, the different ways of achieving the objectives;

An estimate of the total costs of each alternative—both direct and indirect costs, both initial costs and those to which the alternative commits us for future years, both dollar costs and those costs that cannot be measured in dollar terms;

An estimate of the effectiveness of each alternative, of how close it comes to satisfying the objective;

A comparison and analysis of the alternatives, seeking that combination of alternatives that promises the greatest effectiveness, for given resources, in achieving the objectives.

Now let me mention a few things that PPB is *not*.

PPB is *not* a substitute for the experience, the intuition, and the judgment of the decisionmaker. On the contrary, its aim is to sharpen that intuition and judgment by stating problems more precisely, by discovering new alternatives, and by making explicit the comparison among alternatives.

PPB is *not* decisionmaking by computer. In the first place, decisions will continue to come, as they should, from the political process, influenced by value judgments, from the pressures coming from the various interested parties as well as from the process of systematic analysis. PPB, through such systematic analysis, seeks to aid the policy debate by being clearer and more explicit about objectives and assumptions and facts, by trying to distinguish relevant issues from irrelevant ones, and by tracing out the costs and consequences of the alternatives, to the extent these are knowable.

PPB is *not* a computer operation, though computers may be helpful from time to time. Nor can the thinking that must underlie well worked-out plans be produced by machine-like analysts. Most problems of importance are simply not susceptible of solution merely by highly abstract mathematical or economic techniques, though these may contribute to solution of important parts of the problem. In any case, a good analyst should be able to explain his study and its results to the decisionmaker, in clear language, free of jargon.

PPB and systematic analysis are *not* limited to cost-accounting, to economic considerations in the narrow sense; PPB should *not* neglect a wide range of human factors but it should *not* attempt, naively, to measure those factors that are really unmeasureable. Wherever relevant, quantitative estimates are to be encouraged. But good systematic analysis does *not* try to assign numbers to every element of a problem, does *not* ignore the intangible, does *not* rule out subjective evaluation and the appropriate use of judgment, as long as these are made explicit. Good systematic analysis does *not* neglect questions of values. On the contrary, the very name "cost-benefit analysis" reminds us that the question of *who* benefits and *whom does it cost* is a question involving values as well as analysis.

Now let me turn to a few comments about the analytic elements of PPB—objectives, alternatives, costs, and effectiveness.

If PPB led to nothing more than each agency re-examining its objectives, then PPB would be a useful system. Objectives of government programs are often stated in such vague and nonoperational terms as to be little more than home-and-mother platitudes. At the other extreme, they are sometimes stated in such narrow and conventional terms as to rule out any consideration of relevant alternatives. For example, the objective of the inter-city highway program is not merely to lay concrete. Nor is the objective of an educational problem the attaining of a given pupil-teacher ratio. Nor should improvements in the nation's health be confused with attaining a given ratio of hospital beds per thousand of population. Again, the stated and publicized objectives of a program may be different from the real, operational objectives; good systematic analysis will push behind the overt objectives to deal with deeper ones.

In some problems the objective is clearly defined and agreed upon. For example, the inventory policy of a school system should be designed with the objective of minimizing stock outages for a given cost. There are not complex issues of objectives or of measurement in this instance.

But in many cases the problem of stating wisely the objective is not at all simple. In health care, for example, is the objective really to keep patient-day-costs at a certain level, or to take so many chest X-rays a year, and so on? Shouldn't our primary concern be with the social and economic costs of death, or with the value, the significance, the quality of life? Shouldn't the goals of education concern achievement in the standard subjects, learning in special subjects, an improved ability to reason, to be creative, arousal of the sense of wonder, the development of social poise, the improvement of mental and physical health, and the custodial care and civilized taming of the young?

In such complex subjects as these there is a danger that poor work will reduce the multiple, incommensurable, and conflicting goals to a single objective that admits of easy measurement: for example, the loss to gross national product occasioned by deaths from heart attacks, or the test scores showing scholastic performance in basic subjects. But the risks of selecting the wrong goals are minimized if it is required that the analysis be clear and explicit, that it be open and subject to review and criticism, and that it be exposed to competitive analysis.

Since my subject is future developments in PPB, and in systematic analysis which is at the heart of PPB, I note that we need to improve our ability to deal with problems in which objectives are not simple. This, like other needed improvements, will come through doing analysis, exposing it to criticism, and learning to do it better.

In this connection we need to do several things concurrently: we need to take seriously the need for analysis, not just at the Federal Executive level, but also in the Congress, and at the state and local level throughout the country; we need to establish planning and analytic groups wherever an adequate supply of talent exists to make this possible; doing this means that we need more people trained in the necessary skills and methods to do good planning and analysis.

Next, a few comments on the second element of PPB that I listed above—alternatives. A vital element is a clear and objective presentation of alternatives. A planning document that does not present and compare alternative ways of achieving the objectives is a document that merely tries to make a case for a predetermined position.

The alternative means of achieving the objectives may not be obvious substitutes, and it may an important achievement of the analyst to show that there are additional alternatives that had not been recognized.

For example, our ability to support military forces abroad can be accomplished by the use of airlift, or sealift, or prestocking supplies at foreign bases. Or through a combination of these techniques, which might differ from region to region or differ by type of commodity being supplied. Or a new alternative might be invented—as it has—in the system which combines sealift with prestocking by having loaded ships kept on station abroad.

Again, the educational level may be raised by a variety of alternatives—increase in student participation, research and development in education, including the building of model facilities, improvements in the professional staff and in administration, the addition of new equipment, the reorganization of instruction, adult retraining, education in the home, education of the disadvantaged, and other categories of alternatives. Each of these categories, in turn, involves many alternatives. For example, student participation can be increased through loan funds, work-study programs in industry, educational leaves, starting public school at a younger age, new patterns of continued schooling aimed at the dropouts, and many others.

In the field of health there are the obvious alternatives of improved medical education, both for doctors and for auxiliary personnel, community education, expanded research, support of specialized services such as centers for diagnosis and treatment of specific diseases. But there are additional alternatives that are relevant to the problems of national health: an attack upon infant mortality in slums and rural regions, reduction in accidents and homicides, physical education programs, problems of diet, of smoking, continual preventive care, and others.

It is important that these problems be looked at in a context sufficiently broad that many relevant alternatives are compared. This means looking at not only the comparison of alternatives that happen to be around but the *invention of new ones* if the available ones are not satisfactory.

Initially the effort devoted to PPB has had to deal largely with questions of format and structure and the phasing of procedures into the budgetary cycle. In the future, the effort should be devoted increasingly to better analysis, to being more inventive, more imaginative at designing useful alternatives that will achieve the goals of our social programs.

The third element consists of costs. The costs of a given alternative are the resources that can no longer be used for other purposes, the opportunities that this alternative precludes. The PPB analysts often prefer to speak not of *cost analysis* but rather of *resource analysis* in order to remind us that dollar cost is only a convenient and not always adequate common denominator by which we can aggregate the many and varied physical quantities and activities that use resources. For example, we may be "costing" a system that calls for many highly skilled personnel or for large quantities of a scarce commodity. In the long run we may be able to supply these requirements by spending dollars now, but in the short run we may have to give these items special treatment.

The relevant costs cannot usually be gotten by pricing out a system described by a detailed set of concrete specifications. Often we are considering future activities, concrete specifications are not available, and these activities take place in a future whose principal characteristic is uncertainty. And this uncertainty should be treated explicitly. The time-phasing of needed resources should be treated. And all of the appropriate costs should be taken into account—whether or not they are a charge to a particular budget. For example, depending on the purpose of the analysis, meaningful costs of education include the direct operating costs, the capital resource costs, miscellaneous expenses to students and parents, and the foregone earnings of students while in school. The costs of putting an expressway through a city include not only the initial and maintenance costs of the expressway, but also the costs of taxes foregone, the economic and social costs of relocating the displaced residents, the smog generated by additional travel, and all the other social costs involved.

Finally, the concepts, the methods, and the analytical techniques used in a cost analysis will depend upon the context of the problem and the decisions that may be affected by the analysis. For example, in your own personal accounting, how you amortize the cost of your automobile depends on the decisions to be affected by your accounting—choice of limousine or compact, trade in after one year or ten, ride or walk.

In addition to the economic costs, there are, as we have seen, social costs that must be dealt with—for example, in the military, the effect on morale within a service, or the political costs of inconvenience and irritation to an ally. These may not be measured numerically, but they should be recognized clearly and explicitly.

The last item in the list above of the essential analytic elements of PPB was effectiveness—or benefits, or utility, as you prefer. I have a few comments on this subject.

We need better ways of estimating the benefits of proposed programs. Benefits are hard to measure well, especially in the case of new and untried programs. Moreover, I have suggested that benefits are often not adequately expressed by simple mechanical measures of output, like the number of acres reclaimed or number of cases brought to trial. Many important benefits can't be quantified easily—or at all. But numbers can tell us a great deal. Mortality rates, school dropout rates, real income levels, unemployment figures—all these can help us estimate what a proposed program will attempt to accomplish.

Much of the future work leading to the improvement of PPB needs to concentrate on the problems of measuring and analyzing benefits. What should we measure? Which benefits accrue to which people and at what future times—which of these are relevant for a given problem? How can we better handle the mixture of outputs of a program, outputs that are measured in incommensurable terms? I have no quick and easy solution to propose to getting this work done. The only answer I have is a slow and hard one: get as many good people as possible working systematically and continually on the most urgent problems and give them enough time.

We have been discussing the subject of systematic analysis—the elements involved in carrying it out, some of the difficulties involved, and some prospects for future developments. Let us turn now to some of the areas in which we need badly to do better.

Many of our society's most urgent problems are inadquately understood and, therefore, inadquately coped with by us. Despite our nation's wealth, and our willingness to allocate much of this wealth to public purposes, our performance falls far short of what we should be able to attain as the world's most advanced nation in the level of education, technical skills, and administrative competence.

Our shortcomings are of two kinds: one is substantive. It is an inadequate identification, definition, and analysis of important issues of society and of the

alternative choices open to us. These issues usually involve many variables—economic, technical, social—that interact in complicated ways. The other is institutional. Our governments don't make adquate use of the individual talents and organizational skills we possess.

What is needed is more systematic and continuing work on our central concerns, work that is carried out in ways that can help illuminate and improve our social choices.

Out of the long list of social problems that we could discuss here—race, education, poverty, and so on—I choose three as examples of subjects that need deeper analysis: race, public order, and health.

Race: The general situation of the Negro is now recognized to be our key domestic political problem. Most of the others are closely linked to it. Thus the poverty problem is to a considerable extent a Negro one. The U.S. ranks relatively low on a number of indicators of health because of the high incidence of morbidity among Negroes. Urban crime is concentrated in the ghetto slums of our large cities. Negroes also have high rates of mental illness, of alcoholism, and of family break-up. The breakdown of the urban public school has been located disproportionately among Negroes.

The heart of this problem has been located by some observers in the Negro culture, family, and social structure generally. In a real sense, it is comparable to the problems of development in many underdeveloped countries. Both in sections of the "third world" and in the Negro community, there is a self-sustaining negative cycle which preserves elements which are strongly resistant to modernization or social developments. These inhibit their ability to take advantage of opportunities when they occur.

Other observers stress the "low level trap" aspects of Negro life, a life constrained by housing segregation, high unemployment, poor schools, inadequate transportation.

Since the Supreme Court's desegregation decision in 1954, and the growth of the civil rights movement, efforts to improve the situation of the Negro have emphasized an attack on inadequate education through desegregation, Head Start programs, and adult vocational and other forms of education. The results to date pessimistic. Desegregation has failed in a number of ways. Most Negro children do not attend desegregated schools. Integration has been followed by tipping, the fleeing of the whites to private schools or other neighborhoods. It is important to analyze the conditions under which tipping has taken place, to locate those schools which have not tipped and to find out why they have not.

More disastrous, however, has been the inability of Negroes to succeed in integrated schools. The Coleman Report, the most comprehensive study of the effects of integration, suggests that integration may actually have hurt many Negroes, while it helped others. The optimum conditions for improvement seem to be attendance by middle-class Negro youth in predominantly white schools. Inadequately prepared and motivated Negro children placed among whites often do worse. Thus, the problem is pushed towards finding ways of preparing Negro youth to function adequately in good integrated schools.

Headstart also has not proved to be a panacea. Initially, Negro children exposed to intensive educational "therapy" seem to improve in learning capacity and educational motivation. However, when placed in regular public schools, most such children seem to revert downward in ability and motivation.

The third educational suggestion involves upgrading the ghetto schools through pouring in more resources to make Negro schools the best in the country. As yet, for obvious political and financial reasons, little has been done. But there is as yet no evidence that any one school in the country which is primarily Negro does a good job, as measured by the results.

The upshot has been the conclusion that reformers have asked too much of the school system. The school cannot be expected to make up for inadequate cultural background, for a family and neighborhood environment which often negates the values of the school. The Negro family and community, as the Moynihan Report argues, is the crux of the matter. Here too, we find pessimistic research findings.

The larger culture which defines the Negro as inferior, which exposes him to a white dominated world on television, in the press, the movies, the employment structure, also contributes to the negative self image of the Negro.

Although these findings are not beyond question, it seems clear that a program of social experimentation is called for. Various suggestions have been offered:

(1) Provide more jobs. It is being argued that unemployment in the ghettos is much higher than the already high level officially reported. Public work and tax incentives to industry have been proposed. These will be expensive. How

much will they help? If it is too late to change the motivations of Negro adults, it is still necessary to place them in socially respectable roles for humane reasons and to give more stability to the Negro family, to give children fathers they can respect. The one agency which can do this for poor Negroes is the government. Is it possible to find forms of employment for this group which will not be stigmatized?

(2) One possible way to deal with the problem of the Negro community, family, culture, etc., is to create an elite group of integrated boarding schools. Testing the efficacy of such an experiment would, of course, take a number of years. It would be worth looking into the achievements of the small groups of Negro youth who have been attending good private schools during the past few years. The Russians have used boarding schools for war orphans and their experience is worth examining.

(3) We have no real evidence on the ways in which special local schools have succeeded. How well do Negro children do in Catholic parochial schools which have a different sense of discipline and authority structure than other integrated schools?

(4) Incentives—The most readily available incentive is economic. To what extent can behavior and attitudes be changed by economic incentives? If Negro children do badly in school because of a lack of motivation, an understanding of an adequate means—ends relationship between work in school and ultimate payoff if they lack the capacity for deferred gratification, can this be short-cut by paying them for doing well? Can similar techniques work with adolescents and adults? Are adequate jobs with incentive systems in which men are paid more and promoted quickly for conforming to the work ethic enough to break through negative motivations?

We want to know a great deal about the success stories among Negroes. Those children who are doing well in school should be studied intensively, as should successful Negro adults. Are there any communities, schools, religious denominations, members of political groups, who have done much better than others?

David McClelland, the Harvard psychologist, who initiated research in the sources of variation in "achievement motivation" argues that it is possible to change such motivation through courses. Can this be done with lower-class American Negroes? The kind of research we need requires the collaboration of psychologists like McClelland, of sociologists interested in education and social mobility, of sociologists and anthropologists concerned with value systems, of specialists on family structure, of psychiatrists and psychologists interested in personality formation, of students of incentive systems, and the like. Such research should be of different sets of factors on behavior. At the moment, students of the Negro problem cannot supply answers to questions concerning where the government and other agencies should place their resources.

Public Order: The widespread and intense riots of the summer of this year have made public order the most urgent political issue in the country. The surprising intensity and rapid spread of the riots is testimony to the widespread lack of understanding of the attitudes of the Negro community and of the role violence could play in the Negro community.

The President's Advisory Commission on Civil Disorders now is setting about the task of finding out why riots occur in some cities and not in others; why some individuals break the law and others in similar circumstances do not; the effects of police-community relations on the probability of a riot happening or spreading; who takes part in riots; who suffers; what government programs have been most helpful? Although surveys on earlier riots, for example in Watts, give some insights, it will not be easy for the Commission to get answers to these questions, for much of the basic work has not been done.

The riots are an extreme form of deviant behavior that clearly needs better understanding. Even apart from the riots there has been growing public concern about crime. The fact of public concern about crime is incontrovertible; what is less clear is how much crime there is and how to prevent it. With the work of the National Crime Commission we have the beginning of a systematic approach to understanding the causes of crime and ways of reducing it.

It is clear that far too little work has been done in most areas relating to public order, except perhaps in those dealing with purely legal questions, and this lack has been a major handicap in devising strategies to meet the crime problem. Crime and delinquency until very recently were unfashionable stepchildren of the law, sociology, and social sciences. This subject has enjoyed low status and attracted few first-rate people and little research money. To some extent this situation has changed, but the result of several generations of neglect is that there

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are few good workers and only very fragmentary sound work. For example, the Crime Commission Report in 1967 continues to rely on the empirical and observational studies of the Chicago School of the Twenties to show the relationship of the city slum and crime.

Statistical description of the incidence of criminal behavior and of the operation of agencies of justice is generally poor. Economic analysis of the costs of crime and the operation of illicit economies is unavailable. Legal research has tended to view problems in isolation. Rarely have empirical or sociological studies been made of the actual workings of the criminal justice institutions, of their effect on the persons involved, of their success, or of other practical issues. Relatively few studies have drawn on talents from a broad range of disciplines to study criminal problems.

There are two broad classes of questions to be examined. One is the effect of the social environment on the incidence of crime: education, jobs, family structure. This environment is partially susceptible to change and one class of policy issues is the effect of specific changes on crime. The other is the operation of the criminal justice system both in terms of its efficiency and its fairness.

One issue is the definition of crime. This issue becomes clouded when the concept of criminality is used outside the area of violence and to enforce moral or economic order, or to deal with medical problems or administrative violations.

Another is the criminal law process viewed as a decision system, some of it formal and some of it very informal and not readily observable. Thus, law enforcement officers exercise broad discretion—police reaction to events in the street and the decision to arrest; prosecutorial decisions whether to charge, what charge to file, and guilty plea negotiations; judge and jury discretion whether to convict and what sentence to impose; and finally, the many decisions made by correctional authorities in dealing with the convicted offender. How can we measure how the system in fact operates when most cases are disposed of informally? What would be the impact of policy guidance as to how discretion should be exercised and of other checks on the way these decisions are made? How can we better select and train the persons who make such decisions? What kinds of procedures and information can help in making these decisions?

Another aspect is the relationship between public perceptions, particularly the sense of fear and insecurity and the attitude toward offenders, and the reality of crime. Consider the effects of these public perceptions on the quality of social life in the city, upon the definitions of crime, upon tolerable methods for dealing with offenders, and upon the opportunities that are available for the reintegration of offenders into society. Consider the effect of the perceived high incidence of violent crime on the flight from the inner city. How can a community be led to accept the presence of a halfway house or a center for treating addicts in its nighborhood? How can the public be encouraged to employ persons with police records?

The economics of crime. What does the nation spend on security, including law enforcement agencies, private policing, locks and alarms, and insurance? What is the loss from theft, bodily injury? Consider the role of insurance companies and their capacity to distribute the costs of crime as well as to encourage adequate security by property owners. What is the place of deviant systems (e.g., professional crime, the fencing of stolen goods, employee theft, shoplifting, commercial fraud) in the nation's total economic structure? Consider the collateral economic effects of crime on small business, movement to the suburbs, and its impact on the economic squeeze on big city governments.

There are other questions including the applications of technology to public order, but this list should suffice to indicate some of the analytic needs.

Health: As individuals and as governments, we have been devoting increasing energies, concern, and resources to the attainment of good health. Because health care has been equated largely to medical care, the greatest emphasis has been on improving medical care.

In recent years there has been a remarkable rise in national expenditures on health care services and supplies from $17 billion in 1955 to $37 billion in 1965. If these trends continue, health care services in 1975 will account for 7 percent of our total national production—implying a national health care budget of around $90 billion.

The nation has purchased far less than one would expect with these resources. As measured by the only index of health for which reliable statistics exist, and one of the major objectives of improved care, life expectancy, there has been a barely perceptible improvement in the last decade. Nor have we reached an "upper limit" of life expectancy. Among countries for which good statistics are available, the United States ranks thirty-seventh on the basis of remaining lifetime for men

at age 40 and at age 10 the life expectancy of males is 4.5 years less than that of those in the leading country (Norway).

This experience raises the question of whether our emphasis on medical care as the principal means to improved health is appropriate. A major policy issue is whether there are more productive ways to increase health levels than simply by increasing the inputs of medical care. Answering this question will require research to provide a better understanding of the relationships to health of nutrition, environment, occupational factors, etc.

In any case, medical care will continue to be the largest and most important component of the health budget. And the need for improvement in the medical care system is apparent. The present system has overburdened practitioners who cannot spend sufficient time with their patients; physicians whose actual medical practice deviates significantly from current best practice; patients treated in a hospital when they could equally well be treated on an outpatient basis; hospitals whose high costs are not justified by the extent or effectiveness of the services they provide; persons with serious medical conditions who cannot gain good access to medical care. These problems are increasing rather than diminishing as medicine grows in complexity, physician-specialization becomes dominant, and hospital insurance covers an increasingly large number of people.

It is quite clear that the traditional patterns of medical practice and hospital organization are becoming increasingly obsolescent. But these traditions are so deeply embedded in our society that they will not be changed until the cost of this obsolescence is irrefutably documented. Such documentation should be a major objective of a research program, since the fragmentary evidence now available indicates that the cost in terms of dollars and lives is high: Studies have found wide variations in the quality of medical practice conducted both inside and outside of hospitals and in the costs of care provided. Studies of hospitalization rates for Federal employees indicate that perhaps as many as one-third of the hospitalizations paid for the Blue Cross-Blue Shield were not medically justified.

Still another major problem area relates to the provision of care to the poor. The federally supported Medicaid program is one approach to solving this problem, but many barriers other than finances impede the access of the indigents to good medical care. The problem is to devise new programs and policies that will move us in the right direction—and will do so within the constraints imposed by the nature and history of our health institutions and professions.

These comments are made by way of example, to suggest a longer list of areas of social concern that are in need of concentrated work.

In all of these areas the problem is not so much lack of knowledge as lack of knowledge relevant to policy; not so much lack of technique, as lack of technique for analyzing policy questions; and not so much lack of skills, as lack of skilled people working together on these problems. What must be found is some way to harness our knowledge of social processes, to sharpen our process of analysis, and to involve and train good people in methods of structuring and solving complex policy questions.

These problem areas are, in large part, the concerns of government at all levels. But they lack the means for tackling these problems effectively. At the Federal level few Departments have an analytic capacity of any consequence. They generally lack the ability to identify problems with precision, see that relevant data are collected, policy alternatives formulated, valid experiments run, existing programs evaluated. Even the simplest fact, such as finding out how many able-bodied males in this country are supported by welfare, has taken many months for a high official to acquire. Straightforward data on health care, education, ghetto jobs, housing are often inadequate. The more complex question, "What is really being accomplished by these programs?" is rarely addressed in depth.

As the current hearings of this Subcommittee show, actions have been taken by the President within the past two years to introduce more systematic methods of analysis of objectives and programs throughout the Federal Government. I suspect that the hearings will also show that while progress has been made in some agencies, little has happened in many. The future will undoubtedly see an improvement in the performance of government agencies in conducting systematic analysis.

Finally a question of great importance is the extent to which the Congress has available to it the data and analyses it needs in order to discharge its responsibilities. Most of what it needs it should be able to get from Government agencies. But a good case can be made for the Congress having available to it an improved analytic capability of its own. How this might be provided is a matter on which I am not prepared to comment. It does seem to be a suitable subject for investigation by the Congress.

Chairman PROXMIRE. Mr. Haldi?

STATEMENT OF JOHN HALDI, FORMER CHIEF, PROGRAM EVALUATION STAFF, BUREAU OF THE BUDGET

Mr. HALDI. Thank you, Mr. Chairman.

I would like to summarize briefly my rather extensive statement so as to leave more time for discussion. I think that will be more fruitful.

Chairman PROXMIRE. Yes, I might say, of course, that Mr. Rowen's statement will be printed in full in the record, and so will yours.

Mr. HALDI. I would like to cover briefly two other aspects of PPB. The first one, frequently overlooked, is that PPB is far more than just ad hoc analyses of problems. Under PPB analysis is carried out within a structural program framework with which you are probably already familiar.

But to review briefly, all agencies are now required to have what is called a program and financial plan (PFP). Details for this are spelled out in Bureau of the Budget Bulletin 68–2 and Circular A–11. Since each agency is required to have, as soon as possible, accounting backup for its program and financial plan, full implementation in an agency will require a good deal of work. But if properly constructed and properly monitored, the PFP can be a valuable management tool. The existence of PFP's has also resulted in a lot of discussion, both in various committees and outside of the Congress, concerning the budget structure and the possibility of changing from the existing appropriations structure to a program-oriented budget structure. I personally think that this is a matter to which the Congress should give a considerable amount of consideration, after the present program structures have been experimented with and have been perfected more than they are at the present time.

Along this line, I believe the Defense Department proposed this year that their appropriations structure be changed, but it was rejected by the Congress. As PPB evolves and develops, however, the possibilities and opportunities for using the program budget structure and the program framework—both as a way of making appropriations and as a way of reviewing the entire agency—ought to be given serious consideration by the Congress.

This emphasis on programs which the program structure and the PFP bring to a head, is a rather valuable management aid, I believe, in the sense that it brings together the efforts of a number of diverse people in an agency—the accountants, the financial controllers, the budget officer, the statistical data gathering people, and the analysts—and it enables them to focus all of their efforts on the agency's programs.

As PPB was implemented in each agency, we first defined its programs. Then, after adopting a program structure, we asked: What data do we now have to get program reports? What data are available on program outputs? What data are available on program costs?

From such fundamental questions we often found considerable weaknesses in an agency's entire data gathering system. Consequently, this effort has been a very healthy influence, I believe, in getting more and better information gathered systematically around well-defined programs; that is, programs which have a common thread, or a common meaning.

Moreover, the idea of using these program structures and conducting systematic budget reviews by programs has a lot of merit and I think the procedure should also be considered by Congress as well as by the executive branch.

As each agency has put together its program budget and looked at its activities from the viewpoint of what the entire agency has been doing, I think that in some cases agencies themselves have been surprised to find a number of diverse bureaus engaging in similar activities. For example, I believe someone in the Department of Interior said they have nine different bureaus concerned with estuaries. And estuaries, of course, represent a relatively small problem area in the context of the whole Interior Department.

I think it is fair to say that this is the first time that the Interior Department has looked at what might be called the estuary problem as a departmental problem.

Conducting similar program reviews in Congress and asking agencies what they are doing in a program area, what other agencies are engaged in the same program area, and how their efforts relate, overlap, or duplicate, and what gaps are perhaps not being filled, would be a healthy way to look at the many programs and activities carried on by Government agencies and bureaus. So I suggest that Congress consider conducting some reviews, perhaps on a trial or sample basis, by program area instead of by the agency-bureau-appropriation-account approach generally followed now.

The role of analysis, which is talked about so frequently, is the second aspect of PPB that I'd like to talk about. I put it last not because it is less important. In fact, I believe it is most important. I think that in the analytic process there is a definite role for Congress which I shall try and describe. In my prepared statement I have distinguished, for purposes of discussion, two roles for analysis. One is the study of new programs and the other is the evaluation of existing programs. The latter is a sort of systematic, critical, analytic approach to finding out what programs are doing, what their objectives are, the extent to which they are achieving their objectives, what program information is available—and what information is not available but could be made available through better information gathering efforts—and finally putting together a sort of analytic picture of the program as it currently exists. This is one important role for analysis.

We have tried a few sample program evaluations, and they have been proven extremely valuable. Such analysis, if done critically, but fairly and without bias, can act as a sort of discipline on the agency. It can be compared in many ways to the discipline that competition forces on private business firms. This discipline is characterized by the recurring critical review of operating results. Business managers are regulary forced to sit down and take stock—particularly if things go bad—because the system provides regular feedback on whether each program or product is performing badly, mediocre, or well. To reiterate, it is of course competition which forces firms regularly to sit back and reappraise their whole effort. This discipline is frequently lacking in the administration and management of Government programs. Consequently, it is not always easy to get agencies to take a really critical analytic look at their various programs.

My own personal view is that the process would work better if Congress had available to it an analytic capability that could first,

carry out at least some investigations; second, act as a prod on the agencies to be more critical in their own self-examinations and third, finally, appraise the technical aspects of analyses prepared by the agencies. In my opinion nothing would help the whole PPB effort more, or have a more healthy influence than for Congress to have available to it a sizable staff of qualified analysts.

Just how big such a staff should be, or where the staff should be housed or placed, or how it should be set up, I am not qualified to say. I leave that to people much more experienced in the ways of Congress than myself. But my opinion, in just a rough order of magnitude is that the General Accounting Office has about 4,500 employees, of which about 2,500 can be classed as professional employees, and I estimate that somewhere between 5 and 10 percent of the size of the GAO would be adequate for the analytic effort needed.

Chairman PROXMIRE. How many people is that?

Mr. HALDI. Well, 5 to 10 percent would mean a minimum staff of about 120 professional people available to the entire Congress, or a staff of maybe 200 to 225, including the professional and support staff. As you can see, I am thinking of numbers considerably larger than an individual congressional committee has available to it through its regular committee staff, although I am not thinking of any large organization the size of the GAO.

This is not a large staff when you consider that one, the Government spends $135 billion a year, which represents a lot of resources, and, two, the Government itself manages a great number of programs. The Government does make a lot of grants and have a number of loan programs which depend upon the various recipients to accomplish some end result but the Government directly manages a great variety of services and programs. It manages the Forest Service, for example; one-fourth of all the timber produced in the United States originates in the national forests. It manages the whole air space control system through the FAA. It makes charts and maps through the Geological Survey and Coast and Geodetic Survey. I needn't go on. The Government runs all kinds of programs. It alone hires or selects the people who run the programs. It carries out the programs. And the end results represent the efforts of Government agencies. In these programs no State or loan recipient, or other organization intervenes in accomplishing program objectives. Such Government-operated programs amount to billions of dollars annually.

I am suggesting that a good analytic effort would provide useful and worthwhile monitoring of Government-managed programs. It would probably also provide a sort of discipline on the agencies. I have in mind a type of analytic effort and a type of discipline that one simply does not get at through accounting audits. There is nothing wrong with accounting audits, let me be clear about that. It is just that accounting audits are not designed as an analytic appraisal of the stated program objectives or the statistical results pertinent to the accomplishment of these objectives. These are things that accounting audits are not designed to go into. They never have been, and I doubt if they ever will be.

The other area of analysis which is equally important, perhaps even more important, is the area that Mr. Rowen spoke of and covered

in more detail in his prepared statement: the analysis of new programs, or the analysis of basic issues to which we have just begun to address ourselves to. If you consider a period as long as the next 20 years, with the country growing the way it is, a considerable number of new programs will certainly evolve, as they seem to do each year.

A good analytical effort on these problems, as we turn to face them, is going to have a lot of initiative in shaping the sort of legislative proposals which cannot be ignored. It is going to give initiative to whoever has analytic capability available. Proposals emanating from such sources will be better thought out, and will have been subjected to criticism, and will have fewer loopholes. They will not be perfect, to be sure. But solid thinking by a number of bright people about program proposals can oftentimes go a long way toward anticipating difficulties and filtering these out.

This is another reason why the Congress should consider having directly available to it its own staff of trained and experienced analysts rather than having to rely almost exclusively on the analytic efforts which come out of the executive agencies.

Now, we often get analyses carried on in the private sector, in the universities, or by nonprofit research corporations. And a lot of good work that comes out of this particularly basic fundamental work. But we need the type of analysis which is pointed 100 percent toward possible Government programs.

The trouble with a lot of academic research is it doesn't really sift and filter program proposals. They don't carefully cost out all of the implications of a program proposal, as there is not much academic reward for this. Academic publications are not interested in fully costed-out proposals. Oftentimes academics are simply not qualified to cost out all the aspects of their proposals. So academic work is oftentimes of a more fundamental nature.

I think that when you start shaping specific programs, or writing basic legislation which is fundamental in the way it shapes programs, then you need a small group of well-trained analysts who can help examine and criticize the pros and cons, or the good and bad aspects of various program proposals. This is what you might call applied analysis. Sometimes it is available from outside the Government. But all too frequently this type of analysis is not available. I suppose in the very big issues it is almost always available. But there are a great number of issues which are not that big, which don't make headlines, and for which such analysis is not available anywhere. In the aggregate, the smaller programs are quite important.

So I suggest that Congress consider the possibility of having its own analytic staff and using their staff as a spur to get better work from the agencies themselves.

(The prepared statement of Mr. Haldi is as follows:)

PREPARED STATEMENT OF JOHN HALDI

Mr. Chairman and Members of the Committee, it should be made explicit at the outset that virtually none of the individual "components" of the Planning-Programming-Budgeting (PPB) system are "new." For a number of years AEC and NASA have had program budgets,and their congressional appropriations have also been made along program lines. We know from experience with these agencies that the program budgeting aspect of PPB will work, provided we want to make it work. Moreover, the financial-statistical reporting systems of some agencies are much better than of other agencies. Not a little of the work associated with PPB

involves trying to get many Government agencies to adopt practices which are standard in the few "best" agencies. If PPB were as new and untried as is sometimes contended, it would be imprudent for the President and the Bureau of the Budget to have all agencies adopt it without experiment. However, this is definitely not the case, and there is no reason to wait for several more years of experimentation with techniques that we already know to be useful.

On the basis of the experience gained through my personal involvement with the installation of PPB in the Government, I would like today to discuss what I consider to be the four most important points pertinent to the future development of the PPB system. Briefly, these are:

First, the PPB system should become a valuable aid for managerial control as well as for management decision-making; when fully developed, it is meant to be a complete system designed to help executives do a more effective job in managing their agencies or bureaus.

Second, given time to develop, the PPB system should produce more and better program information for Congress as well as for the executive branch.

Third, systematic program analysis will play two important roles in the PPB system:

Evaluation of existing, ongoing programs; and

Appraisal and development of new proposals.

Fourth, systematic program analysis, especially analysis of new programs and basic changes in existing programs, should and will become an increasingly valuable tool of Government decision-makers. As the capacity for good applied analysis develops, it will carry with it a considerable amount of initiative in both the legislative and budgetary processes.

Although full implementation of PPB throughout the Government is proceeding somewhat more slowly than I and others had hoped, we now have enough experience to see that the potential originally envisioned exists for all agencies. In fact, those agencies which are making the least progress with PPB probably have the most to gain from it. It should be understood that even today some of the details of PPB are not fully worked out; the total system is improving and evolving as we gain experience and learn from our mistakes. But as PPB continues to take root, it should play an increasingly important role in the budget process. Consequently, PPB should become increasingly important to Congress. Preparation for this hearing has forced me to collect my thoughts on the future and the potential congressional role more than in the past. There are several recommendations which the Joint Economic Committee and the Congress ought to consider. Briefly, they are:

First, Congress should consider adopting program budget structures for appropriations;

Second, Congress should consider holding budget hearings along program lines rather than strictly along bureau and appropriation lines;

Third, Congress should press agencies to develop better program control systems, with better information and better reports flowing to Congress;

Fourth, the Joint Economic Committee should consider holding hearings on the subject of national goals and objectives;

Fifth, Congress should create its own analytic staff which will be directly responsive to its own needs and which will act as a check on the quality of the analysis done by agencies; and

Sixth, Congress should become an important consumer of program analysis; competition in analysis should be encouraged and when differences emerge, as they almost invariably will, they should be aired before congressional committees.

Needless to say, these changes should be made judiciously, in some gradual fashion. For example, it is possible to start by having just one department present two budgets, one in PPB format and one in the customary appropriation, line-item format. When enough experience has been gained with the PPB format so that the two are equally familiar, the two can then be compared on their merits. Similarly, it is possible to take one program area, and have each agency concerned with this area list its objectives, show what it is doing to achieve its stated objectives, and say how it thinks its efforts relate to those of other concerned agencies. The sample program area chosen for such an experiment could be large, such as "Health," or it could be smaller and somewhat more restricted, such as "Estuaries." [1]

[1] The Interior Department admits to having more than five different bureaus concerned in one way or another with estuaries. Agriculture, the Corps of Engineers and perhaps other agencies are probably also concerned with some aspect of esturaries.

Summing up my views about Congress and PPB:

Congress need have nothing to fear from adoption of the PPB system;

Congress should participate fully and demand that the PPB system be developed to the maximum extent possible; and

Congressional "participation" in PPB, to whatever extent it does materialize, should act as a healthy stimulant to development in the executive branch.

PPB Should Become a Valuable Aid for Managerial Control as Well as for Decisionmaking

The two primary goals of the PPB system are, in essence:

First, to help give the taxpayer the right Government programs; and

Second, to give him more from those programs—that is, more quantity or more quality of whatever the programs produce—for each dollar of taxes spent.

The Congress has often indicated its agreement with these general goals. But how can the PPB system achieve them? This is a fair question to ask, and the answer is: *By better management of Government programs.*

As used here, the term *management* is meant to be interpreted broadly. It includes, but goes far beyond, high-level decision-making. Our real interest lies in the end results achieved by our programs. Overall management and implementation are therefore important because, if the organization persists in carrying out badly all policies, decisions and strategies devised by top management, then even the best analysis and decisions will be somewhat thwarted. The PPB system has a great deal of potential for improving what might be called "managerial control"—the functions of budgeting, controlling, accounting, and information feedback—which affects considerably the way programs are executed. This potential tends to be frequently overlooked, however, as discussions about PPB often seem to narrow quickly to a debate over the role of analysis in governmental decisionmaking.

In any large organization, including Government agencies, the total management picture is a composite of the efforts of—

Executive management;

Line management; and

Staff:

- Budget officers;
- Financial managers;
- Information managers; and
- Planning groups.

Adoption of a program budget, which is one of the first steps in the installation of a PPB system, emphasizes the agency's major programs for reaching our national goals, such as Child Health Care, Crime Prevention, Outdoor Recreation, or Education for the Underprivileged. This emphasis on programs is important—more important than it may at first seem—because it provides a common ground for uniting and integrating the efforts of those who are trying, each in their own individual way, to contribute to better management. A common linkage via programs can greatly enhance the overall effectiveness of these complementary groups.[2] But, do not blow up this importance out of context, either. Let us all be clear that adoption of a program budget will not, by itself, result in any significant program changes. The definition of a program structure may be *necessary,* but is certainly *not sufficient* for achieving the desired end result—better design and execution of programs.

Thus a total PPB system should be viewed a tool, a device, a means, a system, or whatever you like to call it, for helping Government executives do a better job. In no sense does it replace either management or the decisionmaking function. Given time, as PPB develops into a complete system, it will offer the top executives of an agency:

Better program information and reports, including:

Better financial information;

Better statistical information; and

More integration of financial and statistical information.

[2] The emphasis on "programs" by a Government agency is analogous in many ways to the emphasis given "product lines" by many private firms. Thus program budgeting, program accounting, and program reporting are similar in many respects to product-line budgeting, product-line accounting, and product-line reporting, all of which are standard practices among many of our biggest and best managed corporations. PPB can be viewed simply as an attempt to get Government agencies to adopt the best management practices of our time.

Better methods of displaying comprehensively the program decisions which they make, including:

Estimates of program costs *and* program outputs; and

Making visible future implications of current decisions.

Better analyses of complex issues requiring top-level decisions and direction.

The relationship of these various components is shown somewhat more specifically in Figure 1, which indicates how the annual planning-programming-budgeting cycle should work in large Government agencies when the system is fully developed. As expected, the emphasis throughout Figure 1 is on programs. Moreover, although it is not clearly indicated in Figure 1, program evaluation and cost analysis are permanent, ongoing functions at all times, with information feedback and followup also on a recurrent basis. The view taken here, then, is that in its fully developed state PPB will become a *complete decision-making and control system* which includes analysis (systematic analysis, cost-effectiveness analysis, etc.), but it will be more than just analysis.

Proper installation of a complete PPB system in an agency will also help integrate the entire planning-budgeting progress reporting system in a much more meaningful way than has been achieved to date.[3] The purpose of this integration, of course, is to insure that (a) decisions to initiate or continue programs are based on meaningful evaluations of their costs and benefits, (b) the implications of program operations and costs in future years are considered along with annual budgets, and (c) provision is made for periodic reevaluation of programs in quantitative terms that can be compared with the stated program objectives.

Were it true that PPB is just analysis of selected issues, and no more, then PPB would not deserve to be labeled "A System." Moreover, there would have been no need for the Bureau of the Budget to require an investment of valuable time and resources by each agency to—

Define a program structure;

Define wherever possible measurable "outputs" for each element in the program structure;

See that good statistical data exists on these outputs;

Develop a multi-year Program and Financial Plan (PFP);

Display estimates of financial requirements *and* outputs for each program element for several years beyond the upcoming budget year;

Promulgate program change procedures,

Update and maintain the PFP on a current basis; and

Develop accounting backup and progress reporting support for the program structure adopted.

In short, a complete PPB approach is systematic in its treatment of each of these basic management functions:

Defining objectives;

Evaluating alternatives;

Developing plans; and

Maintaining control.

Obviously all of these functions have been performed in the past with varying degrees of success. The unique contribution of PPBS is welding these together n a consistent management framework.

For PPB to achieve its full potential as a management system will require a number of changes from the existing mode of operations. The Bureau of the Budget, for example, will need to—

First, require all budget submissions, including justification and backup material, to be submitted in program terms;

Second, conduct all budget reviews along program lines; and

Third, make its program decisions on the basis of the program submission and in terms of the program budget.

FIGURE 1. THE ANNUAL PPB CYCLE IN A LARGE GOVERNMENT AGENCY

1. Do program analysis—
   Evaluate existing programs (use progress reports—see step 5 below);
   Study new program proposals and alternatives; and
   Do analysis on a permanent, full-time, continuing basis.
2. Agency management makes program recommendations or decisions:
   Use studies from program evaluation and analysis (see step 1 above); and
   Obtain approval from Bureau of the Budget, the President, and Congress.

[3] A great deal of effort and cooperation from the people responsible for these functions is also required.

3. Give budget allotments and directions to the "field organization"—both in program terms.

4. Programs are implemented by the field organization:

Each installation or "center" should have financial responsibility for its activities;

Each center should be charged for all resources which it uses; and

The "system" should give field managers personal motivation to do the right thing.

5. Progress reports (monthly or quarterly, say) on program performance flowback from the field organization:

Program costs;

Program outputs; and

Actual and planned program performance compared

6. Corrective top management action as necessary.

7. Agency management makes major program recommendations or decisions for the next year (that is, the budget cycle begins; evaluation and analysis is on a continuing basis).

The Bureau of the Budget is moving more in this direction each year. Congress, too, has an important role to play. At a minimum, it should consider—

First, using the program budget structures for appropriations (after we have had another one to two years' experience with them); and

Second, conducting at least some of its hearings along program lines rather than strictly along bureau and appropriation account lines.

Since more than one agency or bureau is involved in many of our programs—major programs like health care, education, poverty or crime; and less major programs like outdoor recreation, estuaries, or water pollution—a systematic program approach should give congressional committees a much better perspective for considering appropriations requests. Undesirable duplication and overlap are more easily revealed in this way. Also, where agencies are involved in similar programs but, say, in different regions or areas, their performance can be more easily compared and they can be made to "compete" with one another in terms of vying to provide more value of output for each dollar of appropriations. In my opinion, this type of competition among Government agencies would be just as healthy a stimulant as is competition in the private sector of our economy.

PPB Should Produce Better Program Information

It was previously stated that a complete PPB system should lead to a substantial increase in more useful program information. I would like now to elaborate on this point.

I believe it is fair to say that in a number of Government agencies, perhaps most, financial records and statistical data are *not* now kept in ways that enable them to be brought together to assess the need for their programs, the results of their programs, or full program costs. This sort of information may seem rather basic, but when available such data are usually recorded separately and in non-comparable ways.

Often this sort of information is simply not available. Initiation of the PPB system, with its focus on "programs," has revealed extensive deficiencies in the data base of a number of agencies. For example, it would not be unusual to find financial records kept by appropriation account and by object class, with no explicit attempt to develop good program cost data at the field level (unless, when by purely fortuitous circumstances, appropriation and program accounts coincided). Moreover, in those agencies which do keep program cost records in field offices, it would not be unusual to find financial records collected along lines of the agency's districts and regions, whereas statistical information pertaining to the agency's programs may be recorded by county, along State lines, by standard metropolitan areas, or in some other way not at all consistent with the financial data which is available.

It may seem somewhat ironical that those Government agencies which spend much time recording and collecting statistical data cannot assemble consistent program information (costs related to other relevant measures) because the data are not in a useful form. However, this is a problem even in our more sophisticated agencies.

Other agencies have not had to worry about *comparability* because they simply lacked basic data. They have therefore had to start systematically collecting data rather than straightening out what they already had. The Bureau of Indian Affairs, for example, is now in the process of more accurately determining the

number and economic characteristics of Indians living on the reservations; that is, BIA is taking a detailed census, reservation by reservation, for the first time.

Critics of PPB sometimes convey the impression that its practitioners are trying to put numbers on those intangible or imponderable elements which cannot be quantified, and which it is misleading to try and quantify. We are so far removed from this sort of thing, however, that such criticisms scarcely warrant response. As the example from the Bureau of Indian Affairs illustrates, initiation of the PPB system has encouraged agencies to do such fundamental things as count and describe their clientele groups and make a population forecast. Some professors have at times been surprised to discover that accurate population data were lacking for many foreign nations, and yet we are discovering similar "gaps" here at home.

It will take time to develop the data and the type of reports which a good PPB system should produce, but, as they evolve, such reports should be valuable aids to identification of program weaknesses and areas that can be improved. They should help managers at all levels do a better job and become more productive.

From the outset, it should be recognized that better information on program costs and outputs has important potential as a worthwhile control device. In time, such information should become an important supplement to the present controls on travel, personnel ceilings, vehicles, etc. Cost-output information will probably *not* replace these existing controls for some time to come, although conceivably it could.

The present system of controlling in some detail *inputs* or *object classes* without paying systematic attention to program *outputs* can lead to undesirable economic consequences. The present system does not provide a balanced picture. Even if tight controls on inputs do force agencies to carry on their activities at minimum cost,[4] agencies are never forced to ask themselves whether they are pursuing the right activities, or the right *mix* of activities. Yet this is really a much more important question to ask. One of the ultimate paradoxes from our present approach usually occurs when Congress accuses an agency of not asking for sufficient money because some aspect of one of its programs is, by general agreement, lagging. It is quite possible, when this situation arises, that general priorities have shifted, but that the agency has not shifted its programs accordingly. The agency may be spending money elsewhere with virtually no results, or with relatively little effectiveness, and the resources represented by this money could, in theory at least, be transferred to the lagging part of the program. In fact, in this light the agency may already have too much money, rather than too little. But if tradition, political processes, or some other reason causes us to be absolutely wedded to the inefficient or inconsequential part of our programs, along with the more efficient and more important part, and if this *mix* cannot be changed, then of course the paradox is explained. The only way to get more of the desired result is by spending more total money, and of course the agency should have asked for more.

THE ROLE OF ANALYSIS IN PPB

Probably the most important component of the PPB system, the most difficult to initiate, and the most difficult part to gain acceptance of in the Government, is systematic analysis of Government programs. Unfortunately, the application of analysis to Government programs has become somewhat controversial and because of this I would like to define briefly what I mean and what I think others associated with PPB mean by *systematic analysis*.

Systematic analysis is often associated with quantitative analysis. However, it is by *no* means coextensive with quantitative analysis. The word "analyze" does not have the same meaning as the words "quantify" or "measure," although analysis often includes measurement. Let us be more specific and examine the steps involved in a good systematic analysis of a Government program.

First, the analysis should start by *defining program objectives*. "Objectives" include statements about—

What the program is trying to accomplish;

How the planned program accomplishments fit in with what other Government agencies or private business firms are doing in the same area;

Who the program aims to reach—that is, the target group or clientele group of the program.

[4] Congressional controls on *inputs* usually do *not* achieve this result. And, moreover, the more individual inputs that are controlled, the more likely are we to get *less* economic efficiency.

Statements of program objectives should be made after analyzing the relevant laws, congressional resolutions, and Presidential commitments. These usually embody somewhat broad and abstract statements of general goals, such as "Improve the health of American Indians on Reservations" or "Make American Indians as healthy as the general population," and proceed to somewhat more precise objectives, such as "Reduce infant mortality on Indian Reservations to the same rate that occurs in the general population by, say, 1972." Once formulated from a "legal" background, program objectives need to be examined very carefully to make sure that they are acceptable—politically acceptable, economically acceptable, technologically feasible, acceptable to common sense, and so on.[5]

Formulation of a good, consistent set of program objectives is not nearly so easy as it may appear. It requires a considerable amount of hard thought process, and there are a number of pitfalls to beware of. But these details are not of concern here. One other point worth mentioning, though, is that computers and mathematical models are definitely *not* required in the formulation of program objectives. What is required is an attempt to be as precise as possible about what programs are doing, or what they are supposed to be doing, and not stop short and be content with statements like "Supply a little bit to every citizen who needs it." or "Assist underprivileged groups," or "improve national prestige."

Statements of our national goals are clearly a vital part of the process of systemmatic analysis. If formulated too broadly, like "A better life for all citizens," they are not meaningful guides to the hard program choices and decisions which must be made each year. If formulated too narrowly, however, like "Build concrete freeways" (instead of a broader transportation objective), they will overly restrict meaningful choices. Because of the importance of having good, rather precise statements of our national goals, the Joint Economic Committee should give serious consideration to holding hearings on the subject. This is one area of PPB where congressional leadership should definitely be provided.

Second, after an acceptable set of program objectives have been set down, alternative means of reaching these objectives should be identified. To return to the example from the Bureau of Indian Affairs, if one immediate objective for Indian health is reduction of infant mortality, there are obviously several alternative programs which will help to accomplish this:

Prenatal care programs;
Postnatal care programs;
Training of subprofessional medical personnel; and
Building of clinics.

Just to start the analysis. A most important aspect of this part of systematic analysis is to search *imaginatively* for better alternative means of accomplishing program objectives. To search *imaginatively* one must be *critical.* That is, one must examine sharply the existing way of doing things, with an open mind. The person who is to analyze *cannot* be dedicated to the existing way of doing things. Identification with existing programs almost inevitably leads to little more than defensiveness and rationalizations for the existing state of affairs. Moreover, *creative program alternatives* do *not* come from computers or mathematical models. They come from creative individuals, 100 percent of the time.

Third, the alternatives which result from the search process need to be screened and weighed against one another, in terms of cost and in terms of the extent to which they contribute to achieving the program objectives. This is the step that has often been referred to as "cost-effectiveness analysis." This, of course, is what any rational person does when he makes a major personal expenditure decision, such as buying a house or a car. And it has been done by men for literally thousands of years. However, objections to such analysis are raised on a variety of grounds:

Computers are said to be replacing "judgment";
Intangibles are said to be omitted from the calculation;
It is sometimes claimed that there are attempts to quantify the nonquantifiable; or
Costs are said to be given too much emphasis.

[5] Government agencies customarily have a rather difficult time stating their program objectives with any sort of reasonable precision. Whether they realize it or not, however, existing programs always contain certain "objectives" implictly. For example, whom is the program reaching and whom is it not reaching What is the program accomplishing and what is it not accomplishing? When put down in black and white the answers to these questions may not be what one would like to see, but nevertheless these facts exist for every program. Systematic analysis is merely a discipline that brings one face-to-face with hard and unpleasant issues like these. In a *partial* way, good systematic analysis can help impose on Government managers a helpful discipline which is similar to that imposed on businessmen by the forces of competition.

Quite frankly, Mr. Chairman, these kinds of criticisms—however sincere—reflect a complete lack of understanding. Sometimes they simply reflect chagrin that particular pet projects do not show up well under the light of cost-effectiveness analysis. For, if you remove the cost aspect from cost-effectiveness analysis, then you are left with "effectiveness at any price whatsoever." And this is scarcely an acceptable approach to decision-making. Suppose you were buying a house. There are many intangibles which must be considered: the quality of the school system, the friendliness of the neighbors, playmates for your children, etc. Still, you don't buy a house without also considering such measurable factors as the price of the house, or the distance, time and cost to get to work.

It would be uncandid of me to claim that *all* cost-effectiveness studies were perfect or even represent good analysis. Programs are complex, cost estimates that must extend over many years are subject to a considerable amount of uncertainty, analysts are human, and to be human is to err. All analyses should be subject to careful review and criticism. But it is one thing to attack a specific study as being incomplete, and quite another to denigrate a whole approach just because conclusions differ.

Good systematic analysis does not replace the decision-maker, but is an aid to him. When confronted by complex issues, diverse opinions, and alternative ways to go, it helps him zero in on his final decision by—

Uncovering irrelevant issues;

Pinpointing crucial assumptions and facts which underlie alternative recommendations; and

Tracing out the knowable consequences and costs of each alternative.

Then with the best possible knowledge of what is knowable and quantifiable about the decision, he can use informed judgment and experience to take into account the intangible and unquantified aspects of the problem.

Systematic analysis of Government programs does not represent some brand new set of intellectual tools developed by the Department of Defense or the Bureau of the Budget, but rather it is an amalgamation of the skills and disciplines that are constantly evolving and improving in many fields:

Mathematics and statistics;

Economics;

Operations research;

Management science; and

Computer technology.

Along with others. Perhaps it is worth noting that every one of these topics is now *required* subject matter in virtually *every* Graduate School of Business in the United States. To say that systematic analysis is "wrong" is to say that, first, all the researchers and teachers in these fields are "wrong," and, second, decisions should be made almost "at random," without the benefit of available knowledge.

Let us now return to the role of analysis. For the sake of this discussion, it will be useful to consider the areas where analysis can be useful in two categories:

1. Evaluation of existing, ongoing programs.
2. Study of new proposals—either new programs or changes in existing programs.

PROGRAM EVALUATION

Government programs take a number of different forms, but to narrow the discussion let us distinguish between grant programs and Government administered programs By this classification I mean to include under "Government administered programs" all programs which do not make grants or loans. In other words, I am talking about programs where Government agencies have considerable room for managerial initiative, because they do indeed manage the program. In the civilian area such programs account annually for tens of billions of dollars of expenditure. These programs include a wide variety of activities, such as—

Operate the world's largest hospital system and provide care for several hundred thousands of patients annually (VA);

Operate the world's largest postal system;

Maintain and regulate the Nation's air space by planning, installing and operating air traffic control towers, instrument landing systems, radar and a host of other aids to air navigation (DOT);

Make and sell geologic charts of the entire United States (Interior) as well as charts of all territorial waters surrounding the United States (Commerce);

Grow and cut one-fourth of all commercial timber in the United States (Agriculture);

Plan, develop, and operate outdoor recreational areas for millions of people;
Plan, research and build spacecraft (NASA) and nuclear reactors (AEC);
Train the underprivileged (OEO and other agencies).

It seems a virtual certainty that not only will the Government continue to operate and manage such programs, but in the future their number and scope may well expand. To narrow the discussion, let us focus attention on the role of analysis in evaluating these Government administered programs.

It is fundamental, of course, that Government programs need to be well managed, and that the money and resources appropriated to these need to be guided by correct decisions. Annually, thousands upon thousands of decisions need to be made, such as—

When and where to build new airport towers?
What maps to make?
What timber to cut?

Briefly stated, my arguments linking analysis to systematic evaluation of these decisions are:

1. Many decisions are governed in large part by *criteria* found in agency manuals.
2. These criteria are usually technical in nature, and Congress delegates to agencies authority to establish and change most of these criteria.
3. Bureaucratic agencies characteristically display a deep-rooted *bias*, which might be termed a "professional" bias, a "fundamentalist" bias, or a "program advocate's" bias. This bias is pervasive and predictable.
4. The ultimate effect of these biases is to spend money on projects which are frequently not effective and are not necessary.
5. The loser when this occurs is the taxpayer.
6. In a governmental system built on checks and balances, we currently have no check or counterbalance to argue the case for the general taxpayer.
7. Systematic analysis, originating in the right places, can provide a highly desirable counterbalance to the existing biases.
8. Congress should originate or at least evaluate critically such analysis.

Criteria governing expenditures.—The criteria, rules, or guidelines found in the manuals of all Government agencies cover virtually every area of Government activity. These criteria tend to be all-pervasive, and together they help regulate annual expenditures of billions of dollars. For example, guidelines govern investment in all sorts of facilities, ranging from relatively expensive projects such as dams or air traffic control towers, to realtively inexpensive projects or items such as fish ladders, boundary markers or stream measuring devices. Other investment criteria determine such things as the size and approved construction standards of interstate highways, timber seeding and planting in National Forests, or the quality of information contained in maps and charts. And, once an investment has been made in a facility, still other criteria are used to determine the level of operations at the facility.

Regional and field offices usually rely heavily on their agency manual and the criteria contained in it when making plans and submitting budget proposals. Thus the aggregate impact of these criteria is quite extensive.

Since criteria like those cited here are so numerous, and so technical, Congress delegates to agencies the authority to establish and change them. The right of congressional review is of course reserved, but as a practical matter it can be exercised only rarely. New or changed criteria are usually generated within an agency by routine coordination of proposals through all cognizant or interested branches of the agency. But because the total money involved is so great, two important questions which should be asked are—

What conscious or unconscious motivations govern the agencies when they write their criteria? and

What assurance does Congress have that these criteria lead to desirable decisions?

Agency biases.—At the bureau level many Government agencies tend to be dominated by one profession. For example, the following list associating bureaus and professions should contain no surprises.

Bureau	*Profession*
Geologic Survey	Geologists
Weather Bureau	Meteorologists
Office of Education	Educators
Bureau of Commercial Fish	Biologists
Public Health Service	Physicians
Bureau of Public Roads	Engineers

Since some departments are made of several diverse bureaus, they are not associated with any one profession. In other agencies, however, a single profession tends to be predominant throughout. For example, the entire Justice Department and Atomic Energy Commission are dominated by lawyers and physicists, respectively.

Because bureaus are so frequently dominated by a single profession, there is a tendency for what might be called *professional biases* to be reflected in the criteria which a bureau generates to help govern its various expenditures. These biases generally result in favoring those things which are either professionally interesting or professionally exacting. As one might expect, the economic impact of this frequently is to spend money on projects which are not necessary and which yield predictably few benefits to any clientele group.[6]

The list of uneconomic activities that can conceivably result from this sort of bias is almost unending. Just for the sake of concrete illustration, it is possible to have—

Instrument landing systems installed at airports where bad weather virtually never occurs;

Expensive water pollution control devices installed where less expensive alternatives are available;

Wilderness areas mapped or charted to an unwarranted degree of accuracy;

Stream flow measured at intervals too frequent for any useful purpose;

Multiple fish ladders built where single fish ladders would suffice; or

Trees planted on low-value land while high-value land remains unplanted;

and so on.

The potential for program evaluation.—Where appropriate checks and balances have been built into our Government, they seem to work reasonably well. At present, however, there would seem to be no effective check on the tendency of Government bureaus to engage in uneconomic activities. GAO audits can be useful in preventing fraud or dishonesty and in seeing that activities operate at minimum cost, but even the best accounting audits will not show where wrong programs are being operated or where wrong program alternatives were chosen. One should keep in mind that it is quite possible for an agency to operate wrong programs very efficiently. Accounting audits are not designed to make this sort of managerial appraisal, and it would be grossly unfair to criticize them for doing so.

Subjecting programs to analytic evaluation of the type described earlier is one way to attempt to control unnecessary program expenditures such as those alluded to earlier. It is not possible, of course, to analyze every aspect of every program. But for each agency it is possible to select those programs which consume the greatest amount of money and subject them to a critical evaluation.

Program evaluation should attempt to ascertain in as measurable a way as possible whether programs are achieving their objectives, and whether there exists even more worthwhile objectives which should be considered in lieu of existing objectives. Rigorous analysis of this sort could help subject Government programs to the sort of discipline that competition forces on private business firms when they review their earnings and question whether there exist changes in products or services which their customers would welcome.

But just as competition is not a pressure which all businessmen welcome, so rigorous program evaluation is not welcome in all Government bureaus. Good analysis involves hard work, and it can be a thankless task if its message falls only on deaf ears. In order to have a worthwhile impact on programs, analysis or evaluation *must be properly sponsored and motivated.* This is why the initial Bureau of the Budget instructions implementing PPB required that the head of the analytic staff report directly to the head of the agency or his immediate deputy. And also for this reason, Congress should consider originating its own analysis to act as a check on the work done in agencies. If it is not possible for Congress to sponsor such analysis, then it should at least evaluate the analysis done by agencies. This would provide an important and worthwhile stimulus to the PPB effort.

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[6] Unless, perhaps, the Government employees concerned receive some benefit. But this is not meant to imply that Government employees derive personal benefits in any immoral or dishonest way. People with professional biases often resemble *fundamentalists*, or people to whom things like trees, maps, weather observations, or miles of freeways become end objects to be desired in and of themselves. Bureaucratic biases have recently been studied in much more deatil by Anthony Downs, *Inside Bureaucracy* (Boston: Little Brown & Co., 1967). Instead of the term *fundamentalist*, Downs classifies most bureaucrats as either *zealots* or *advocates*.

ANALYSIS OF NEW PROPOSALS

The term "new proposals" is intended to include major new projects, new programs, and extensive changes in existing programs. As the population grows, as our environment changes, and as the Government turns its attention from one complex social problem to another—problems such as air and water pollution, crime prevention, traffic congestion, depressed areas, education of the poor and underprivileged, poverty, and others—and if we think ahead over some future period such as the next 5, 10, or 20 years, it seems virtually inevitable that a number of new Government programs will be initiated. Nor should we restrict our thinking only to new problem areas, for under the impact of changing techniques and shifting population some of our existing programs will tend to grow obsolete and will have to take new directions.

Each new program, or shift in an existing program, will be aimed at achieving one or more of our evolving national goals. There will always be a number of alternative ways to achieve any specified objective, and planning for these new programs should include a systematic search for the best of the available alternative. It was chiefly to facilitate the earlier discussion, of course, that evaluation of existing programs was treated separately from the generating of proposals or ideas for future changes and improvements. In fact, however, these two are closely linked. For out of careful, critical study of the past often come the best ideas for constructive changes.

As new ideas are generated—from evaluation of existing programs, from people outside the Government, or from whatever source—the better ones will need to be sifted out. This will require good cost estimates, study of probable effectiveness, using the best techniques available, and considerable thought given to questions such as: What can go wrong? In other words, new ideas and proposals should be subjected to systematic analysis, especially where they involve the expenditure of billions of dollars, or even hundreds of millions. From this process can come some of the best and most defensible proposals for new programs and new legislation.

We all recognize, of course, that we have with us at all times an intellectual thought process generating new ideas and, through debate and discussion, a sifting out of these ideas. This process occurs at our universities and colleges, in the public press, on the floor of our legislatures, and elsewhere. From our universities each year come a number of penetrating studies pertaining to public issues. From all this activity, and because of the public spirit of most of these people, when important issues are being considered the Government has available to it many of the experts in the country, if it so chooses.

But we should not be complacent, either. We must also ask: Are we getting *all* the studies that we need? And are they the sort of studies that we need for the budget decisions which we face each year? On the basis of my experience, I believe the answer to both questions is an emphatic *no*. The Government has many programs, consuming in aggregate billions of dollars annually, which are not being adequately studied and which are not likely to be so studied if we wait for outside investigators to somehow develop an independent interest. Only a few of the studies done by independent investigators tend to be strictly pertinent to those decisions which have to be made at budget time.[7] For example, it is not common practice for an academic study either to cost out alternative approaches or to present alternative possibilities in the manner needed for program management of budget decisions.[8] Hence, unless the Government commissions such studies to be made they are not likely to be forthcoming. In their absence we will have to continue making budget decisions involving billions of dollars with a considerable dearth of information—information that could be obtained at a relatively small cost.

PPB was, of course, initiated in order to help overcome this weakness. Looking ahead, we can foresee a day when all agencies will have an analytic staff, and will have in-depth studies forthcoming from these staffs on a regular basis. As we approach this state of affairs, some of the previous caveats concerning evaluation ought to be kept in mind. Recalling succinctly, analysts are human, and their work is not and should not be above criticism. We should consider building into

[7] This is not meant in any way to be a criticism of academic studies. In general, there is no reason why students of public programs should be motivated to develop such presentations.

[8] Cost estimating for complex program proposals can be a profession in itself. There are a number of good reasons why one should not expect good cost estimates in academic-type studies: (a) Cost estimate techniques may not be within the competence of the investigator, (b) outside investigators usually don't have sufficient data, (c) cost-estimating is time-consuming, hard work and usually has little relevance to academic publication, which unfortunately is often the principal goal of many writers.

our system some checks and balances on the output from these analytic staffs. There are probably a number of ways in which this can be done, but the best check on an analytic study that I know of is another study of the same problem. Then, if there are critical differences, they should be "debated" before congressional committees.

Chairman PROXMIRE. Thank you very much, Mr. Haldi. Our next witness is Professor Davis.

STATEMENT OF OTTO A. DAVIS, PROFESSOR OF ECONOMICS, GRADUATE SCHOOL OF INDUSTRIAL ADMINISTRATION, CARNEGIE-MELLON UNIVERSITY, PITTSBURGH, PA.

Mr. DAVIS. Thank you, Mr. Chairman. I will try to summarize my remarks here. I want to hit some different points—two main points, really.

First, there is the issue of congressional control over appropriations and the alternatives the Congress has concerning the budgetary process at the present time. Second, there is the issue of whether PPB should, in some normative sense, be introduced.

For the past several years, I have, in collaboration with two colleagues, Professor Dempster and Professor Wildavsky, been doing some research on the Federal budgetary process. While this research is not addressed directly to this issue, I do think that the evidence has relevance for you. First, I would like to summarize the main points, and then explain what I believe the implications are. Our studies are historical in the sense that they are based on the period from 1948 to 1963. I think that this fact, instead of being a hindrance, should help us put this issue in perspective.

One of the basic ideas that we had was to try to find some equations which were capable of representing the realized behavior of the budgetary process during the period 1948 to 1963. These equations represent "as-if" models, which means that if they fit some part of the budgetary process, then that part acts as if it were behaving in accordance with these equations. I won't go into them. They don't try to define all the influences in the budgetary process, but these equations have now been tested against all requests and appropriations data for all of the nondefense sector of the Federal Government over the stated periods. It can be said that while there are exceptions, that in general the equations fit the data very well indeed. To put it another way, up to a small margin of error the President's budget and final appropriations appear as if they were generated by these equations. Or to put it still another way, the computer which did the computation and estimation could easily be made to predict the following year's requests and appropriations for all of the nondefense sector of the Government and, in general, the figures so generated would closely match the actual requests and appropriations which the humans in the process decided upon.

Now, I don't think the fact that you can make a computer generate the budget is an important point here. The question is whether we can learn something from this which has implications for the budgetary process. One of the things we can learn relates to the inputs of the process; that is, the numbers which a computer looks at when it decides the President's budget and final congressional appropriation. What it looks at is simply past data; that is, past appropriations and

requests data. Knowing only that historical data, it can predict a budget that closely approximates the one decided upon by the humans in the process, at least for the period 1948 to 1963.

Now, a second thing one can learn concerns the rules of behavior which were built into the equations which were fed into the computer. In general, they are rather simple rules. For example, one of them would say that an agency in determining its request might merely look at its appropriation for the previous year and mark it up by a certain percentage. A corresponding example of a congressional rule would say that the agency's request is taken and cut by a certain percentage. There are other rules that relate to agency padding of requests, how the Congress reacts to agency padding, and so forth. The main point is that the agencies look to the Congress and Congress looks to the agencies so that they are taking clues from one another.

I think there are several points to be emphasized here. One is that it is simply possible for the period 1948 to 1963 to produce equations which behave very much like the budgetary process, but which have no reference to considerations of economic efficiency, or even of social justice. Now, I don't want to make too big a thing out of this result because the computer armed with these equations produces only an approximation, and there are differences between actual behavior and the behavior which the computer produces. However, these differences are rather small compared to the appropriations. I think that on the basis of this result that one can conclude finally and conclusively that unless behavior has changed drastically since 1963, there is just a substantial amount of room for improvement in the budgetary process.

During that period, there seemed to me to be too much of what I like to call "5 percentmanship" or "creeping incrementalism," which is defined by the following attitudes—just ask for a little bit more than we got this year, and just cut them a little bit below what they ask for — without sufficient consideration of alternatives, goals, and whether programs are meeting their objectives.

I think that if one is concerned with obtaining a rational allocation of resources, or getting the most out of what we have, then one can only sit back and applaud the basic objectives of PPB, for it is aimed at doing just that.

There is another thing that one can learn from these historical studies. If one looks at the fits of the equations, one is struck by the fact that the fits for the congressional equations are just huge orders of magnitude better than they are for the agency equations.

Now, this fact——

Chairman PROXMIRE. Will you repeat that? I missed it.

Mr. DAVIS. The fits—that is, how well the equations fit or match the data—are much better, much closer, on the congressional side than they are on the executive side. There is a marked difference. The model fits Congress much better than it does the executive.

Now, in fact, I think this has one striking—well, there are several aspects to it, really. All of them are not striking. A main one is that Congress follows this creeping incrementalism much more than do the agencies and the Bureau of the Budget. Another aspect is that new programs are more likely to be brought up on the executive side. The most important thing, I think, that this fact implies is that if one is worried about the implication of PPB for congressional con-

trol, and if one thinks that the additional complexities in the budgetary process caused by PPB analysis might in some way cause Congress to lose control of the budgetary process, then one is really worrying about a fictititious issue. Congress has not had control over the budgetary process if one interprets control in any way other than following what the executive has proposed. That fact of a lack of control shows up rather strikingly and should still be true unless there has been some drastic alteration in behavior since 1963. I have not seen any evidence that would lead me to believe that there has been such an alteration.

If one thinks about this fact, this creeping incrementalism on the part of the Congress, it suddenly becomes clear, I think, that here is a group of hard-working, dedicated, and intelligent men who are trying to do the best they can; but the point is that the traditional budget, and the traditional evidence associated with the budget, simply does not give them an adequate basis upon which to make a judgment or an evaluation of how well agencies are doing. Given this basic fact, the only basis that the committees have to use in deciding upon an appropriation, the only real basis that one can use in such a situation, is trust and confidence in the heads of agencies or those giving the agency testimony, and in what they say, even though the agency itself may not at the same time be conducting the studies to indicate how well its objectives are being accomplished and whether its objectives are what they should be.

I think that we can conclude from the evidence that this is the kind of situation, at least prior to 1963, that existed. The main point to make here is that far from threatening congressional control, far from the complexities having the drastic implication for the Congress that the executive will get more power, PPB opens precisely the opposite opportunity. It is going to be only if the Congress decides to adopt the analytic approach, only if they adopt PPB in full, will they have the capability to assume control of the budgetary process. So it seems to me that at least at the staff level, Congress really has no alternative but to develop this capability so that they can evaluate financial plans and program memorandum and plan and execute special studies of their own. I am sure that no one expects this task to be easy. We all ought to expect it to be painful.

It would seem to me that there are several alternatives which Congress has at the present time. One is following the route which I indicated above—embrace PPB in full, encourage development in the executive branch, and insist that the agencies do a good job and that they try to attain their goals. But Congress should go even further than that and develop in itself the capability to evaluate what the alternatives are, to suggest additional alternatives, and even to do in-house studies itself when it finds, for example, that agencies' program memorandum and special studies don't come up to the desired qua ity. It would seem to me that this alternative is the most desirable one. But there is another.

It is possible to encourage the executive branch to go ahead with PPB, and for Congress to insist at the same time that nothing more than the traditional budget and the traditional evidence be laid before it. Now, if this alternative is chosen, I think that one can say with certainty that Congress will not have any additional control over the budgetary process. On the other hand, the executive branch

at least will know something more about what is going on in this Government of ours.

Then there is a final alternative. The final alternative is for Congress to insist that the budget be developed in the traditional manner, that this reform be abandoned, that all ideas related to PPB be purged, and that staff capability not be developed. In fact, this alternative could easily be chosen simply by denying the authorization and the funds for the agencies and the Congress itself to establish the analytic capability which is required. Now, it seems to me that this is the least preferable of all alternatives. However, I want to make a drastic suggestion here, and it is that if we really want to go back to creeping incrementalism, then I think we can do it much cheaper than we have done it before. What we can do is to take advantage of our knowledge of the traditional budgetary process. All we have to do is take this knowledge, the equations which I have talked about earlier, and program them into the computer. The computer will then generate the traditional budget. It will produce one that will be pretty close to what the humans in the process would have generated anyway. We can abolish the Bureau of the Budget and the budget staffs of every agency in the entire Government. They won't be needed. All that will be needed is a small staff to go over the computer output, the President's budget, and decide when special circumstances would have been introduced so that the budget would not be what it usually would have been.

Even better than that, of course, one can abolish the appropriations committees. They certainly are not needed, because their behavior is even more predictable than the executive branch's behavior. This set of computer output will be the final appropriations which do not need to be looked at on the floor of the Congress either since the Congress almost never changes what the appropriations committees do. All that is needed is for a small staff to look over what the computer produces and decide whether special circumstances have happened which might have caused decisions to be different from what they usually would have been and incorporate the differences on the congressional side, at least, special circumstances are rather rare events so that this staff would have the easier job. So you see, in this way, if we want to go back to tradition, the computer can save us lots of money and lots of manpower. The computer is just very good when it comes around to producing the behavior of this creeping incrementalism.

Now, I want to say it is not unusual, of course, for someone to suggest that machine replace man. It has been going on ever since the industrial revolution. Most of us are better off for it.

I do want to say, however, that I think that those of us who are serious students of the budgetary process do not think that it is time to turn the budget over to the computer. I think most of us are excited by PPB. We think that it is a new dream and a new hope.

I think I can speak for some of my colleagues in saying that. It seems to me just silly to say that we should not go around and collect the data and conduct the analyses and undertake the studies which tell us what our programs are accomplishing, and whether they are what they should be. PPB is, I think, what should be adopted by Congress as well as the Executive.

I would just like to say one last thing about the cost effectiveness of PPB. The problem is not an easy one, since no one has collected

any systematic evidence on it. But I think we have before us a basis of making some reasonable judgment which we can hold until someone does collect some systematic evidence about it.

We have a knowledge of traditional budgetary process. We know exactly what it is. We know that PPB is designed to remedy some of the defects of that traditional process.

Third, we know that PPB is going to be judged, or should be judged, at least in the near future, on the basis of how many bad decisions that it helps us avoid, rather than anything else.

In this day and age, if it can avoid a few bad decisions, it cannot help but turn out in the next 10 years to have been a fantastically good investment.

In concluding, let me say that I draw the exact opposite conclusion to that of most people when they are horrified about the nature of PPB and computers. I think we go to computers when we go back to tradition. I want to say that my own hope is that full acceptance of PPB by both the executive and the congressional branches of the Government—and I think that it is very important that the congressional branch actively embraces PPB—will within the next few years make my own research on the budgetary process during the 1948 to 1963 period become nothing more than a quaint little piece of budgetary history which has nothing to do with the budgetary process of the future years.

Thank you.

(The prepared statement of Mr. Davis follows, and the articles he refers to appear in appendix 3, p. 252.)

PREPARED STATEMENT OF OTTO A. DAVIS

The Potential Application of the Planning-Programing-Budgeting System and Congressional Control of Federal Appropriations

For almost as long as there has been a systematic budgetary process in the United States Government, there have been periodic efforts to improve it. The present effort to install The Planning-Programming-Budgeting System (PPB) in the non-defense sector of the Federal budgetary process illustrates the fact that at least some persons are persuaded that these past efforts have not been sufficient and that there is room for further improvement in that process. Since a reform must be embraced to be successful, since the future application of PPB depends critically upon the attitude of the Congress and especially the attitudes of the members of the House and Senate Appropriations Committees, and since the desirability of PPB really is evident to many of us, it would appear to be prudent to give our attention to the problems and difficulties which may influence attitudes toward PPB since these, in turn, may be critical in determining whether the reform will be embraced. It follows that a discussion of problems influencing Congressional attitudes toward PPB really is a discussion of future applications since these attitudes will help to determine whether the reform will be sufficiently thorough to make it effective.

Anyone familiar with the basic ideas of PPB—the careful definition of objectives, the development of plans for the future and the projection of budgets to get the future costs of programs, the identification of programs and the careful stating of the budget in terms of program costs rather than by line item, the emphasis upon quantitiative analysis, the explicit consideration of alternatives, the expanded role for cost-benefit analysis—must realize that one of the end results of the installation of this new system, although certainly not an intended result, is to make an already complex budgetary process even more complex. If the Bureau of the Budget is successful in persuading the non-defense agencies to effectively embrace PPB and if the agencies are successful in developing and upgrading their analytic staffs, then the budgetary process will become very different from its present form. It will become different in the sense that a new "language" will be introduced. Even more than at present, participants will speak

of the "systems costs" of programs. They will use such complicated terms as "present value" and "discounted benefits" and "opportunity costs". They will argue over such issues as the appropriate rate of interest to use in the discounting, how risks should be introduced into the analysis, whether particular models are appropriate or not for the problem at hand, and whether particular alternatives should or should not be explicitly considered. Given the new language, the new concepts, and the new form, it is only natural to wonder whether the basic responsibilities will remain approximately the same. Since the Appropriations Committees have, at least so far, insisted upon examing the budget in its old form of the line item, it may be natural to suspect that the end result of the introduction of PPB will be a further shift of real control over appropriations from the Congressional to the Executive branches of government. In other words, it may be suspected that the mere burden imposed by the introduction of the new techniques associated with PPB will cause the Executive branch to become the real center of the true decision making authority in the budgetary process. If such suspicions do exist, then they may be sufficient in and of themselves to cause persons to be unsympathetic to the new system. One should expect that Congress, like most other organizations, desires to protect its major responsibilities.

In order to understand the issue of whether the introduction of PPB will cause an effective shift in control, it is necessary to examine the budgetary process as it existed before it could have been influenced by that system in an effort to determine where the major control over appropriations rested then. For the past several years I have been conducting empirical studies of the budgetary process in collaboration with Professors M. A. H. Dempster and Aaron Wildavsky. While these studies are not addressed directly to the question under consideration here, they do provide evidence which throws some light upon the issue of control as well as the basic problem of whether PPB should, in some normative sense, be introduced. Two of the studies referred to here have been published. One, "A Theory of the Budgetary Process," appeared in the September 1966 issue of *The American Political Science Review*. The others, "On the Process of Budgeting: An Empirical Study of Congressional Appropriation," and "A Note on Supplemental Appropriations in the Federal Budgetary Process," appeared in the 1966 and 1967 issues of *Papers on Non-Market Decision Making*. Additional results are now being put in a form suitable for publication. Still other results await to be generated. All results are based upon data which refer to the period 1948–1963. The less technical of the published papers can be read into the record as evidence supporting the following remarks.

The basic idea of the published papers was to see if one could find some equations which are capable of "representing" the realized behavior of the budgetary process of the United States Government during the period 1948–1963. These equations constitute "as if" models, which means that if a particular equation "matches" the data from a particular part of the budgetary process, then it is said that the particular part of the process behaves *as if* it were following the rules of behavior incorporated into the equation under consideration. The equations fall into a class known technically as temporally stable linear stochastic difference equations. In plain English, they do not attempt to represent all of the influences present in the decisions in the budgetary process so that the equations incorporate random variables which stand for those influences not otherwise present in the models. To say that the equations are any good in representing budgetary decisions, one must find that the random variables are small in relationship to the data which the models otherwise explain.

The equations have been tested against request and appropriations data for almost all of the non-defense agencies of the Federal Government. While there are exceptions, it can be said that in general the equations fit the data very well indeed. In other words, up to a very small margin of error, the President's budget and the final Congressional appropriations appear as if they were generated by the equations which were postulated. To put it still another way, the computer which did the computation and estimation could easily be made to predict a following year's requests and appropriations for all of the non-defense sector of the Government and in general the figures so generated would closely match the actual requests and appropriations which the humans in the process decided upon.

One should not emphasize the fact that it is possible to program the computer to generate the budget of the United States Government. We have known for some time that computers can be made to do things which resemble closely the behavior of humans. The important point is that we can learn something about the budgetary process by studying the equations and the computer outputs, the "fits" of the equations to the actual budgetary data. One of the things that we can learn relates to the inputs, the data that the computer looks at when it fits the

equations and the data that it would look at if we asked it to generate the President's budget and the final Congressional appropriations for, say, next year. The data that the computer would need to know is simply the budgetary data, requests and appropriations, for the previous few years for each of the agencies. Knowing only this historical data and our set of equations it could, at least for the period 1948–1963, predict a budget that closely approximates the one decided upon by the human participants in the budgetary process.

A second thing that we can learn relates to the form of the equations or, more accurately, the behavioral rules that were built into the equations. These behavioral rules were rather simple. For an example, one of them relating to agency behavior simply said that the agency determines its request for next year by merely looking at its appropriation for this year and marking it up by a certain percentage. A corresponding example of a Congressional behavioral rule is to determine some agency's appropriation by merely giving the agency a certain percentage of its request. Other rules refer to agency "padding" of requests, Congressional reaction to padding, etc. The point is that the major behavioral generalization built into the equations says that agency participants make budgetary decisions by looking at Congress and Congressional participants, in turn, look to the agency.

Several points merit special emphasis here. The first is that one can, for the period 1948–1963, produce equations which have no reference to considerations of either economic efficiency or social justice and these equations, when fed into the computer, can produce satisfactory approximations to actual budgetary behavior. Now one would not want to conclude that the participants in the budgetary process during that period did not care about efficiency or justice. The equations only produce approximations. There are differences between the actual behavior and that predicted by the computer and these differences may be very important. Nevertheless, the differences are rather small in most instances. Further, it does appear legitimate to conclude on the basis of these studies that unless budgetary behavior has changed drastically since 1964, there is substantial room for improvement in the process. There seems to have been far too much of what one might call "five percentmanship" or "creeping incrementalism" which might be defined by the following attitudes—"Just ask for a bit more than we got this year" and "Just give them a little less than they asked for"—without sufficient consideration of goals, alternatives, and whether programs are meeting their objectives. In fact, this creeping incrementalism is the precise kind of behavioral rule that is built into the equations which tend to explain the budgetary data of the 1948–1963 period so well. If one is at all concerned with the problem of attaining a rational allocation of resources or with "getting the most out of what we have", then in light of the evidence for creeping incrementalism one can only applaud the basic objectives of PPB.

There is another interesting bit of information which one can learn from our studies of the budgetary process during the 1948–1963 period. If one examines the fits of the equations best able to represent agency and Congressional behavior in the budgetary process, one is struck by the fact that the fits for Congressional behavior are, in general, much better than the fits for the agency equations. This fact reflects several factors. One is that the Congress is more prone to follow the dictates of creeping incrementalism than are the agencies and the Bureau of the Budget. Another is that proposals for new programs are more likely to be developed in the Executive branch of government. However, the most important implication of this evidence concerns Congressional control. It is that if persons are worried about the implications of PPB for Congressional control, if persons anticipate that the full adoption of PPB will make the budgetary process so much more complex that Congress will lose effective control, then they are really concerned with a fictitious issue. Unless there has been a drastic alteration in behavior since 1963, one can only conclude on the basis of this evidence that the Congressional equations fit so well that Congress has for the greater part chosen not to exercise very much control over appropriations. Of course, this conclusion will not come as a surprise to anyone who is familiar with the budgetary process as it has existed in the past. A line item budget of the traditional variety simply does not convey the kind of information needed for the evaluation of programs which should form the basis for the decisions on appropriations. Granted this handicap of the lack of proper information, the only reasonable basis for a decision on appropriations becomes a judgment, intuition, and confidence in both those who are responsible for programs and in what they say even though, for the most part, they in turn have neither the data nor an adequate basis for making a proper evaluation. Such a situation means for the most part that effective

control is not and cannot be exercised. This fact shows up in our empirical studies of the 1948–1963 period.

The introduction of PPB, far from threatening to erode Congressional control over appropriations, offers the first real opportunity for Congress, or at least the Appropriations Committees, to assume some effective control in the budgetary process. Only if PPB can be effectively implemented can the proper data be made available in a form which, at least in more instances than at present, will give to the Committees and Congress the capability of assuming effective control. The truth of the matter is the exact opposite of what might seem at first to be the case. Of course, to assume effective control it will be necessary for the Committees to develop, at least at the staff level, the analytic capability to be able to understand and evaluate financial plans, program memoranda, special studies, and other data that may have relevance for an examination of the effectiveness of an agency's program. No one can expect the task of developing such capability to be any more easy for the Congress than the agencies are finding it and no one should expect instant success. The transition is likely to be painful. Nevertheless, it would not appear to be prudent for this opportunity to be ignored.

There would seem to be several alternatives available at the present time, for what the Congressional branch of government can force upon the budgetary process. One alternative is the one mentioned above. It is to encourage the full adoption of the PPB idea by insisting that all agencies develop the analytic capability to determine sensible goals and evaluate present and alternative possibilities for the achievement of those goals, and full adoption includes the development of the capacity in the Appropriations Committees to understand and appraise agency evaluations and special studies, to suggest additional alternatives, and even to initiate inhouse analytic investigations when this might be desired as might happen, for example, when agency memoranda and plans do not come up to desired quality. It would seem to me that this alternative is by far the most preferable.

On the other hand, it is possible to allow or even encourage the Executive Branch to adopt PPB and at the same time insist upon the budget being presented to Congress in its traditional form and without evidence other than that which traditionally has been supplied. In such an instance Congress will certainly not exercise increased control over appropriations. The Executive Branch, on the other hand, will be able to know more about what is going on in this Government and what are the effects of various programs.

A final alternative is for the Congress to insist that the budget be developed in the traditional manner, that the reform be abandoned, that all ideas related to PPB be purged, and that staff capability not be developed. In fact, this alternative can be chosen simply by denying the agencies the authorization and the funds for the development of management and staff capability. This alternative would seem to be the least preferable. It would encourage a return to five percentmanship and creeping incrementalism. If such an alternative is chosen, then we should go all the way and not return completely to tradition. It is possible, if we actually want creeping incrementalism, to have it at a considerable savings of money and manpower. All that need be done is to use our knowledge of how budgets are made under the traditional system, the equations which I mentioned earlier, and to program this knowledge into the computer. The machine can then produce both the next year's President's budget and final Congressional appropriations for us. The budget which it will produce will be very close to what would have been produced through the traditional process. There will be no need for that process. We can abolish the Bureau of the Budget. We can abolish almost all of the budgetary staffs of every agency of the entire government. They will not be needed. All that will be needed will be a small staff to examine the proposed budget which the computer determined to decide whether there were any special circumstances which might have made behavioral rules change and to alter accordingly the computer determined budget. Even better, we can abolish the Congressional Appropriations Committees too for their decisions are even more predictable than that of the actors in the process on the executive side. The appropriations bills need not be considered on the floor of Congress either, for they are seldom altered there. All that will be required will be for a few persons to look over the final appropriations which the computer determined to see whether there were special circumstances or events which might have caused decisions to be different from what they usually would have been; and it might be added that significant special circumstances on the Congressional side are rather rare events. In this way, the computer can save money and manpower. The computer's decisions will not be much different from those which the humans in the process would have decided anyway. The computer is very good when it comes to creeping incrementalism.

It is not unusual, of course, for someone to suggest replacing the efforts of man with those of machine. Such a substitution has been going on at least since the time of the industrial revolution and it has made all o. our lives better. I think, however, that most of us who are serious students of the budgetary process do *not* believe that the time has yet arrived when man and his judgment should be replaced by machine determined budgets. It is my opinion, and I think that I can speak for some of my colleagues, that a clearly superior alternative exists. I think that most of us are excited by the idea of PPB and believe that its full adoption can substantially improve the budgetary process. Certainly, it seems ridiculous to suggest that we should not collect the data, undertake the studies, and conduct the analyses which help us to know, or at least make better guesses about, what it is that our programs are accomplishing and whether they are what they should be. On the other hand, no one who knows what PPB is about can possibly believe that its full implementation will be an easy task or be accomplished in a short period of time. No one should expect miracles overnight.

It is commonplace to point out that there are few, if any, areas of government which do not have potential for the application of the basic ideas of PPB. Even an area like Justice, which I understand some persons think should be off limits for PPB, provides plenty of potential for the application of the basic ideas. It is time that we become sophisticated enough to realize that laws really cannot be separated from their enforcement, that enforcement is easier in some areas than in others, and even that enforcement is more desirable in some areas than in others. There is no such thing as perfect enforcement. In short, a choice concerning which area is to be emphasized has to be made either explicitly or implicitly. There would seem to be little reason for forcing the choice to be an implicit one. Some might object that in areas such as justice the benefits cannot be measured. However, rational choice does not always require benefits to be measured in terms of dollars, which is often impossible anyway. It is possible, though usually not so easy, to define objectives upon which we have to get some sort of consensus and then discuss which alternative is the most effective in reaching the objectives. Choices made in such a manner can be expected to be better than those arbitrarily decided upon or made upon the basis of a whim.

Finally, consider the problem of the cost effectiveness of PPB. The problem is not an easy one since no one has, to my knowledge, collected systematic evidence which would shed much light upon the issue. Nevertheless, there is some fragmentary knowledge which might help us come to a reasoned judgment which we can hold until systematic evidence does become available. First, there is our knowledge of the traditional budgetary process and the fact that its very form does not provide the kind of information which can be the basis for reasonable decisions about appropriations. Second, there is the fact that PPB is aimed at providing the kind of information which does give a better basis for judgment. Third, there is the fact that PPB is probably best judged, at least in the near future, on the basis of the number of bad mistakes which it prevents us from making. In this day and age one does not have to avoid many bad decisions to make the cost effectiveness of PPB look rather good. Given this last fact and the history of our decision making, it will be incredible if within, say, the next ten years the return on an investment in PPB does not turn out to be fantastically good. My own hope is that the full acceptance of PPB, by both the Executive and Congressional Branches of government, will within the next few years make my own research on the budgetary process during the 1948–1963 period be nothing more than a quaint piece of budgetary history which has nothing to do with the budgetary process of the future years.

Thank you, gentlemen.

Chairman PROXMIRE. Thank you, Professor Davis, for certainly much more than a quaint piece of budgetary history.

Our last witness is Mr. Weitzel, the Assistant Comptroller General.

STATEMENT OF FRANK H. WEITZEL, ASSISTANT COMPTROLLER GENERAL OF THE UNITED STATES; ACCOMPANIED BY ELLSWORTH H. MORSE, JR., DIRECTOR; AND DANIEL B. RATHBUN, DEPUTY DIRECTOR FOR SYSTEMS ANALYSIS, OFFICE OF POLICY AND SPECIAL STUDIES, GENERAL ACCOUNTING OFFICE

Mr. WEITZEL. Mr. Chairman, we appreciate your invitation to be present today and participate in the discussion of PPBS. I regret that Mr. Staats could not be here today, and I know you do. With his long experience in budgeting and his early introduction to PPBS, when he was with the Bureau of the Budget, he is extremely well qualified to pass judgment on PPBS. Since becoming Comptroller General, he has repeatedly supported PPBS, both in words and by initiating changes in the General Accounting Office, designed to strengthen this approach to planning and budgeting.

And I might say that while I completely recognize that Professor Davis' suggestion of putting the budget on a computer and abolishing the present machinery for presentation, consideration, and enactment of the budget was only intended to dramatize the need for improvement in analytical approach and capability, as an agent of the Congress, I do not want to associate myself with that suggestion.

We welcome this opportunity to express our views on PPBS and thereby contribute to your timely evaluation. We feel it is extremely important that a balanced view of PPBS be developed at this point in time when it is being adopted in the Federal Government and being considered by many other governmental units.

In our opinion, careful and objective evaluation at this time will do much to correct the extreme views held by overly zealous proponents and opponents and promote the wise use of what we believe is an important means of improving the manner in which scarce resources are allocated among competing programs.

Our views on PPBS reflect our evaluation of its theoretical properties and our review of experience with it in the Department of Defense. While none of the elements of PPBS is particularly new or revolutionary, we have concluded that, taken together, the elements listed below supplement the traditional tools of management. Taken together, they provide the discipline which is a prerequisite to effective management.

First; explicit identification of objectives:

While the ease with which objectives are identified will vary over a wide range, there is simply no chance of developing and operating programs on rational bases if this essential requirement has not been satisfied. This key will frequently involve an agonizing reappraisal of long-established programs, but whether this involves merely making explicit previously identified aims or a redirection of effort, it is the cornerstone of effective planning/budgeting.

We feel it is important to note that systematic examination of the interplay between means and ends inherent in the systems analysis will frequently cause program managers to amend objectives so as to bring them into accord with available resources.

Second, identification of total costs:

We are all familiar with programs which are sold on the basis of modest initial costs without adequate understanding of the total

commitment involved. While total costs could be identified without PPBS, systematic treatment of total costs will, in our judgment, be greatly facilitated by the total program or systems orientation of PPBS.

We know that realization of the potential of PPBS is dependent in part on the support it gets from Federal agency accounting systems in the form of cost information, and I address this subject below.

Third, systematic examination of alternative means of accomplishing given objectives:

There are very few, if any, objectives which cannot be achieved in alternative ways. Yet, the systematic examination of alternative programs involves hard, time-consuming work and will not, in our estimation, be carried out in the absence of positive incentives. PPBS supplies these incentives.

Fourth, multiyear planning and programing:

Given the incessant changes which characterize the bulk of governmental programs and the associated almost constant introduction of new programs and modification of existing programs, a meaningful planning-programing period must be of sufficient duration to cover program development and implementation or modification. In most cases, this requires that a period of at least 5 years be considered.

While it is difficult to predict this far in the future, the assumption that things will remain unchanged is itself a prediction of highly dubious validity. Certainly, failure to come to grips with the difficulties involved in evaluating the flow of costs and benefits over time almost insures inefficient linkage of the budget year to more distant years.

While PPBS was designed, and is being implemented, as a set of techniques to improve the executive decision process, we believe that PPBS will serve the Congress as well. The Congress' ability to legislate wisely depends in some measure on the quality of the information provided in and its committees by the executive branch.

To the extent that the executive decision process benefits from more explicit identification of objectives, from more systematic examination of alternatives, and from forward planning, the Congress will share in these benefits, since it is an obligation of the executive branch to provide Congress with such information as it requires to make informed choices among alternative legislative programs.

And in connection with Mr. Haldi's point about setting up program reviews at the congressional level, I would like to mention that when we testified on the legislative reorganization bill 2 years ago, we made a suggestion that Congress set up some kind of machinery for looking at the agencies' activities from the standpoint of programs as a supplement to the present way of reviewing them. We recognize the difficulties inherent in this suggestion, because of the committee organization of Congress. And these difficulties may be very real. But we made a suggestion that perhaps joint subcommittees could be set up, or a subcommittee or committee could be delegated the authority from another subcommittee or committee to go into areas on a broader program basis, for example, conservation of resources, rather than have overlapping, duplicating or isolated consideration of some of these problems in the Congress.

We feel this approach might be helpful.

The Comptroller General is responsible for prescribing accounting principles and standards for the guidance of executive agencies and for the cooperative development of accounting systems. PPBS accentuates the importance of having accounting systems that can produce adequate and reliable cost and financial information for use in assessing program performance in relation to plans and in making cost projections.

Our principles and standards have long called for agency accounting systems to provide cost information classified by major organizational segments and by budget activities. In April of this year, we amended these principles and standards to make clear the requirement that agency accounting systems must also be capable of producing cost data that are compatible with PPBS program structures.

We feel that this will provide a means for the PPBS people to make much more use than they have been able to in the past of cost information produced in the actual administration of programs authorized by Congress. We recognize that these costs do not cover the full cost of the program. It is not the economic cost, the social cost, but at least it would give more accurate and compatible information on the programs that are actually being administered now by the agencies.

In our examination of agency accounting systems to determine whether they comply with our principles and standards, we place special emphasis on determining whether those systems can produce cost information that is compatible with the PPB classifications.

Another step we are taking is to inquire into ways in which our audit techniques can be improved by greater use of the more advanced analytical techniques that are applied in making cost-benefit studies which are an integral part of PPBS. We believe that we can thus increase the effectiveness and usefulness of our audit work.

I would like to point out that the trend of our audit work is in the direction of more evaluation of programs. We are trying to cover larger segments of programs, and patterns of program administration. I cannot say that we are nearly all the way there. We are trying to point our audit efforts in this direction. And we hope to be able to use the results of PPBS evaluations in the agencies in making more analytical studies, or perhaps not making studies in GAO, when we feel that these areas have been sufficiently covered in the PPBS efforts in the agencies.

There are signs of increased interest in the Congress in our office being able to provide technical assistance to congressional committees in making or reviewing cost-effectiveness studies of Government programs.

As you know, one section of the proposed Legislative Reorganization Act of 1967 contains a specific provision directing the Comptroller General to have this kind of capability.

We are taking steps in this direction and plan to continue. Such efforts are, we believe, essential in the light of the widespread adoption of PPB techniques in the executive agencies and the related need for our staff to be able to understand and evaluate Federal agency applications of PPB.

To strengthen our analytical capabilities, we recently established a new systems analysis group within our office of policy and special studies, headed by Mr. Morse, who is sitting at the table with me.

In order to prepare for the establishment of this office, in July 1966, we selected three young men who had demonstrated outstanding analytical capabilities and interests and sent them to universities for additional training in systems analysis. They completed this work in June of 1967. And they are now on board on our staff.

More recently, we obtained the services of an experienced systems analyst, Mr. Daniel Rathbun, from the Department of Defense to provide leadership for this group. We plan to expand the size of this group slowly by reassignments within the office and outside recruiting as the need arises.

As Mr. Rowen pointed out, we have been advised that the best way to get additional recruits in this period of competition for experienced and competent analysts is to scramble for them.

In addition to this specialist group, we are providing training in PPBS to a large number of our accounting and auditing staffs. During the past fiscal year, approximately 210 staff members, at various levels of responsibility, have participated in some form of training program directly related to PPBS.

For most of these staff members—about 180—the training consisted of a 1-day or 2-day orientation in PPBS connected with our continuing training in financial management. For others, the training was more extensive. Some 27 of our staff members took courses on PPBS of up to 15 days' duration given by the Civil Service Commission.

We realize that this is only a beginning, and we plan to continue our in-house training in this area and to participate wherever appropriate in PPB training opportunities offered by other institutions.

We believe that our office will derive a number of important dividends from these efforts. Clearly, our ability to assist the Congress in evaluating agency programs will be increased. With goals clearly identified, with the rationale employed in selecting the goals clearly described, and with data on the costs and benefits associated with proposed and alternative programs, analysts in GAO will be better able to center attention on areas of congressional interest.

Similarly, in the case of studies initiated by the GAO, we should be able to penetrate to the key issues with relative dispatch. Also, knowledge of the quality of PPBS efforts in different agencies can help us shift resources out of areas that are well in hand and into areas more deserving of attention, thereby improving the allocation of GAO resources

While we are still in the process of developing our capabilities in this area, the broad outlines of our role are emerging. We will be emphasizing the contributions that such traditional management tools as accounting and auditing can make to PPBS and we want to use all tools to serve the Congress more efficiently.

To this end, we will make analysts available to congressional committees, conduct studies requested by congressional committees, and initiate studies of Federal programs.

In summary, after a careful consideration of the values of PPBS and the admittedly difficult problems involved in its use, it seems clear that we cannot afford to not utilize this valuable aid. We believe it is applicable in its entirety to most governmental programs; in some areas, it may prove advisable to emphasize selected elements.

In all cases, properly combined with the traditional management tools, it holds promise to be of material assistance in the decision-making process in the executive branch and in the Congress.

Thank you, Mr. Chairman.

Chairman PROXMIRE. Thank you very much. And I thank all of you gentlemen for a very fine job.

Mr. Rowen, you make, what is to me, a very intersting reference to the supersonic transport. And this raises a very profound question in my mind. The PPB is obviously enormously helpful where you have tangible and concrete costs, tangible and concrete benefits. But it is something else where you have something—I think your example is a very good one—a cost such as the sonic boom, which you are dead right does represent a very serious social cost.

Is there any possible way of achieving any degree of objective, acceptable measurement of what this cost represents?

Mr. ROWEN. I think one can do some useful things. One of the first things that comes to mind is to run experiments.

After all, if there is a factor that is deemed to be important, possibly crucial, and there is a good deal of uncertainty about it, one of the thoughts that comes to mind is experimentation. And, in fact, this is a point that we can generalize on. There are a lot of new Federal programs that involve enormous amounts of uncertainty. We ought to do a lot more experimentation before we get committed.

There have been tests on sonic boom. There are those who would argue that some more tests might be in order. That is one possibility.

Chairman PROXMIRE. Those tests certainly are not very popular. They had some of those tests with the B–58 flying over Milwaukee. And the Milwaukee residents just swamped us with protests. Eventually, they more or less accepted the boom because it was a military effort. But I think with a supersonic transport flying a commercial flight, there might be quite a revolution.

Mr. ROWEN. I think the reducing of uncertainty by experimentation——

Chairman PROXMIRE. How do you measure the result of that experimentation? Supposing you did have supersonic flights over cities, and you get complaints. How do you crank this into the cost evaluation?

Mr. ROWEN. I suspect you don't end up putting a cost number on it. I cannot think of what that cost number would be, with the possible exception of physical damage, which is not the most important aspect, I am sure. But, getting the people's reaction on a cost figure is not what you want.

On the other hand, you may get something which is quite important in terms of congressional decision. How much do the people protest or accept the phenomenon? That is really what you want to know. And as I suggested in my prepared remarks, ending up with a single cost number, is not really what you are looking for. It is getting essential information, reactions, often impressionistic and highly subjective, but more valid.

Chairman PROXMIRE. You see, right now a Member of Congress gets the usual reaction, you get letters and complaints, and you talk to your constituents, and that kind of thing. You don't get the kind of cost analysis on the basis of the figures that are available that I think all of you gentlemen argue that the PPB can give us. And to

the extent that would not obscure these other elements, I think you raise a very helpful point. There might be a tendency if you relied too much on PPB to forget some of these nontangible elements that are not reducible to costing.

Mr. ROWEN. That is the danger. And there are lots of other dangers, too.

Chairman PROXMIRE. What do you think about the Federal Government offering grants to State and local executive branches to establish a PPBS staff? We had testimony the day before yesterday from the State and local officials. And the estimate was that less than 10 States, eight States, I think, eight to 10 States, have anything like a PPBS system in budgeting. Those that have it are pleased. The first State that had it, I think, was Wisconsin, which makes me proud.

But, of course, it would help our State if other States had it. We could learn from each other. The Federal Government could learn more from the States. I am told that all the big cities have it, 10 or 12 of the biggest cities in the country are using it, New York, and so forth. Maybe it is not a satisfactorily complete PPB system, but it is program budgeting with considerable analysis, and so forth.

Do you think such a PPBS grant program would be helpful, or do you think we ought to proceed further on a Federal basis first so that we have a better idea of what we are doing?

Mr. ROWEN. I think it would be helpful to encourage States and cities to move in this direction. And I think one might use grants, which ought not to be very large, because there aren't that many reasonable people around. One might argue that it should not be necessary to pay local governments to do what it is obvious that they should be doing, anyway. I think that is wrong.

Most of them haven't done what they obviously should do. Most of the States in this country, and the cities, are wealthy enough to be able to allocate resources to this end. Most of them have not. And I think the Congress could perform a useful function in encouraging this.

Chairman PROXMIRE. Mr. Haldi, you say that we might time the introduction of this kind of thing into the Congress on the basis of giving Congress a chance to become better acquainted with the framework of this operation. Do I understand that correctly?

Mr. HALDI. Yes, sir; that is correct.

Chairman PROXMIRE. What do you have in mind in terms of timing? How long will this take? How can we speed it up, because, obviously, it will enormously help to have more rational and efficient Federal spending policies by the Congress.

Mr. HALDI. It depends a great deal on the will of the Members of Congress. But I would suggest that it could be speeded up, for example, by some short training courses in PPB for congressional staff members. I would view this as highly important. It is my understanding that there are no funds available for the training of congressional staff members on the Hill. I'm not sure about this, but it is what I have been told.

Chairman PROXMIRE. Do you feel that the Comptroller General is the congressional arm, the congressional watchdog, that is responsible to the Congress, and to the extent that they have already moved into this field, is this a way?

Mr. HALDI. This is a way, yes, sir. They have had their own training program. Perhaps that can be opened up to some of the staff members of the Congress. I think that sort of thing would be helpful.

You could run several concurrent experiments in program hearings, so that many Members of Congress would be exposed simultaneously. I think a gradual approach is recommended, but it can be more gradual rather than less gradual. If all Members are apprehensive about it, it could be very gradual. You could pick up a number of small program areas—estuaries, for example—that are all over the Government. These just proliferate, and they have many committees working on them. Oceanography, for example—how many agencies are dealing with oceanography?

Chairman PROXMIRE. I agree that we should do this as fast as we can. And that is why I am concerned with any notion that we should wait until Congress gets a feeling for it, because I am wondering if Congress is going to. And we are also involved in so many things, especially in the Senate, but it is true in the House, too. For instance, I have three committees, and 15 subcommittees, and I work with the constituents and go out to the State a lot. And it is very very hard to get the attention of the Members of Congress, for something like PPBS that is technical. It is remote from election issues remote from politics, remote from personalities, and therefore it does not have the excitement that a lot of other things have.

Mr. HALDI. I would suggest that some kind of study group or commission or joint committee, or something temporary, whatever you want to call it, be set up to address itself specifically to that problem, so that they could focus on it exclusively. You could get Members of Congress, perhaps, and people from the GAO, and maybe high-level congressional staff members, people who know and understand the workings of Congress to come up with a program to get rapid introduction in the Congress on a systematic basis.

Chairman PROXMIRE. Don't you think that you can possibly make some substantial contribution to economy through PPB—I think that one of the reasons it has caught on as well as it has and advanced as rapidly as it has is the spectacular Defense Department utilization of PPB. If this can be done by the Congress in some way, pick out some program and show that it works there, and it is a very helpful tool, and it is a way in which Congress can engage in really a constructive dialog with the executive branch, can make a useful and effective representation, it seems that that might help.

Mr. HALDI. I would agree 100 percent, yes, sir. You take a program area, and then you brief the staff, perhaps expose the staff to analytical studies, and perhaps brief the congressional members also, so that you can have a more healthy dialog. That would be a sort of trial run. To me, the ultimate state of affairs is the healthy dialog that can be brought into existence through having other analytical groups vie with each other. Analysts are not perfect. They err sometimes. And they may make different assumptions. I believe that competition in analysis can lead to a much healthier discussion. And you need to involve Congress in one way or the other, either by having their own analytic group behind them, or by having competing analytic groups before them.

Chairman PROXMIRE. I have a number of additional questions, but my time is up on this round.

Congressman Moorhead?

Representative MOORHEAD. Thank you, Mr. Chairman.

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I appreciate all of your statements, and welcome all of you, but particularly Professor Davis, from Carnegie-Mellon University, in my congressional district.

I was concerned, Professor Davis, when it seemed that your testimony was taking the turn of predicting or favoring the abolition of Congress. I was a little concerned that one of my constituents would take this position. But fortunately you veered off of that subject. However, isn't the computer—not programing as you were doing it, sir—but isn't the computer a useful tool in this PPBS process?

Mr. DAVIS. Most definitely. If one has to examine such data, it is an indispensable aid. But an aid is what it is. We get all excited about computers, but they are nothing more than an aid. It is a calculating machine.

Representative MOORHEAD. But it is a very important aid to the process; is that correct, sir?

Mr. DAVIS. If one has to do a lot of computing, a computer is about the only way one can do it, really, if one has much data to analyze.

Representative MOORHEAD. One of the things that I looked into a year or so ago is the use of computers by the Congress. And I found that we had one system—to handle the payroll of the employees of the Library of Congress. It seems to me that the Congress can no longer continue in the horse-and-buggy era. One of the things that I hope comes out of this hearing is that we do encourage the Congress to use more up-to-date methods so that we can better carry out the functions assigned to us under the Constitution.

In this connection, Mr. Weitzel, I wonder if you would agree with Mr. Haldi that the congressional staffs or congressional committee should have PPB analysts on the staff, and the job can be done by GAO.

Mr. WEITZEL. Mr. Moorhead, perhaps the job should be shared. Of course, it is a question of policy for Congress to determine to what extent it wants to have analytical capability or full PPB capability with congressional committees, or in some other central reservoir that would serve the Congress, or whether it wants them in GAO. As I mentioned, the pending legislative reorganization bill would call on the Comptroller General to increase this kind of capability, and to service committees or Members of Congress, presumably both, by making studies on request and by lending people to help the committees. But I can certainly visualize that at least some of the committees, perhaps all, would want or certainly could use analysts and people with PPB capability.

There is this question of the extreme shortage of experienced and competent people in this field with the quick growth of it in the executive branch.

Another excellent suggestion, I think, grew out of a colloquy between the chairman and Mr. Haldi. And that is the possibility of giving some brief training to present staff members of congressional committees. To the extent the committees desire this, I am sure that Mr. Staats would be glad to cooperate by making available any training facilities that we have and placing selected staff members in the training that we are now giving.

Mr. MOORHEAD. How long would it take for the top man in a particular committee to become knowledgeable on PPB data assuming he has had general training? At one point you mentioned a 2-week

training period. That doesn't mean very much to me. Is that time adequate to bring the top man of a particular committee up to date on PPB data?

Mr. WEITZEL. I am going to ask Mr. Rathbun of our staff in a moment to consider this, so that he can be thinking about it. But I would like to make a couple of preliminary observations.

There is a balance, it seems to me, that will have to be drawn between really giving a person a full comprehension and grasp of the system and the time limitations which would somewhat limit his ability to spend that much time. As I mentioned, we have been giving material varying from 1 or 2 days, up to 15 days participating in courses that are given by others. Also, we have sent three of our young men to universities for a full academic year of training. And we don't consider that they are yet PPBS experts.

At this point I would like to turn this over to Mr. Rathbun.

Mr. MOORHEAD. I think you had better identify him for the record.

Mr. WEITZEL. Mr. Rathbun is Deputy Director for Systems Analysis in our Office of Policy and Special Studies.

Mr. RATHBUN. Mr. Moorhead, I would think that it is very difficult to generalize, but I am of the opinion that a very limited exposure, say, 2 weeks, would be extremely helpful. I am inclined to think it might be appropriate to devote this limited period of time to the careful examination of some problem such as the estuary problem. I think 2 weeks could be spent very productively and would yield substantial dividends.

Mr. WEITZEL. I might supplement that by saying that when we first started on this activity we sent Mr. Ahart, who is now Deputy Director of our Civil Division, to school at Monterey for the course that was being conducted there for executive branch people.

I think it was a 30-day course; wasn't it, Mr. Rowen?

Mr. ROWEN. Yes.

Mr. WEITZEL. He found this very helpful in getting familiar with the general objectives and the guidelines and the general techniques of PPB. I join Mr. Rathbun in feeling that even a 2-week course could be tremendously helpful in getting people acquainted with this, and perhaps removing some of the fears of where PPB might take us, and showing that it is only one of the tools for effective financial management and general management of agencies.

I would like to say also that I think this program approach that PPBS stresses is one of its salient features, and should be one of the most helpful devices for giving Congress the kind of information it needs.

At the same time we feel that it is one of the testing points of PPBS, because when you dig up all of these 13, 15, or 19 different bureaus, or even agencies that are working in particular areas, somebody is going to have to make a decision as to who should do what.

And this is illustrated by just one of the recent surveys we have made—and we have made several—in the mapmaking area in the executive branch. I think both Mr. Haldi and Mr. Rowen are familiar with this. The Budget Bureau has certain overall management responsibility. We have made some recommendations, and part of them are being carried out. The Budget Bureau has been working hard with the agencies. But we felt that there was too much duplicating activity in the several different Government departments in the map-

making field. The PPS approach is just the thing that would draw this out and point out what could be done, not only to save money, but to have a more effective overall job done for the Government.

Mr. MOORHEAD. Thank you.

I think what you were referring to is an example of the creeping incrementalism that Professor Davis talked about, one agency starts on the problem, and another agency has something similar to that.

Take the estuary problem: How would PPBS discover the fact that nine bureaus were involved in it, and how would it present to the Congress the alternatives of choosing one or the other for doing the job?

Mr. WEITZEL. I think, Mr. Rowen, Mr. Haldi would be more competent on this point.

But as I understand the PPBS system and its ultimate operation, it would come to light in the agency first, and then in the Budget Bureau, and then hopefully for consideration by the Congress, how much of this activity is going on.

Now, water pollution activities are one area where I think some helpful work has been done to consolidate existing work.

Air pollution is bound to be another one.

Any area which becomes a proper and important area for activity to be carried on by the Government is going to be subject to competing efforts by different agencies that have an interest in the general area to do more work. That is not only human nature, but it is to be expected of an alert management. And an agency that has some responsibility will want to do more work.

This is nowhere more apparent, I think, than in the field of Federal grants to State and local activities. I think the figure of about 400 is given as the number of different appropriations for grants that are made by many agencies. In some cases multiagency grants to a single city or a single State may be, if not completely duplicating, overlapping or supplementary to others in the same areas of population.

PPBS, we would hope, would be helpful in pointing out these. But then you still have to make a decision as to who is going to get the job. And this is partially an Executive decision and partly a congressional decision. And it will require more overall consideration both in the executive branch and in the Congress on the program basis rather than on the bureau or agency basis on which it is mostly handled at present.

Mr. MOORHEAD. My time has expired.

I would just like to make one comment.

Chairman PROXMIRE. Maybe you would like to have Mr. Haldi comment on this, since he raised this estuary problem.

Mr. MOORHEAD. Mr. Haldi?

Mr. HALDI. I think the subject was covered pretty thoroughly by Mr. Weitzel.

But if you focus on programs, presumably a comprehensive program report would be prepared. Estuaries represent just one subcategory of Interior's total framework. But after a program report is prepared you need some single or central place in Congress where such a report can be reviewed and looked at comprehensively, or someone will just isolate a small part of it and focus totally on that part to the exclusion of any other part.

Frankly, I am not too familiar with the estuary problem. But another area that would be equally typical would be outdoor recreation.

I think most of us are more familiar with that. It is less technical. In the Department of Agriculture you have something like five different bureaus that in one way or another are providing outdoor recreation. The Forest Service provides it on Forest Service land. They also have some bureau administering grants to help the States develop recreation areas. In the Interior Department, there is the Park Service, the Bureau of Outdoor Recreation, and the Bureau of Land Management, which provides recreation in the land that it manages. And the Corps of Engineers provides water-based recreation in the various dams that it builds.

It all adds up to a total outdoor recreation effort by the Federal Government of from $200 to $300 million. And nowhere do the various programs get looked at comprehensively to see whether overall they add up to a reasonable sort of program.

We do have today in this particular area the President's Outdoor Recreation Advisory Council. This particular group was started before PPB. But this is an ad hoc approach to one isolated area that was recognized as being an area of overlap and duplication between agencies. I think the general situation is well known. It comes out to something like about 75 percent of the people live in the East, but over 60 percent of the total recreation facilities provided by the Government are out West. It is sort of a gross imbalance, you might say.

I don't know the extent to which this problem gets focused in Congress. Each year Congress appropriates a little more to each agency than in the past.

But this type of situation should be multiplied a hundredfold, or more. It proliferates throughout the Government. What you need is to get program reports prepared and looked at in the executive branch, and then you need a counterpart in Congress, so that the program just doesn't get torn apart, ripped asunder, and buried again.

Mr. MOORHEAD. This was the point I was going to raise. I am a member of the Government Operations Committee. And we work closely, of course, with the Comptroller General. It seems to me that this might be one committee in the Congress where we could start at the beginning, because it does have Government-wide jurisdiction, and close relationship to the General Accounting Office. It might be the opening wedge for bringing PPBS into the Congress.

Thank you, Mr. Chairman.

Chairman PROXMIRE. Mr. Haldi, you stressed very, very heavily the importance of a program approach instead of the appropriation approach that we use now. Will you just take a minute or two to indicate what is the difference, and how it would work, for example, with Defense, with which you are familiar, I understand. Say the defense appropriation bill comes in, and we consider this enormous $70 billion appropriation bill, and we are approaching Defense on a program basis, the question is: How would we do it?

Mr. HALDI. Yes, sir.

Well, each year, as you probably know, there is published in the President's budget, a part 4, which might be called the program approach. The first program under "Department of Defense" is strategic forces. DOD has a military-airlift-sealift category. Also a general purpose forces category and several other categories. Mr.

Rowen is more familiar with the Department of Defense than I am, since he spent about 5 years in it.

Chairman PROXMIRE. This is more available to the House and Senate, and it is used by the Defense and Armed Service Subcommittees.

Mr. HALDI. Yes, sir.

Chairman PROXMIRE. So don't they use this programmatic approach to some extent now?

Mr. HALDI. I believe they do. And I believe they have been more or less forced to in this case by the fact that Mr. McNamara supports his prepared presentations almost exclusively in terms of this program approach.

Chairman PROXMIRE. So they are using this now in Defense to some extent?

Mr. HALDI. I believe that is correct; yes, sir.

Chairman PROXMIRE. We have a lot of confidence—I don't think it is misplaced—in not only the integrity and intelligence, but also in the efficiency of the job that Senator Russell and the members of the Appropriations Defense Committee do. They cut a billion six-hundred forty million, and they did it in a way that many people thought improved the defense appropriation. It wasn't a crude incremental cut or a percentage cut, it was a discriminating reduction. And these are men who have served on Defense Appropriations for so many years that they are thoroughly familiar. And maybe the House does a better job than the Senate, because they spend so much time on this.

With that information available, and with the Executive making a presentation in program terms, it is puzzling to me why there isn't some very substantial element of PPB right now being used.

Mr. HALDI. It is a puzzle to me, frankly.

Chairman PROXMIRE. Is it your conclusion that it is not being used by the Appropriations Committee of the House and Senate?

Mr. HALDI. In the nondefense areas it is my impression that the program approach is not being used.

Chairman PROXMIRE. In the defense area first. This is, after all, half the budget, more than half the administrative budget.

Mr. HALDI. Yes, sir. I hesitate to answer definitively, because my assignment in the Bureau of the Budget was to work on all the nondefense agencies of the Government. And that was a sufficiently big enough assignment so that I just didn't really keep up with all the things that were happening in the defense budget.

You suggest that the defense budget is very large and complex, and it is. As I understand it, the Defense Department conducts its internal reviews, and the subsequent Bureau of the Budget review, and the Presidential review, all in program terms. Since all the basic and important materials are prepared along program lines, and various backup studies are all focused on the program issues, I rather imagine that the Appropriations Committee would be almost forced to use these materials—at least to the extent they want to get into the substance of the situation.

Chairman PROXMIRE. So we can get into this to some extent by simply borrowing some of the experience and success which the Subcommittee on Armed Services has had in the Appropriations Committee?

Mr. HALDI. I would think so; yes, sir.

Chairman PROXMIRE. After all, these are men who are the very top men, by and large, on the Appropriation Committees in the House and Senate. And they are men who are on other subcommittees too. It shouldn't be difficult for them to take this very helpful discipline that they have learned in regard to defense and apply it.

And once again it is a little puzzling to understand why it hasn't been more vigorously applied in these other areas.

Mr. Rowen, do you have any views on this?

Mr. ROWEN. I am afraid I am not familiar enough with the inner workings of the Congress to say.

I do think it is much more important to have programs looked at in various ways, rather than be excessively concerned about the precise form in which the budget is presented. The structure is of less consequence than the total range of information available.

Chairman PROXMIRE. So that if the executive doesn't present it in a programing way to the Appropriations Committee, it is more difficult, very much more difficult for the Appropriations Committee to use PPB and to ask about the various alternatives, and to consider the cost-effectiveness approach, if it is not called to their attention by the initiators, who have so much more in terms of staff, so much more in terms of time for this particular function.

So that I would think that if Congress is going to do this, they are going to need a vigorous initiative on the part of the administration pushing it in all these areas.

It may be that the executive isn't ready in the non-Defense areas. After all, this is relatively new. I am getting the impression that while the President asked that all the departments use this 2 years ago, it takes time before it is fully operational and they know what it is doing and have some confidence in it. Maybe we are going to get that in a year or two. Is that possible?

Mr. ROWEN. You are quite right in suggesting that the response on the part of various Government agencies hasn't been uniformly good. A lot of what is needed is plain commonsense. Take our recreation example. It is strictly commonsense. It is not technical. It is a matter of bureau resistance. And I think the Congress can play a major role in overcoming the resistance and say, we want to see the following program, here is a list, please present a list of the following sort—which by and large Congress doesn't do other than in the conventional and traditional way.

Chairman PROXMIRE. Mr. Davis, you gave a most delightful presentation. I am a little bit puzzled. I would like to see this computer result, because it just seemed to me that the record for 1948 to 1962 is about as unpredictable, may be irrational—it may not have much to do with analysis.

But let me point out what Congress did in reducing expenditures.

In every year without exception between the 79th Congress in fiscal 1946 through 1967—and I realize you didn't cover all of these years; you covered most of them—the Congress reduced the administration's request. And I will run down quickly how much.

In the fiscal year 1946 there was a $1.4 billion reduction.

In the next year there was a $1.6 billion reduction; then in succeeding years, $2.6 billion; $2.7 billion; $2.8 billion; $1.9 billion; $4.7 billion; $8.6 billion; $12 billion; $2 billion; and the next year, $267 million, which wasn't very much.

And so on.

The point is that it just went all over the place. One year you would have a $12 billion reduction, and the next year $2 billion reduction.

How could a computer predict that this is what the Congress was going to do with any degree of accuracy? You could predict the direction and say that Congress always cuts. But how could you say in advance what the Congress would do?

Mr. DAVIS. What you are looking at there is a figure for an aggregate cut in the total budget. Now, what I looked at wasn't the total budget, I looked at the budget on an agency-by-agency basis, bureaus, et cetera, and did not examine Defense at all. One finds—and this is the kind of evidence I was talking about—a varying performance. It is true that in some particular agencies that you can't predict as well as in others, although most are rather predictable. Some are just so very predictable that one notices that for long periods of time an agency request becomes identical to a congressional appropriation.

Chairman PROXMIRE. Let me interrupt to say that I think you could make a wonderful contribution if you could actually predict at the beginning of the year, say in January or February, whenever the budget is available for the Congress, you get your computer to work and you tell us in a week or two all that Congress is going to do in the House and the Senate, and you omit the ones in Defense as hard to predict.

Mr. DAVIS. I haven't studied Defense, so I don't know.

Chairman PROXMIRE. But the other departments are predictable.

It seems to me that this would dramatize the point you were making so well here this morning; it would dramatize it in a way that would make us take a hard look at the apparently automatic, impulsive, uncritical action on the budget without any real emphasis on objective and critical scholarly consideration.

Mr. DAVIS. It could certainly be done. Now, I have chosen not to do that and not go beyond 1963, because I want to get some additional data on another part of the budgetary process. This additional data is not a part of the public record.

Chairman PROXMIRE. You don't have to worry about embarrassing your Congressmen or your Senators, because they are not on the Appropriations Committee, so they are not to blame.

Mr. DAVIS. I don't want to embarrass anyone. I want to do a little research, and I was advised not to get too close to the sensitive of the present day so I chose not to do that. My access to the additional data which I want depends upon a promise not to examine anything current. I couldn't obtain this additional data when I tried once before.

Chairman PROXMIRE. Somebody cut off your sources.

Mr. DAVIS. They were already cut off. Harry Rowen opened them up for me when he was with the Budget Bureau upon my promise, among other things, to refrain from examining current data which might be sensitive.

The other thing I want to say is—when I was talking I didn't put this in the remarks, even though it is in the published papers—there are periods when one observes that the behavior of Congress and its actions on the appropriations changes rather dramatically. In the work I have done, I haven't been able to predict with accuracy exactly when these changes in behavior are going to occur. It is a conditional

kind of prediction that one would have to do if one wanted to produce, say, next year's appropriations. You might even notice when I was talking about replacing the budgetary process with a computer, I said that one would have to look out for instances when some additional information comes up which might cause people to do what they would otherwise not do. In such an instance the computer would make an incorrect prediction. You can't predict it dead on the button all the time. If you examine these instances when behavior does change, you generally find that they are associated with a very reasonable type of event. For example, one observes that Congress is much more lenient with the Weather Bureau when we have years of big hurricanes than they are otherwise.

Chairman PROXMIRE. I would like to ask each of you gentlemen to comment on a part of an editorial that you may or may not have seen this morning. It appeared in the Washington Post. And I thought it was a most helpful editorial. It had no reference to our particular hearings here. But it is certainly pertinent. I will just read the last paragraph:

> Many years ago, Wesley C. Mitchell, a great American economist, wrote an essay on 'The Backward Art of Spending Money' in which he contrasted the rationality of business spending, which is tied to goals and quality standards, with the irrationality of consumer spending. There is now a similar dichotomy between private and government spending. As individuals we spend in order to satisfy known wants and cease to spend when they are not satisfied. But as taxpayers, we buy programs, and most of us have no way of judging their effectiveness or assigning them priorities. And neither does the Congress which makes the decisions. This problem is not going to be easily solved, but a beginning can be made by creating a bipartisan commission to evaluate Federal programs.

I would like to ask each of you if you could tell me briefly what you think PPB contributes to the approach of such a commission. I have introduced a bill to provide for such a commission. I did some time ago. But do you feel that PPB can be the principal instrument of such a commission?

Mr. ROWEN. If I may answer, Mr. Chairman——

Chairman PROXMIRE. Yes.

Mr. ROWEN. It should be in a general sense what Mr. Haldi suggested, that the commission look at the question of how the Congress can equip itself better, staff GAO, and whatever arrangements are available to it to obtain greater expertise to assess Government programs.

The particular three letters, PPB, may not be appropriate as the central focus. They may seem too technical. But certainly a broader interpretation and more systematic data, better analysis, and a better grip on analyses seems to me to be one of the central purposes of such a commission.

Chairman PROXMIRE. Mr. Haldi?

Mr. HALDI. Yes, sir, I believe PPB can be of help in many ways.

The first is merely by having laid a lot of groundwork to identify programs in a reasonable sense or meaning of the word "program." It was only with a great deal of effort and concentration that agencies were able to state what was a reasonable way of looking at their programs, or what constituted a reasonable definition of their programs. This alone is sometimes a major job. Take a big department like Agriculture, which spends $6 billion a year, which has 22 bureaus, and try to decide what their programs are. I think the commission,

without the PPB groundwork having been laid, could quite possibily get bogged down in deciding how to define programs before they could even start to take a substantive look at the agriculture programs.

Second, once you start to look at programs in any reasonable way, you need program data. In some cases basic data about programs is there. But in many cases the basic data either hasn't been marshaled along program lines or the data doesn't even exist, and in many instances this is very elementary data.

I don't think I need to give specific examples. I do believe that PPB would greatly facilitate the work of such a commission as you suggest just by groundwork that has been done to identify programs and collect program data. And, of course, the executive branch is now getting the PPB documents from the agencies and these might provide a useful initial point of review, since where they are supposed to define the agency objectives as they see them.

So, in summary, I believe that PPB work done to date will provide such a commission with a good beginning, but not an ending—at least not in the work I have seen so far.

Chairman PROXMIRE. Mr. Davis?

Mr. DAVIS. I hate to say this, but I am not clear in my own mind exactly—could I ask you to clarify exactly what purpose you have in mind for the commission?

Chairman PROXMIRE. Well, what we want to do is establish priorities to determine if some of these programs may be abolished, to get some, at least some independent support behind that kind of thing, to determine, I suppose, more than anything else whether or not you can provide some kind of a useful framework that Congress can use in the future to continuously evaluate programs.

Now, in a way it is duplicating what we are doing here this morning. But in a way it also would be a method of dramatizing PPB in making the rational approach better known.

Mr. DAVIS. It sounds like a good approach to me. I think it is an absolute necessity somehow that we adopt this more rational way of doing things. If, in your opinion, a commission is a good mechanism to push the adoption of a more rational method of determining programs and appropriations, and I agree that we have some programs designed to misallocate resources, then I certainly would be willing to support the idea.

It seems to me that it is very necessary that we become more rational and sensible in government. I would like to say too that despite everything we have said here, there are a lot of questions about PPB which haven't been brought out yet because we don't know the answers because we haven't looked at PPB in sort of a behavioral role context, and because we don't know very much about how people with their own objectives might try to manipulate the system, which is certainly going to happen. We are going to have to learn about the organizational and behavioral characteristics as we go along.

This fact is why I think it is just very essential for the Congress to have some knowledge about PPB. They are the ones with the real power to ask these kinds of questions and make demands for analytical studies that can be backed up and laid out on the table and have their voice heard.

Chairman PROXMIRE. Mr. Weitzel?

Mr. WEITZEL. I think that PPB would be of very valuable assistance in the work any such commission would have. I don't know that

it or the commission could give final answers in these areas, because some of them are, and I think have to be, decided at the political level by Congress itself.

However, a great deal of emphasis and dramatization could be given to the proper or some appropriate priorities, and also to the need for more machinery for allocating scarce resources.

Now, in this connection Mr. Rathbun has just noted that in his opinion the PPB system at present is not very helpful in trading off, say, Agriculture and Defense, I don't know that it has gotten to that point. And as I say, that is going to be one of the testing points of the PPB system.

There has existed a means of presenting, at least, budgets on the program basis, at least since 1950, when Congress passed the Budget and Accounting Procedures Act that was reported out of Mr. Moorhead's Committee on Government Operations and the Senate committee. That provided for budgets to be set up on a program or functional basis whenever the President so decided.

It is significant, though, that in considering that legislation Congress carefully removed the words "performance budget" from that bill. There were some Members that said that if the words "performance budget" stayed in the bill they didn't want it, because they feared that they would lose the traditional type of control that they had over Government expenditures.

Now we, the Budget Bureau and the Treasury, through the joint financial management improvement program, have been working—and I know that the agencies of Government generally have been working—toward a program presentation of the budget ever since 1950. I don't think we have completely achieved it. But there certainly is much more emphasis on it than there was 17 years ago.

Chairman PROXMIRE. Haven't you eroded some of that objection to using a program approach?

Mr. WEITZEL. Yes.

Chairman PROXMIRE. How long ago was that objection to a performance budget?

Mr. WEITZEL. This was 1950.

Chairman PROXMIRE. That was long before this whole concept had been discussed at all?

Mr. WEITZEL. It was. But it was related to it.

Chairman PROXMIRE. Long before the performance by the Defense Department under Secretary McNamara?

Mr. WEITZEL. It was long before that. But I feel that PPB is completely consistent with the idea in the 1950 legislation. I think that the Appropriations Committee now get more information on a program basis than they did at that time.

But I think it is also significant that in passing the 1968 Defense Department Appropriations Act the Appropriations Committees expressed some concern about moves being made to place the appropriations on a program basis rather than on the basis that is being used now. Mr. Anthony, the Assistant Secretary and Comptroller of the Defense Department, has been endeavoring to develop an accounting system that would give the Secretary, the Bureau of the Budget and Congress a better idea of the total costs of projects and programs within the Department, and would enable them to take a look more at the program rather than the budget activities they examine now.

They get some of the information now, but appropriations are not made on that basis.

One of the reasons that they are not is, as stated by the House Appropriations Committee in its report on the 1968 Defense budget, a feeling that at present the program structure, being independent of the budgeting and accounting systems can be altered or redirected as circumstances or prudent management require, whereas once a program system becomes part of the legislative history it will require further legislation to change it.

Chairman PROXMIRE. Has the executive branch been using real initiative in this area? They have been doing it in Defense, but have they been doing it in the rest of this area?

The President ordered them all to apply PPB in their departments 2 years ago.

Are they beginning to refer to this at all?

Mr. WEITZEL. I would say, and I think Mr. Haldi and Mr. Rowen would concur, that it has been a slow process, partly due to the lack of people to carry it out, and partly due to the necessity of doing this gradually in the agencies where they have complex programs and a need for revised cost and other data-gathering machinery——

Chairman PROXMIRE. Is that gradual development wise and necessary?

Mr. WEITZEL. I think it is probably a practical approach. If you try to force it too fast you can produce some adverse reaction within the agencies, and also some gap between the need for something to be done and the orderly way to get it done.

Chairman PROXMIRE. Is it going fast enough?

Mr. WEITZEL. In abstract terms, no.

Chairman PROXMIRE. In concrete, realistic terms, is it going fast enough?

I get the impression from almost all the other witnesses, Mr. Weitzel, that they think we should push much faster than we are, that we have very little to lose by moving ahead, that the roadblocks are the irrational, human tendency to stick with the old way of doing things. These are the real obstacles in the way, and if we don't get some force and drive and desire for this kind of additional information and this kind of more refined and objective analysis, that you aren't going to make progress.

Mr. WEITZEL. I think a great deal of help can be given by an impetus from this committee in that direction. One of the essential ingredients is for the agencies to realize that Congress wants and will use this information as far as the actual consideration of the authorization bills and the appropriation bills is concerned. They know the President wants it, and they know the Bureau of the Budget wants it. And I am sure they are trying to meet his requirements within the executive branch.

Chairman PROXMIRE. That brings me to the question I wanted to ask you.

Why is it that the Congress doesn't use all this information that you have developed so well? I think you made a good presentation. It was a revelation to me where your agency is as to PPB, and how rigorously you are trying to approach this thing.

Why is it that you haven't succeeded in getting the Congress to take this very, very helpful and useful tool and use it more?

Mr. WEITZEL. I think to a considerable extent the Congress has used it. And there has been a considerable increase in the amount——

Chairman PROXMIRE. We don't discuss it on the floor. It is rare that you have anybody get up and use this objective PPB analysis in committee.

I am a member of the Appropriations Committee, and of a number of subcommittees in it. Nobody ever refers to the benefit-cost unless you are talking about public works. Nobody talks about alternative programs, or rarely, sometimes, but not very often, and certainly not in the PPB framework——

Mr. WEITZEL. I think there needs to be more exposure, Mr. Chairman, to the benefit that can be obtained within and by the Congress and its committees and its members from the use of the PPBS techniques. It is developing rather rapidly within the Government, after being limited largely until the last few years to the Department of Defense. Because of this, I think that there isn't enough general information within the Congress and its committees as to what information is available and what can be done.

Another point is that Congress does not have full access to the material produced by PPBS within the executive branch.

Now, this is a question of policy that has to be worked out between the executive branch and the Congress. Mr. Schultze, I believe, testified to another subcommittee recently that he wanted full information to be made available in connection with the legislative proposals, and so forth, but that program memorandums, if they were made available to the Congress, might raise the question of whether the executive branch agencies could expect full candor from their people in analyzing programs, setting up alternatives, and so forth.

So there has not been, I would say, an overwhelming flow of information from the executive branch to the Congress as a result of these analyses.

Chairman PROXMIRE. That is the point I want to get to. I only have a couple of more questions.

But I think that this last aspect is very important.

First, I think it requires a lot of initiative and force on the part of the Executive to get anything done these days. They have the initiative. Everybody knows that the President initiates most of our legislation, and he determines a great deal, an enormous proportion of what we do up here, especially with regard to spending.

But I am very much concerned, on the basis of the last point you made, that the executive branch, number one, does not provide Congress with all the PPB information with which they could provide them. Now, you represent the Comptroller General. You are probably in the best position of anyone of our witnesses this morning to indicate whether or not this suspicion, this feeling, is valid or not.

Mr. WEITZEL. I am sure there is the feeling. However, I think you have to consider the relative positions and interrelationship between the legislative and executive branch, the division of power under our constitutional form of government. The General Accounting Office, for example, does not have general access to the budget justifications prepared in support of the forthcoming budget estimates. This is considered to be in support of the President's budget. And we don't get them, certainly not prior to the budget document coming to the Congress as the President's budget. And we don't normllay get

the justifications even after that. We may get them on occasion from the Appropriations Committees. The initial justifications are considered something within the bosom of the executive branch in support of the President's budget.

Chairman PROXMIRE. I would certainly think that the executive branch speaks with one voice and is completely under the control of the President of the United States. It should be that way, it has to be that way. I am not talking about conflicts and differences of opinion, I am just talking about information which they have which enables them to arrive at the conclusion at which they arrived.

Mr. WEITZEL. I think that you will find that the executive branch will bend over backward to give all the information they can in support of their proposals and requests if Congress calls on them for it. I think if the Appropriations Committee or the legislative committee or your subcommittee were to ask the Bureau of the Budget or an executive agency for information you would get it in any amount that you requested.

Now, there was that proviso on the part of Mr. Schultze in testifying recently before another subcommittee, but he made the point specifically that he very much wanted Congress to have all the information that they could use.

Chairman PROXMIRE. It is my understanding that to some extent within the executive branch itself you don't get complete cooperation in making PPB information available from one agency to another.

Mr. WEIZEL. I can't say. Perhaps Mr. Rowen or Mr. Haldi can give you better information on that.

But knowing the way these things work, I would doubt that there would be a complete interchange of all of the information that is available, simply because it might be to the hurt of the particular agencies that compiled it and made it available to a friendly competitor across the street or down the street.

Chairman PROXMIRE. Well, these estuary agencies are an example of that.

Mr. WEITZEL. That was within the same department, as I remember. But when you get them in department categories you have got different——

Chairman PROXMIRE. I am sure that is the case if you take the whole scope of the Government, Department of Agriculture and every department dealing with this kind of thing.

Mr. HALDI. I think we started to get at the heart of the matter right at the end of Mr. Weitzel's comments. And that is: It is quite easy to get agencies to give you studies which support their proposals.

Chairman PROXMIRE. You have to ask for the ones that don't and then you are not sure to get them.

Mr. HALDI. In the first place, it is like pulling eye teeth to get them to make a study supporting something that they aren't in favor of doing. And if they do such a study, their immediate response is to bury it in some file cabinet or some obscure place. The Bureau of the Budget has enormous difficulty in getting a look at such studies, if they exist. And if it were known that such studies were going to get to the Congress, the Bureau of the Budget would probably have even more trouble in getting at such studies.

And this was really at the nub of my suggestion that Congress become the initiator of such studies.

Chairman PROXMIRE. This is why Congress needs a real PPB staff and not simply have to rely on well-informed staff members who know something about PPB and can suggest questions that they can ask.

In addition to that, they should have their own substantial staff in this area.

Mr. HALDI. That is correct; yes, sir; very definitely so.

Mr. MOORHEAD. My experience in Congress has been that there are two things that are most difficult.

One is to stop a bad program, and the second is to start a good one.

And the agencies have a vested interest in keeping programs going that may have been started in the 1930's when conditions were entirely different, but there is nothing that signals us to look out for it; all we have is the incrementalism, and there is nothing that stands out like a sore thumb, so that the money is appropriated and we keep going along.

I would hope that expert use of PPB in the Congress could hopefully accomplish the objective of stopping the bad program.

And secondly, we have a terrible time when a new need arises in getting the Congress to appropriate the money, because it is easy to say, they didn't have this last year, so they won't miss having it this year.

So that these two items, it seems to me, would be helpful.

And I think this is part of what your testimony is today; is it not?

Mr. HALDI. Yes, sir; that is right to the point. Exactly to the point.

Mr. WEITZEL. Mr. Chairman, just one example which I think will illustrate Mr. Moorhead's point.

When Lindsey Warren, our former Comptroller General, who had been a Member of Congress for 16 years, testified on the Reorganization Act of 1945, he said that an agency could be set up for the edification of the three blind mice, and in 2 years they would come up with a complete program in justification for increased appropriations.

And I would also like to concur with Mr. Haldi's statement that the hard thing is to get the information against an existing program, or indicating that it could be done differently in an alternative way.

Chairman PROXMIRE. That is right.

You know, we have had this experience with the Subversive Activities Control Board, which is about as—well, there are lots of things that are useless, but this is about as useless a thing as I can think of. The function has ceased. They haven't done anything for 20 months. They make fancy salaries. It is in the public eye. But we can't abolish it.

So this is a very, very tough problem. And I suppose it is going to take a long time to get progress, even in something that has been as spectacularly demonstrated as PPB.

But we certainly want to use this and develop it and encourage it in any way we can.

You gentlemen have done, I think, a superlative job today in helping us compile a record on this matter. Thank all of you very, very much, for most helpful testimony.

This completes the hearings of the Subcommittee on Economy in Government on PPB for this year. Without objection, relevant materials may be placed in the record at the discretion of the Chairman.

(Whereupon, at 12:15 p.m., the subcommittee adjourned, subject to the call of the Chair.)

(Additional materials, subsequently received, appear in the appendixes which follow:)

APPENDIX 1

STATEMENT OF ROBERT L. BANKS ON DISCOUNT/INTEREST RATES IN EVALUATION OF PUBLIC INVESTMENT PROJECTS

THE ROLE OF THE DISCOUNT/INTERTST RATE IN EVALUATING THE ECONOMIC EFFICIENCY OF GOVERNMENT FINANCED TRANSPORTATION PROJECTS

My name is Robert L. Banks. I am a transportation consultant specializing in economics of the several modes of transportation. I appreciate the opportunity to appear before this Subcommittee to discuss the question of the appropriate interest, or discount rate to be used in assessing the economic feasibility of government investment in transportation projects.

My comments will be directed specifically at the discount/interest rate used in evaluating water resource projects. Analysis in this area is probably more advanced than in most other areas, and the techniques employed therefore point the way for studying other government investment projects. It is particularly important that this path finding analysis conform to sound economic principles.

In constructing the benefit-cost ratios which it presents to the Congress as a part of the appropriation procedure, the Corps of Engineers computes average annual benefits by a discounting process, and these are compared with average annual cost of operation plus interest and amortization computed in the manner of an equal-payment mortgage. The same discount/interest rate is used for both purposes.

Although I am particularly concerned with water resource evaluation, my comments would be relevant to appraisal of other government projects, especially where a choice between alternative investments is involved.

What brings me before you is my belief that the method by which the interest/discount rate is determined is inappropriate and ought to be changed. Since publication of Senate Document No. 97 in 1962 the discount rate has been "based upon the average rate of interest payable by the Treasury on interest bearing marketable securities of the United States outstanding at the end of the fiscal year preceding such computation which, upon original issue, had terms to maturity of 15 years or more." [1]

This formula has produced a rate of 3⅛ percent for use over the past several years. I believe this rate to be unrealistic at present; its use can lead only to faulty economic evaluation. A new formula is needed.

The paramount objection to continued use of the present formula is the subject of the balance of my testimony, but an incidental objection is the use of *coupon rates* of interest, rather than *yields* in application of the formula. The 3⅛ percent was calculated by the Treasury Department on the basis of coupon rates. Such rates are a fiction, rarely do securities sell at precisely their coupon rate. Yield, on the other hand, is a measure of the cost of borrowing. If in benefit-cost calculations the cost of borrowing by long term debt is to be determined by the interest rate (which I will argue against), the cost should at least be computed on the basis of bond yields, not coupon rates.

Before proceeding, I should also make clear that the issue of proper interest rates to be used in evaluating the economics of governmentally financed projects, which is the subject of my testimony, should not be confused with the question of what interest rates the government should charge for its various loan programs. The latter issue is beyond the scope of my testimony. I am concerned only with the rates employed in evaluating economic feasibility of public works projects. This is a separate issue and can be discussed most fruitfully in isolation from the heat of controversy which so often surrounds the question of rates charged by the government.

[1] *Policies, Standards and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources*, The President's Water Resources Council, Senate Document No. 97, 87th Congress, 2nd Session, Washington, D.C., May 29, 1962, p. 12.

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I. BACKGROUND

The selection of an appropriate rate has had considerable attention in academic circles for the past several years, and is increasingly recognized as a national issue. As the government sector grows larger in the national economy, and more and more public money is invested, the urgency becomes greater than ever before. Moreover, the new planning and programming approach to budgeting which involves appraisal of alternatives, places a premium on well-founded inputs, one of which is the discount rate at which intertemporal differences are equalized.

One of our national goals is efficiency in the use of our resources. Misunderstanding of government investment projects stems in part from the vagueness of specifying goals of social welfare functions and confusion surrounding means of achieving them. National welfare goals are, of course, manifold. The goal of efficiency, with which I am concerned, involves the maximization of social output over time for any given input of resources. In benefit-cost analysis, decision-makers want to maximize the present value of total benefits less that of total costs. The aim is to achieve an economically efficient allocation of limited resources.

Another, and different, goal might be to minimize the inequality of income distribution among regions or social classes. In the establishment of the Area Redevelopment Agency and its successor, the Economic Development Administration, for example, this objective was quite clear. Not so clear is the tendency for waterway development projects sometimes to be authorized for similar reasons, but clothed in a favorable benefit-cost ratio and ostensibly approved as an economically sound project. Good management requires that even when a goal other other than efficiency is held paramount, the benefits and costs be properly measured so that the true net costs or benefits are known. Economic efficiency may be secondary in considering a particular project, but it may still have a bearing on the method by which the social objective is achieved.

There are any number of goals other than economic efficiency which also might be fostered through public investment in waterways and other forms of intercity or urban transportation. Some, such as the goals of the Northeast Corridor High Speed Ground Transportation Project, the Federal airport and air navigation facility programs, urban transport measures and the supersonic air transport program have been pursued without any real pretense of quantifying economic benefits. Their value has been sensed or appraised by intuitive means, not by formal methods resembling benefit-cost analysis. This approach leaves us in the dark as to the efficiency of expenditures, but we at least understand that we do not have a measure of their efficiency.

As to water resource development projects, on the other hand, we are led to believe that they are approved only upon their economic merit: a benefit-cost ratio is computed for each, and benefits in excess of costs, as estimated by the Corps of Engineers, indicate economic feasibility. But if the benefit-cost analysis is improperly executed, we delude ourselves. An incorrect interest rate contributes to this delusion.

II. THE CRITICAL ROLE OF DISCOUNT/INTEREST RATES IN BENEFIT-COST CALCULATION

Benefit-cost analysis is an administrative technique used to appraise the economic efficiency of a proposed investment project. There are many imponderables in the enumeration and valuation of both benefits and costs, but only the interest rate is of concern here. I shall demonstrate why and how the benefit-cost ratio varies inversely with the discount/interest rate, other things being equal. The policy implication of this relationship is that an inappropriate rate of discount/interest rate will make a project appear to be economically more or less desirable than it really is. A rate that is too low can even mean the difference between a favorable and an unfavorable benefit-cost ratio.

One of the outstanding characteristics of government projects where large physical plants are involved is that benefits and costs accrue in different time patterns. Typically, the period of project life can be divided into two distinct stages. In the earlier period annual costs are normally in excess of benefits and there is an annual loss. Net profit comes, if ever, in the later stage of project life, after use and benefits have had opportunity to build up. The benefit-cost ratio reflects the balance between discounted values of the sum of annual profits and those of annual loss as defined above.

The impacts of discounting upon profit and loss are different. The total sum of annual profit returned in the *later* stage of project life will be discounted more heavily than that of annual loss, which accrues in the *earlier* period. Moreover,

even if the annual flows of benefits and costs over the life of the project are constant, the *discounted* values of benefits and costs vary with the discount/interest rate selected. Because of the timing of net costs and net benefits, discounted benefits shrink at a much faster rate than discounted costs if a higher rate of discount/interest is chosen. This phenomenon is illustrated in Figure 1, at the end of my statement, which shows benefits shrinking faster than costs as the interest/discount rate increases. The top frame shows hypothetical flow of costs and benefits over the life of a project. Construction costs occur early, and costs are peaked before settling down at the level of annual operating and maintenance charges. Benefits commence slowly, and build up over time. These flows are not discounted in the first frame.

In the second frame the benefits and costs have been discounted at interest rate i. Both have shrunk, but the profit (excess of benefits over costs) has shrunk more than loss because it accrues at a more distant time period. In frame 2, the area under the profit curve is still larger than the area under the loss curve, indicating that the benefit-cost ratio is greater than unity.

Frame 3 shows the relationship when a higher discount rate is used, in this case i+1%. Now the profit and loss are equal and the benefit-cost ratio is 1.

The illustration is continued in frame 4, which shows that when discounted at rate i+2%, profits fall below losses and the benefit-cost ratio becomes less than unity. The varying patterns shown in frames 2, 3 and 4 demonstrate that the choice of discount rate does not merely affect the measure of project efficiency. Of even greater importance for decisionmaking in the public sector, it can mean the difference between a favorable and an unfavorable benefit-cost ratio.

Although Figure 1 is hypothetical, the patterns depicted are in themselves not atypical and they apply equally to all investment situations. In effect, Figure 1 is simply a graphic representation of the principles embodied in conventional compound interest tables.

In numeric terms, the effect is as follows: Let us assume that a hypothetical project has a 50-year life. Let us assume further, for the sake of simplicity, that all costs, of whatever nature, amount to $400,000, and that these are all incurred in a single year, the fifth year of project life. Similarly, we will assume that all benefits amount to $400,000, and that these are all incurred in a single year, the fifth year of project life. Similarly, we will assume that all benefits, amounting to $1,000,000, occur in a single year, which we will choose as the 25th year of project life, so as to conform with the usual temporal sequence. If a discount/interest rate of 3⅛ percent is used, the discounted or present value of the benefits is $463,300, and discounted costs amount to $342,960. The resulting benefit-cost ratio is 1.35 to 1.

If, on the other hand, a rate of 5.5 percent were to be used for the same project, the discounted benefits and costs are reduced respectively to $262,200 and $306,050. The benefit-cost ratio is also reduced to 0.86 to 1, indicating that the project will yield a net loss to the economy

It will be noted that in this illustration the switchover point from a favorable to an unfavorable ratio occurred within a rather narrow range of interest rates.

Figure 2, attached, illustrates the inverse relationship between the discount rate and the B/C ratio. In this case, the project which appears feasible when evaluated at 3⅛ percent, is clearly infeasible at rates in excess of 4⅛ percent.

III. AN APPROPRIATE INTEREST/DISCOUNT RATE

It is clear that a benefit-cost calculation is valid only if an appropriate interest rate is used. Scholars have considered at length the question of a proper rate.[2] They are not in complete agreement as to what the rate should be, or by what formula it should be determined. However, I think it is accurate to state that none believes that a rate as low as 3⅛ percent has been adequate for the past decade or more. The concept which finds most support in their writings is that the economically relevant interest rate is the one which measures the opportunity costs of the funds utilized by the project.

The heart of this concept is that any government project must use up economic resources. In the absence of the project, the resources would be left to private investment which would yield a certain amount of real output in the future. The opportunity to invest and earn a certain rate of return for a different use by the *private* sector is foregone as a result of governmental investment. It is a loss to the private sector. This loss is known in economic theory as the opportunity cost of that government project.

[2] See Selected Bibliography attached.

This definition leads us away from the notion that interest cost, or appropriate discount rate is adequately reflected by interest rates on some selected group of government bonds. It states that true cost includes cost of all resources used by government, including those diverted by taxation from use in the private sector. There is a lack of unanimity among economists as to the specific value of this social cost, largely as a consequency of the practical problems of measurement, but I am aware of no one who argues that it is much below 5 percent at present.

Characteristics of the Appropriate Rate

The appropriate rate of interest/discount has several characteristics. First, it measures the *true* opportunity cost of any government project. If it is used, the same degree of economic efficiency will be achieved from the allocation of resources to the public sector as would otherwise be attained from their use in the private sector. Thus, the social goal of efficiency is satisfied.

Secondly, it is not arbitrarily selected. A rate linked to other and more limited criteria, for example, the coupon rate or yields on long-term government debt, ignores the fact that a large part of the funds to be invested by government are raised through taxation, which involves different costs to different taxpayers.

Third, it is a weighted average, reflecting time preference and expected rates of return from investment of *all* taxpayers.

Cost to Society

Departure from the appropriate interest/discount rate necessarily results in an inefficient allocation of resources. In addition to violating the social goal of allocative efficiency, use of the wrong interest/discount rate conflicts with advances made in the past several years in defense management. Principles pioneered in the Defense Department focus mainly on cost-effectiveness. The application of this management technique to all Federal budget divisions is now being extended to other agencies through program budgeting.

As indicated earlier, there may be good reason for pursuing programs for reasons other than economic efficiency, but this does not relieve the Government of the need to know the true economic cost, nor is it reason to distort analyses of true cost.

IV. CONCLUSIONS

In evaluating government projects the social goal should be unequivocally understood. A principal goal, as I see it, is to achieve an optimal allocation of our limited resources. I believe that if a project is designed to serve other purposes at the expense of economic efficiency, it should be authorized explicitly in terms of those other goals.

To avoid distortions in the benefit-cost calculation an appropriate interest/discount rate should be calculated on the basis of the opportunity cost principle. In the current situation it probably is in excess of 5 percent. Use of a rate below this range will only permit skim milk to masquerade as cream. The present practice is not only economically indefensible but it is also incompatible with our political and social philosophy. For these reasons the interest/discount rate issue requires review.

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Figure 1

TIME FRAMEWORK OF BENEFIT/COST ANALYSIS

Impact of Discounting is More Severe for Benefits than Costs

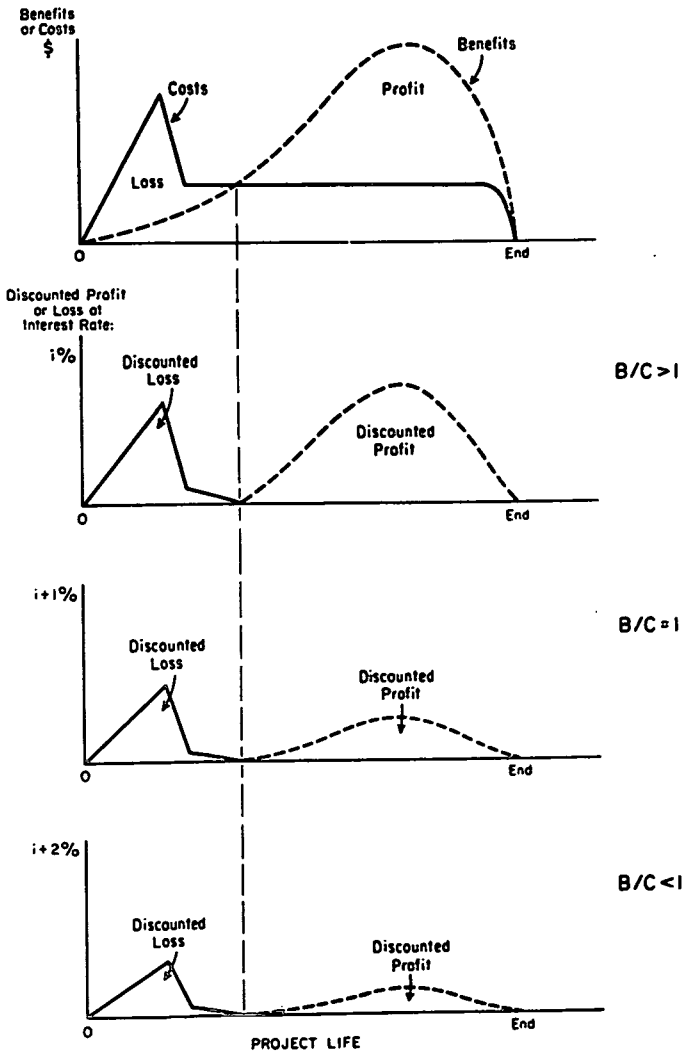
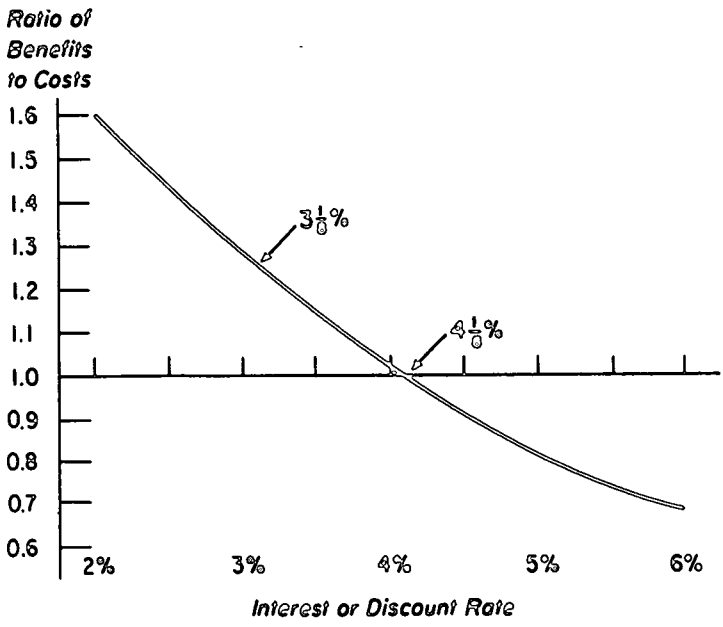


Figure 2

Estimated Benefit - Cost Ratios At Various Interest Rates



APPENDIX 2

The following article was referred to in the text, page 101.

PROGRAM BUDGETING IN WISCONSIN [1]

By JOHN W. REYNOLDS and WALTER G. HOLLANDER

The enactment last June of a short, simple bill signaled the green light for Wisconsin to take a giant stride toward achieving a major improvement in state budgeting.

The measure was entitled simply *A bill relating to the development of program budgeting.* To a casual reader, it effected what might be considered a few minor technical changes in the state budget law. Its key section merely amended the law specifying the format of budget bills and appropriation requests by adding the words ". . . or other meaningful classifications."

But the significance of this small amendment is large. It means that budget requests and appropriations no longer will have to be divided into objects lines, i.e., personal services, materials and expense and capital—the things that are purchased. Rather, they will be broken down into the services that are to be performed and the programs to be carried out.

This does not imply we are going to eliminate all use of detailed items of expenditure. It does mean, however, that we will have the flexibility necessary to separate those items of cost detail which are important to administrators in evaluating and controlling the efficiency of their operations from those cost groupings necessary for program policy decisions which determine the nature and scope of state services.

Passage of the bill formalized the legislature's endorsement of program budgeting and propelled the state budget office (the Bureau of Management in the Department of Administration) into the final stage of its previously quiet, but determined, drive to implement this modern budgeting concept. Plans have now been completed to recast the 1965–67 biennial budget into a totally new format—with both agency requests and legislative appropriations to be structured along well defined program lines. The entire project is being done without any outside consulting assistance—a unique situation among the few states that have introduced this modern budgeting concept.

The success of these efforts, we believe, is a remarkable achievement in executive-legislative cooperation, especially because it developed and took place during a period of partisan division between the two branches.

The objectives of program budgeting—to assist policy-makers more easily to weigh the alternatives available—are in no way related to partisan ideologies or to the relative balance of power between executive and legislature. But nearly all legislative measures stand the chance of being caught up in these conflicts. Fortunately, in Wisconsin, the adoption of program budgeting did not.

How did it happen? How will Wisconsin's budget look in program form? Why do we think program budgeting is important for Wisconsin and where do we think it will lead the state? Those are the questions we hope to answer in this article. The answers should provoke thoughtful discussion and consideration of this new budgeting method, not only among government administrators and in the academic community, but also by elected policy makers in other states, and in local governments.

[1] In this article Governor John W. Reynolds of Wisconsin and Walter G. Hollander, Senate Co-Chairman of the Legislature's Joint Committee on Finance, describe the development and character of a new approach to budgeting in their state: budgeting in terms of the basic purposes of government—services to be performed and programs to be carried out. The new departure, the result of bipartisan cooperation of the executive and the legislature, has been authorized by legislation of 1964. This followed a series of carefully devised preparatory steps taken in the preceding five years. In the authors' judgment, an impressive series of benefits is to be expected from the new system—above all, better-informed planning and decision making for the provision of state services to the people.

What Program Budgeting Is

Before seeking to answer the questions, however, it is pertinent to look briefly at the concept of program budgeting and its objectives. The term itself is somewhat forbidding to the uninitiated. What we understand it to mean is simply the casting of budget requests and appropriations into groupings on the basis of the services performed and for whom they are carried out, i.e., what is done and for whom it is done. Thus, in the Department of Public Welfare we have, as separate programs, mental health services, correctional services and family services. These describe what is done and for whom it is done. A more detailed description of the program definitions will be given later. The important thing, though, is that they describe what programs the Department of Public Welfare carries on in those areas. The dollars requested or spent in each of these areas can be weighed against the results achieved. This is certainly far more significant than determining whether an agency should be authorized another clerk, or a new typewriter, or a trip to a professional conference by a staff member.

We are not sure who originated the idea of structuring the budget and appropriations according to the programs that are to be carried out. We do know, however, that it was the highly respected Hoover Commission which, on the federal level at least, first used the term and defined its use. Its Task Force Report on Fiscal, Budgeting and Accounting Activities said that "a program or performance budget should be substituted for the present budget, thus presenting . . . expenditure requirements in terms of services, activities and work projects rather than in terms of the things bought. Such a budget would not detract from congressional responsibility and should greatly improve and expedite committee consideration."

Some confusion has apparently occurred because of the introduction of the term "performance" or "program and performance" in connection with program budgeting. They are often used interchangeably, as seen above in the Hoover Commission report. Here in Wisconsin we refer simply to program budgeting. However, we plan to introduce new techniques of performance measurement which will help administrators, the Governor and the legislature to evaluate programs better and to make more meaningful budget policy decisions. These performance measurement techniques, in our view, are not an integral part of program budgeting, but they do evolve logically out of it and enhance the entire budgeting system.

How it Happened in Wisconsin

As all experienced political practitioners are aware, major revision of a state's budgeting system does not just happen. Resistance to change in the way of doing things is one of the great stumbling blocks to any kind of major improvement in the management of government services. This fear of change exists among politicians as well as government administrators and employees. Indeed, the various interest groups which often exert strong influence on policies and practices frequently collaborate to maintain the status quo.

Breaking down this resistance to change, dissolving the fear that program budgeting would mean loss of control over expenditures, and educating the various interests to the meaning and advantages of this new system did not occur overnight. In fact, this process began in Wisconsin nearly six years ago.

INITIAL STEPS

The first step was in the conversion to program budgeting of one major department—Conservation—in 1959. Financed through a segregated fund, and receiving less strict scrutiny than general fund agency budgets, this proved to be an acceptable department with which to experiment in using the new format. The Conservation Department cooperated willingly, and the interest expressed by legislators was sincere, if not enthusiastic.

This was followed in 1961 by the conversion of the Motor Vehicle Department to a program budget—again, an agency financed through a segregated fund. But that year the Board of Health was also switched over to a program budget—the first agency funded by general purpose revenues to come under the new system.

In the meantime, in 1960, the Governor had invited a group of business executives to study the state's administrative practices and make recommendations for improvement. This group split into several task forces. To each task force was assigned an administrative analyst from the state budget office. The task force on budgeting, which had an opportunity to compare the old budgeting methods with the new formats that were being developed for the Conservation

and Motor Vehicle Departments and the Board of Health, recommended strongly that the state convert all agencies to program budgets.

In 1962 a legislative interim committee, charged with finding ways for improving efficiency and economy in government, recommended that we convert to program budgeting on a gradual basis. Early in 1964, a citizen's committee appointed by the legislature to examine expenditures and administrative practices enthusiastically endorsed the work that had been done toward conversion to program budgeting and urged speedy adoption of this new method.

The endorsement of program budgeting by these groups and the support they lent were major mileposts in Wisconsin's journey toward full implementation of program budgeting.

UNDERLYING CONSIDERATIONS

All during this same period, there was a growing awareness among individual legislators, especially the members of the Legislature's Joint Committee on Finance, that the old methods of budget review were no longer workable. While some of them understandably harbored reservations about the idea of a complete revision of Wisconsin's budget practices, many became convinced that such a step would soon be imperative. They had applauded the work of the budget office, which over the several previous biennia had considerably improved the budget document and its explanatory material. They were also impressed by the support shown for the idea by impartial citizen and taxpayer groups.

Still another factor was developing during this same period which strongly influenced legislative thinking. Over the past decade, Wisconsin's budget, like those in nearly all other states, expanded considerably, due almost entirely to rising school enrollments, increasing demands on higher education and more expensive health and welfare treatment and rehabilitation programs. Citizens expected and were being provided more state services than ever before. The trend began shortly after World War II, but was intensified as the effect of the postwar baby boom made itself apparent in the middle 1950's. As a result of these developments, state budgets grew, not only in the level of expenditures, but also in the volume and complexity of the detailed material needing review.

ASSIGNMENT TO DEPARTMENT OF ADMINISTRATION

Because of the frustration of trying to comprehend the budget and make meaningful policy decisions in the face of this growth and complexity, the Finance Committee members decided that something had to be done to lighten their burden and make their task more purposeful. At this point, in the fall of 1963, both the Governor and the Joint Finance Committee asked that the Department of Administration take the necessary steps to proceed with full implementation of program budgeting for the 1965–67 biennium. In his directive to the Department of Administration, the Governor said:

"The recent budget session pointed out the potential for improved methods of evaluating the costs and alternatives of State government services. Many legislators have indicated a desire for a budget which clearly identifies state services and the costs, and which promotes selection of alternative program service possibilities. In addition, interested civic groups, newspaper reporters and editorial writers, and many private citizens seek the policy implicit in our present budget figures, but frequently seek in vain. What is needed is fiscal data which explains, by program, the services provided by state government."

The Joint Finance Committee in a letter to the department pointed out that "* * * When an agency presents its budget to the committee in terms of its proposed contribution to the State of Wisconsin, the Joint Committee is then able to make the most meaningful policy recommendation in terms of the wishes of the elected representatives of the people. Therefore, * * * we urge the Department of Administration to take the necessary steps to implement program planning and budgeting for all state agencies."

FRUITION IN 1964

Armed with these directives, the Department of Administration proceeded with an all-out effort to develop a meaningful budget format that would achieve the desired objective—to define agency programs in a way that would clearly spell out the services provided and which would facilitate more meaningful budget policy decisions by administrators, the Governor and the legislature.

To accomplish this, and to help all parties involved to understand the new concept better, agency administrators were asked to prepare program formats

(with necessary subdivisions) for their entire operations. When these were agreed upon with the Department of Administration, the existing appropriations (for 1963–65) were recast into the new format. A complete prototype program budget was developed for seven separate departments. Another document was prepared, showing the program breakdown for all state agencies. These were presented to the Governor and Joint Finance Committee. For both the Governor and the committee this was the first substantive description of what had been talked about for a long time. Both endorsed the proposals enthusiastically. A short time later the program budget bill was passed.

We are now engaged in the final phase of the conversion. New forms have been developed and new instructions prepared. Agencies are currently in the process of developing their 1965–67 budget requests on a program basis.

KEY FACTORS FOR SUCCESS

The most significant things which contributed to the success of this effort to convert to program budgeting in Wisconsin were these: (1) the budget office established a channel of open communication with the legislative appropriation committee, based on mutual respect and trust; (2) the Governor showed genuine interest and gave vital support to the project; (3) the support of outside groups was gained by factual, straightforward explanations of the methods, objectives and benefits of program budgeting; (4) a group of highly trained, competent budget personnel was able to translate the professional jargon of program budgeting into terms which could be understood by the decision makers—the Governor and the legislature; (5) awareness grew that budget methods established in another era no longer were sufficient for today's needs.

The Program Budget Format

What will Wisconsin's program budget look like, and how will it improve the budget process?

Briefly the budget will simply divide each agency's total operations into major components of services—programs. This is the level on which appropriations will be made. In the budget document, and in supporting material, each of these programs will be broken down into sub-programs and activities. Following the "what for whom" rationale noted earlier, which is the basis for the major program, each sub-program will describe this relationship more specifically.

For example, using again the Department of Public Welfare, following are the sub-programs that fall under the major program of family services:

A. Family Services Administration
B. Child Welfare Services
C. Services to the Blind
D. Services to the Aged
E. Aid to the Disabled
F. Special Aids to Local Units of Government
G. Aids to Individuals

These sub-programs describe what aspect of family services are to be provided to each group being served.

The remaining breakdown—by activity—answers the question "how?": i.e., who, or by what administrative techniques will the group be served? Thus, under Child Welfare Services, we have the following activities:

1. Child Center (institution for emotionally disturbed, dependent and neglected children).
2. Boarding Home Care for Foster Children.
3. Special Projects
4. Aid to Dependent Children
5. Licensing and Direct Services
6. Community and County Services

In the budget document, each of these programs, sub-programs and activities will be described in narrative form, and data will be presented showing the level of service and results of the component parts. The requested budget will be portrayed in terms of what change, if any, is proposed in the level of accomplishment.

Another important feature of the new budgeting method is the "total funds" concept. Under it the programs will be structured not according to the source of funds which finance them, but according to the services to be provided. This will eliminate the great fragmentation which has characterized Wisconsin's budgets up

to now. It will enable the Governor and legislature to review programs for their relative worth and accomplishment, irrespective of whether they are financed by general purpose revenues, agency receipts, segregated revenues or federal funds.

A new form has been developed which will serve as the primary tool in analyzing why and in what ways a proposed program will change in cost from one fiscal period to the next. Essentially, this form will categorize each of the factors which contribute to a change, up or down, in the proposed level of expenditure. It will also help to identify the change in the number of people served or in the kind and quality of services provided. Use of this technique will largely eliminate excessive reliance on objects of expenditure, which could only vaguely and often inaccurately be related to proposed accomplishment.

Expected Results

We believe this new method of constructing budgets will produce several very important results. First of all, it will help agency administrators to carry out their budget preparation on the basis of what they hope to accomplish. Thus it will serve both as a tool for reviewing the efficiency of existing operations and their results, and also as a basis for planning future services.

A second important result, we believe, will be a substantial upgrading of the budget decision-making process. In the budget process, the Governor proposes and the legislature establishes state policy. Previously, there has been no good way for these policy decisions to be formulated. The Governor and legislature were asked to determine, simply, *what is to be bought*—in terms of personnel, services and goods. They were forced to transcribe these data into their own concepts of service level. Now they will be asked to decide first *what is to be done*—what services are to be provided to whom and at what level, and the data will be uniform for both. These significant policy decisions can only be made if the Governor and legislature are given information on a basis which encourages such decisions.

A third benefit will be a substantial improvement in the ease with which the public can comprehend, and therefore appraise, responsible government. This is very important, for only if interested citizens are able to know and understand what government is doing can they intelligently judge its value and effectiveness.

The Future of Budgeting in Wisconsin

We believe that the introduction of program budgeting will have an important effect on the quality of budget preparation and planning, and will improve the basis for sound decision making by elected policy makers. Because the programs will be structured according to the groups they serve, and will encompass the funds derived from all sources, a much more comprehensive review of the budget requests will be possible and program policy alternatives will be more readily discernible.

Where do we go from here? In a directive to the department heads, describing how the state would proceed with the implementation of program budgeting, the Governor outlined a three-part program to improve financial administration.

1. Budgets stated in terms of services to the people in order to present fiscal policies in the context of services to be accomplished.
2. Criteria to measure the cost of state services and the performance of state agencies in providing these services.
3. Organization for long-range fiscal planning to establish state goals and institute plans to achieve those goals.

The first part of the three, of course, is the implementation of program budgeting. The other two, we believe, are made possible by program budgeting and follow logically from it. Development of unit costs and yardsticks to measure the performance of state agency operations is feasible only if these operations are divided into meaningful units. The programs, with their respective subdivisions, fit very neatly into this requirement. Thus, unit cost data and performance measurement will both evolve out of and also build on the essential foundation—program budgeting.

Long-range fiscal planning and the establishment of goals for future programs is a second logical outgrowth of program budgeting. The natural extension of this, in turn, is the development of better departmental program plans and the synthesis of these plans into broad functional plans. These plans, because they are based on the programs, will further strengthen and unify the budget process.

When these things are accomplished, state government operations will not only be much more comprehensible; there will be a meaningful basis and systematic techniques for planning, reviewing, modifiying and carrying out state programs. This, we think, will help both the Governor and the legislature to weigh the value and effectiveness of state government, and to balance and decide upon the essential policy alternatives available to them. It will also help interested citizens to understand and evaluate the services their state government provides.

Program budgeting is not a panacea. Neither are performance measurement and long-range fiscal and program planning. They will not, by themselves, hold down budget levels or provide better service. But if used properly they will promote better planning and better decision making.

Such a program will not only make state government more efficient, but also more responsible to the needs and wishes of the people it serves—a prime objective to all those who are interested in democratic government.

As elected representatives of opposing political beliefs, and serving two separate branches of state government, we are proud of the way in which our forces united to accomplish this significant improvement for Wisconsin.

The following material is included in the record at the request of Chairman Proxmire:

OCTOBER 10, 1967.

Hon. WALTER G. HOLLANDER,
Senate Chairman, Joint Committee on Finance,
Madison, Wis.

DEAR WALTER: I am delighted to learn that both you and Chairman Wackett, as co-chairmen of the Joint Committee on Finance of the Legislature, support the presentation made by Mr. Warren Exo to this Committee on Planning-Programming-Budgeting procedures and their use in Wisconsin.

Your observations will be most helpful to our Subcommittee on Economy in Government, and I have asked the staff to insert your supporting letter in the published record of the hearings at the appropriate point.

I am delighted to see Wisconsin in this and in other fields as among the pioneers, and I hope that other states follow your good example.

Sincerely,

WILLIAM PROXMIRE, *Chairman.*

OCTOBER 10, 1967.

Hon. BYRON F. WACKETT,
Assembly Chairman, Joint Committee on Finance,
Madison, Wis.

DEAR BYRON: I am delighted to learn that both you and Chairman Hollander, as co-chairmen of the Joint Committee on Finance of the Legislature, support the presentation made by Mr. Warren Exo to this Committee on Planning-Programming-Budgeting procedures and their use in Wisconsin.

Your observations will be most helpful to our Subcommittee on Economy in Government, and I have asked the staff to insert your supporting letter in the published record of the hearings at the appropriate point.

I am delighted to see Wisconsin in this and in other fields as among the pioneers, and I hope that other states follow your good example.

Sincerely,

WILLIAM PROXMIRE, *Chairman.*

WISCONSIN LEGISLATURE,
JOINT COMMITTEE ON FINANCE,
Madison, October 5, 1967.

Hon. WILLIAM PROXMIRE,
Chairman, Joint Economic Committee,
Washington, D.C.

DEAR SENATOR PROXMIRE: We have learned that on September 19, 1967, Mr. Warren Exo, a representative of the Wisconsin State Department of Administration, appeared before the Sub-committee on Economy in Government. Exo discussed the general development of a planning, programming and budgeting process in our state and specific instances where this system has been applied to the decision-making process in Wisconsin.

As co-chairmen of the Joint Committee on Finance, we would like to take this opportunity to support Mr. Exo's statements with respect to the benefits to be realized from the planning, programming and budgeting process. In our experience, the program budget framework has significantly improved the departmental, executive and legislative decision-making process. Specifically, we believe that program budgeting—

(1) Provides legislative decisionmakers with an improved understanding of issues and alternative courses of action which are open;

(2) Better enables legislators to review existing policies and to make comprehensive policy decisions to meet state needs;

(3) Focuses decisionmakers' attention on the service goals of state programs; and

(4) Provides legislators with a method to monitor programs and judge how effectively program objectives have been achieved.

Our committee has twice considered biennial budgets presented within the program budgeting framework. This presentation has helped the committee and the legislature to understand and more clearly focus on the critical policy issues. The program budget format has increased our understanding of and improved our ability to make choices between alternative courses of action. In addition, this clarification of issues and alternatives has had a positive affect on the ability of our state's citizens to comprehend and to participate in the budget process.

The new budgeting system has challenged several of our legislative traditions. However, the adjustments in our thinking and our procedures, which were made necessary by the introduction of program budgeting, have modernized and strengthened the legislative process. The planning, programming and budgeting process does not guarantee solutions, but it does provide an improved mechanism for both executive and legislative decisionmaking.

We believe that such budget decisionmaking system, when fully developed, will not only make state government more efficient, but also more responsive to the needs and wishes of the people it serves. While the difficulties in implementing a planning, programming and budgeting system should not be underestimated, as legislators we believe that if the system is properly used it will promote better decisionmaking and improved state services.

Respectfully,

WALTER G. HOLLANDER,
Senate Chairman.
BYRON F. WACKETT,
Assembly Chairman.

[From Green Bay Press Gazette, Dec. 21, 1966]

WISCONSIN REPORT

STATE BUDGET REFORM AIDS UNDERSTANDING OF EXPENSE

(By John Wyngaard)

MADISON.—The state budget story as it is being told in daily dispatches from the state capitol is a gloomy one for those citizens who regard their tax obligations as already high. To the critical, it may appear that the unceasing pleas for heavily increased spending powers by the endless number of agencies is unreasonable in view of their private financial circumstances. If there is any general consolation available, it lies in the fact that the story in Wisconsin is not unique.

There is financial trouble everywhere in the country, in the big city halls, perhaps, even more critically than in most of the state houses. Wisconsin has a tradition of liberal governmental service and, doubtless, a tradition of taxpaying patience that stands out among the state communities of the land also.

Yet there are some comforts for those who would recognize them. It can be said, for example, that the budget-making process in Wisconsin today is more careful and deliberate than ever before in its history, and very likely, superior to that of most cities and most states. Almost surely it is more careful and prudent than that of the national government where budget-making is virtually incomprehensible to the interested citizen.

Reform in Methods

A little publicized reform in state government in recent times has been the total revision of the budgeting method.

The declared purpose was to make the business of managing the public's tax dollars more intelligible to legislatures and the public and to provide more effective supervision over the appetites of the thousands of administrative officers. The improvements were the result of long and patient work by a group of professional budget officers in the Department of Administration, among whom Wayne McGown, the present head of the bureau of management, was one of the most effective.

The new Department of Administration is not yet willingly accepted as a fiscal housekeeper by many of the operating services. There remains a good deal of resentment from officers who remember earlier times when they had their own way without much supervision. They cannot quite accustom themselves to outside controls and advice.

The merit of internal conflicts aside, the all-important process of distributing state funds in appropriation laws is now more refined and accurate and most of all, understandable, than ever before. The most untrained legislator, the greenest statehouse reporter, no longer has any excuse for failing to comprehend. It is clearly set out for all to see who want to see.

Example of Operations

As a result, the budget hearings have become a kind of short course in state government operations.

Once they were great blurs consisting largely of self-serving speeches by the bureaucrats and publicity thrusts by the elected politicians. Reporters figured out the bulky document on their own account, and their resources were typically inadequate. Today they can determine at a glance what the program is costing, what is being done, what the unavoidable increases will be, and the price of requested enlargement or improvement of services.

Most department heads have accommodated themselves to the challenge of more explicit and documented arguments. Some have been indifferent. They included may of those who are also regarded as the less effective leaders of their services. To single out an example at random, the performance of Commissioner James Karns of the Motor Vehicle Department before Gov. Knowles a few days ago was a model of exposition and clarity of explanation of a huge department that touches the interest of virtually every citizen. Wisconsin may be spending too much or too little, taxing too much or at a reasonable level. But for the first time in modern history, perhaps the men chosen to make such decisions are in a position to know precisely what they are doing.

APPENDIX 3

(The articles in this appendix are referred to in the text of the hearings, p. 210.)

A NOTE ON SUPPLEMENTAL APPROPRIATIONS IN THE FEDERAL BUDGETARY PROCESS (1) *

By

Gary W. Bowman, Otto A. Davis, Henry J. Gailliot, and Alan C. Hess

1. Introduction:

The sources of funds for the agencies of the United States Government are two distinct types of appropriations. The regular appropriations associated with the annual budget are the largest source. Other appropriations, which are usually made during the current fiscal year, are called supplementals. In two recent papers [1, 2] Davis, Dempster and Wildavsky studied the process by which regular appropriations are allocated to over one half of the non-defense agencies of the Federal Government. The research reported here concerns supplemental appropriations.

The second section briefly summarizes the relevant aspects of the Davis-Dempster-Wildavsky papers. Section 3 presents several alternative behavioral models, which are based upon micro considerations, of the process of making supplemental appropriations. The empirical tests and results for these models are reported in section 4. Two additional models which reflect macro considerations, along with an indication of the empirical results, are discussed in section 5. A final section reports conclusions.

2. Relevant Aspects of the Davis-Dempster-Wildavsky Papers:

In Davis, Dempster and Wildavsky [1, 2] it is reported that one of three simple linear equations describes the relation between the regular appropriation requested by the Bureau of the Budget for any particular agency and the final Congressional appropriation for that agency. (2) Let y_t represent the actual regular appropriation for some given agency in the tth year and let x_t represent the requested appropriation for the same agency for the tth year. Then the

*Reprint No. 303, Graduate School of Industrial Administration, Carnegie Institute of Technology, Pittsburgh, Pa. 1967.

alternative behavioral equations are

$$(2.1) \quad y_t = a_o x_t + \eta_t$$

$$(2.2) \quad y_t = a_1 x_t + a_2 v_{t-1} + \varepsilon_t$$

$$(2.3) \quad y_t = a_3 x_t + a_4 \lambda_t + \delta_t$$

where the a's are coefficients to be estimated; η_t, ε_t, and δ_t are stochastic disturbances which are assumed to be serially independent with finite variance and zero expectation; v_{t-1} is a stochastic component generated according to the first order Markov scheme

$$(2.4) \quad v_t = a_2 v_{t-1} + \varepsilon_t$$

and λ_t is a dummy variable representing that portion of the agency's request x_t which is not based upon the previous appropriation y_{t-1}. For some given agency, the selection of the particular equation best representing Congressional behavior is based upon certain criteria which are applied to empirical estimations from existing data.

One criticism of the Davis-Dempster-Wildavsky papers [1, 2] is that supplemental appropriations, which might be an integral part of the allocative process, are not considered. One of the purposes of this study is to determine whether such a criticism is valid. It will be seen that some of the models reported below are related to those of the Davis-Dempster-Wildavsky papers so that an assessment of this criticism is made possible.

3. Micro Models for the Granting of Supplemental Appropriations:

Four basic conditions, all involving micro considerations, are distinguished. Each of these conditions implies an alternate model. The conditions and the associated models are discussed below.

Imagine first that the Congress usually anticipates giving some specified agency a part of its annual appropriation in the form of a supplemental. In this instance, supplemental appropriations are given to the specified agency nearly every year. Since it is obvious that some agencies satisfy this condition, one may add richness to the model by postulating that, at least up to a random error, the Congress tends to grant relatively large supplementals when it has given the agency a smaller regular appropriation than might be expected on the basis of its past behavior. Correspondingly, Congress might tend to give relatively small supplementals when it has granted

the agency a larger appropriation than past behavior would lead one to expect. In order to formalize this hypothesis, consider the following definitions.

s_{it}: The supplemental appropriation for the ith agency in year t.

m_{it}: The estimated residual for the tth year for the one of (2.1, 2.2, or 2.3) selected in the Davis-Dempster-Wildavsky study to best represent Congressional behavior in granting regular appropriations to the ith agency.

The above hypothesis implies a negative correlation between s_{it}, the supplemental appropriation, and m_{it}, the estimated residual. The behavioral equation for this model is

$$(3.1) \quad s_{it} = \beta_{io} + \beta_{i1} m_{it} + e_{it}$$

where β_{io} is a constant, β_{i1} is an unknown coefficient, and e_{it} is a stochastic disturbance which is assumed serially independent with a finite variance and zero expectation. Note that in this formulation the constant β_{io} represents the "usual" or the "expected" supplemental appropriation for the ith agency if there is no trend. Also observe that $\beta_{i1} < 0$ is anticipated. Finally, observe that this model can be slightly refined by removing any time trend (if there is one) from the supplemental appropriations since the interest here is in explaining deviations from "expected" supplementals whether or not this value rises or falls over time. For reasons made clear in section 4, this modification was not accomplished.

The second situation applies to an agency which receives a supplemental appropriation only after it has suffered a large cut in what otherwise might be expected to be its regular appropriation. This condition could be expected to occur only infrequently, probably less than two years out of three. Further, there should be a negative correlation between supplementals and the residuals of the appropriate equation from (2.1, 2.2, or 2.3) above which relate regular appropriations to agency requests. Consider the following definition.

R_{it}: The value of the estimated residual in the tth year for the equation selected from (2.1, 2.2, or 2.3) to be the one best representing Congressional behavior in granting regular appropriations to the ith agency if that residual

is less than or equal to K (a constant) and zero otherwise.

One expects R_{it} to be negatively correlated with the supplemental appropriations s_{it}. The behavioral equation for this model is

$$(3.2) \quad s_{it} = \beta_{i2} + \beta_{i3} R_{it} + \phi_{it}$$

where β_{i2} is an unknown constant, β_{i3} represents the unknown coefficient, and ϕ_{it} is a stochastic disturbance. Note that $\beta_{i3} < 0$ is expected. Observe that one might interpret this model as Congress correcting its own behavior by granting supplemental appropriation.

The third condition or situation applies when an agency has planned so badly that it runs out of funds necessary for the operation of its on-going programs. Consequently, if these programs are not to come to a halt, the agency has to request and the Congress has to grant a supplemental appropriation. In the following year one can expect that the agency will take this situation into account and "pad" the request for its regular appropriation in order to help insure that it will not again run out of funds. On the other hand, one can also expect the Congress to attempt to teach the agency a lesson with the only real weapon at hand by appropriating a sum which represents an unusually large cut in the agency's request. In other words, the agency's appropriation for the following year $y_{i,\,t+1}$ should be below the value predicted from the appropriate equation from (2.1, 2.2, or 2.3) above so that the estimated residual for that year $m_{i,\,t+1}$ should be larger (negatively) than usual. If this situation is repeated many times, one should observe a negative correlation between supplemental appropriations s_{it} in the tth year and the estimated residuals $m_{i,\,t+1}$ for the following year. These notions are formalized in the behavioral equation

$$(3.3) \quad m_{i,\,t+1} = \beta_{i4} + \beta_{i5} s_{it} + u_{it}$$

where β_{i4} is an unknown constant (possibly zero), β_{i5} is an unknown coefficient, and u_{it} is a stochastic disturbance. Note that $\beta_{i5} < 0$ is anticipated.

The final condition involving micro considerations consists of situations in which supplemental appropriations could be given for a number of reasons. These reasons may be eminently sensible or rational to anyone with knowledge of the context in which the supplemental appropriations were made. Yet, to an outside observer without such knowledge these appropriations may be viewed as nothing more than a random variable. Two examples may make this

point more clear. Consider an agency such as the Forest Service. One of its activities is fighting forest fires, which certainly are more likely to occur during periods of dry weather. This Agency could either omit a provision for this activity in its annual budget and cover the necessary expenditures with supplemental appropriations, or it could make a provision and only have to make a recourse to supplemental appropriations in exceptionally dry years. In either event, of course, the supplementals would appear to be similar to a random variable to an outside observer without knowledge of the situation. As another example, consider the start of a new program. There is no reason for this new program necessarily to be begun through the regular budgetary process. Supplemental appropriations are often used for such a purpose. Again, to an outside observer such supplementals can be viewed as a random variable. The behavioral equation for this model takes the particularly simple form

$$(3.4) \qquad s_{it} = \beta_{i6} + \psi_{it}$$

where β_{i6} is an unknown constant and ψ_{it} is a stochastic disturbance. Note that in this instance the unknown constant is interpreted as the smallest supplemental appropriation which the agency can be granted so that $\beta_{i6} = 0$ is usually to be anticipated. Also observe that the restriction $\psi_{it} \geq 0$ is necessary here since negative supplementals are not allowed.

4. A Summary of the Empirical Results:

It is now necessary to discuss briefly the method for selecting from the alternate models that particular one which seems to best represent Congressional behavior in the granting of supplemental appropriations for some given agency. Note that, aside from the difference in the frequency with which supplementals are given, models (3.1) and (3.2) share similar features. If one ignores for a moment the subtle characteristics of the definition of R_{it}, both of these models predict a negative correlation between the supplementals s_{it} and the residuals m_{it} for the corresponding year. Accordingly, it is appropriate, at least in initial stages of investigation, to treat these models as one and try to determine whether it, (3.3) or (3.4) best represents Congressional behavior.

Now observe that while the combined model (3.1 and 3.2) predicts a negative correlation between the supplementals s_{it} and the residuals m_{it} for the corresponding year, model (3.3) anticipates a negative correlation between the supplementals s_{it} and the residuals $m_{i,t+1}$ for the following year. Model (3.4) predicts no such correlation.

Accordingly, one might examine the statistics associated with the regression equation

$$(4.1) \quad s_{it} = \beta_{i7} + \beta_{i8}\, m_{it} + \beta_{i9}\, m_{i,t+1} + \varkappa_{it}$$

where the β's represent a constant or the coefficients and $\varkappa_{it}$ is a stochastic disturbance. Then if neither of the coefficients (β_{i8} or β_{i9}) are significantly different from zero in the desired direction at a prescribed level of confidence, one must presume that (3.4) obtains. Otherwise, the combined model or (3.3) should be selected depending upon which of the coefficients was most significantly different from zero. An alternative procedure is to fit (3.1) and (3.3) separately and to use the same selection criteria with the fit for (3.1) representing the combined model (3.1 and 3.2). Both of these procedures were followed in the empirical work with very similar results in each instance, but for reasons of brevity only the results of the latter method are reported below. (3)

Consider estimating a simple regression on pairs of data obtained by making independent draws from a specified probability distribution. Since the draws are independent, the variables are truly uncorrelated. Yet, if this experiment were conducted repeatedly, one should expect to obtain significance at the 10 percent level 10 percent of the time, significance at the 25 percent level 25 percent of the time, etc. Figure 1 represents the expected results, in terms of the significance of the computed t statistic of the coefficient, for 80 repetitions of this experiment. The first bar indicates the expected number of computed t statistics which should be significant at the 100 percent level but not the 90 percent level; the second bar shows the corresponding number significant at the 90 percent level but not the 80 percent level; etc. Each bar contains 10 percent -- i.e., 8 -- of the total number.

Figure 2 is a histogram analogous to Figure 1 except that it reports the actual number of computed t statistics in each class which resulted from estimating the indicated regression coefficients from the data on supplemental appropriations and the appropriate residuals. Note the similarity of the two figures. A chi square goodness of fit test indicates that the two histograms are not significantly different at the 30 percent level.

It should be pointed out that the histograms were compiled without regard to the signs of the coefficients. In fact, the signs are important. In the empirical results there were 33 negative coefficients and 47 positive ones. Using the normal approximation to the binomial and a null hypothesis that positive and negative

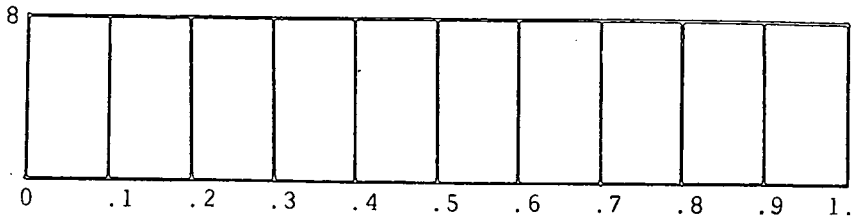


Figure 1

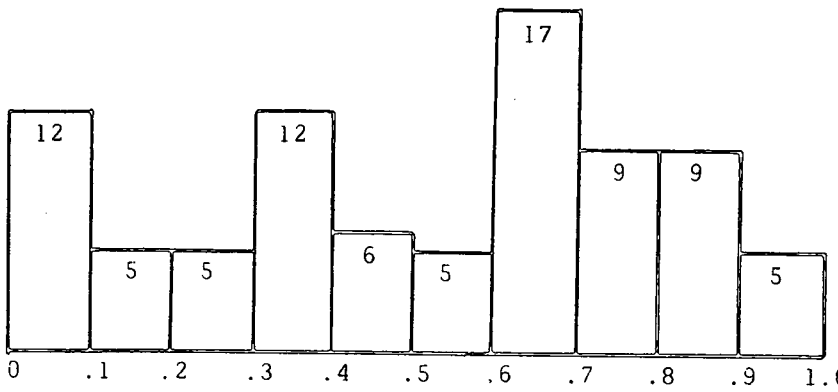


Figure 2

coefficients are equally likely, one cannot reject the null hypothesis at the 10 percent level of significance. In short, the evidence seems to support the notion that supplemental appropriations are not related to the residuals of the equations representing Congressional behavior in the granting of regular appropriations. The evidence indicates that (3.4) is the most appropriate of the models presented in section 3 to represent Congressional behavior in the granting of supplemental appropriations. Model (3.4), on the other hand, merely indicates that the factors affecting supplemental appropriations are statistically independent of those influencing the process through which regular appropriations are made. This result is obtained whether or not an individual agency usually receives an annual supplemental.

5. Macro Considerations and the Granting of Supplementals:

The conclusions of the previous section do not imply, of course, that the only factors affecting supplemental appropriations are specific to individual agencies. It may be that over-all, or macro, considerations help to determine the conditions under which these appropriations are granted so that supplementals may be given more freely in some years than others. In order to explore this possibility, two models were formulated and tested.

Suppose first that the Congressional decision-makers desire for the Federal Government to operate at neither a "profit" nor a "loss" so that they desire to see annual receipts equal the total of all appropriations, both regular and supplemental. Of course, when the regular budget is enacted only a projection of governmental receipts is known. Later in the year, better information is available. According to this line of reasoning, the Congressional decision-makers should be willing to grant both more and larger supplemental appropriations in a year when a surplus was anticipated than in a year when a deficit was expected. In order to formalize this notion, define

$$(5.1) \quad S_t = \sum_i s_{it}$$

so that S_t represents the total of the non-defense supplementals granted in the tth year. Also define

E_t : The mid-year (fiscal) estimate of the positive or negative surplus of the budget in year t.

The model can be written

$$(5.2) \quad S_t = \beta_1 + \beta_2 E_t + \rho_t$$

where the β's have their usual interpretation and ρ_t represents a stochastic disturbance. Note that $\beta_2 > 0$ is anticipated.

The estimate of the surplus or deficit for the current fiscal year is published along with the President's proposed budget for the following fiscal year. Utilizing these estimates for the 1947-1962 period and the corresponding data on supplemental appropriations, the least squares estimates of the parameters of (5.2) were calculated. The estimate of β_2 was negative and not significantly different from zero at the 60 percent level. It was noted that the total supplemental appropriations for several years were greatly influenced by single agencies. In at least one instance this influence was caused by the start of a large new program. In order to mitigate this effect, all

agencies with a supplemental appropriation of over one billion during the period were eliminated and the regression recalculated. The results were again negative and insignificant. This evidence suggests that the consideration of a budgetary surplus or deficit has no influence upon Congressional decision-makers in their determination of supplemental appropriations.

Another possible influence is that of unemployment. One might think that Congressional decision-makers are more willing to grant supplemental appropriations when unemployment is relatively high and increased governmental spending might bolster the economy. Define

U_t : The rate of unemployment as reported in The Historical Statistics of the U. S.

Consider

$$(5.3) \quad S_t = \beta_3 + \beta_4 U_t + \gamma_t$$

where the β's have their usual interpretation and γ_t represents a stochastic disturbance. Note that if the Congress does consider the rate of unemployment in making supplemental appropriations, then $\beta_4 > 0$ is implied.

Using the supplemental appropriations for the non-defense agencies, least squares estimates of the parameters of (5.3) were calculated. The estimate of β_4 was negative and insignificant at the 30 percent level. The calculations were repeated after the removal of those agencies which had a supplemental appropriation of over one billion during the period. The results were again negative and insignificant. This evidence suggests that unemployment is not a factor in the determination of supplemental appropriations.

6. Concluding Comments:

The evidence suggests that the factors affecting supplemental appropriations are statistically independent of those influencing regular appropriations so that supplementals properly may be overlooked in a study of the regular budgetary process. It does not appear that there are factors, or at least easily identifiable ones, which simultaneously affect the level of all supplemental appropriations. Indeed, the determinates of supplementals appear to be so agency-specific that one might have to be able to predict unexpected contingencies if one wished to be able to explain the nature

of the apparent randomness.

NOTES

1. This research was supported by a grant from Resources for the Future, Inc., to the Graduate School of Industrial Administration, Carnegie Institute of Technology.

2. It might be noted that the budgetary processes in municipal governments appear to be somewhat more complicated in the sense that the over-all budgetary constraint seems to be a central concern. See Crecine's impressive study [3].

3. The data refer to the period 1947-1962 inclusive. For obvious reasons, only those agencies studied by Davis, Dempster and Wildavsky [1] for which records were available were considered.

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ON THE PROCESS OF BUDGETING: AN EMPIRICAL STUDY OF CONGRESSIONAL APPROPRIATION *

By

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1. Introduction

Present-day governments directly allocate a significant portion of any country's resources. In view of the interests of economists and others in problems associated with the allocation of resources, it is somewhat surprising to find that relatively little academic effort has been spent on the study of the processes through which governments actually apportion funds between alternative uses. (2) The authors hope this paper will help to remedy the deficiency.

The budgeting of appropriations for the many and diverse agencies of the United States Government is a highly complex process. Nevertheless, on the basis of statistical evidence from over half of the non-defense agencies, it would appear that the realized behavior of the process follows quite simple laws. Indeed, for the agencies considered, certain linear systems of two stochastic difference equations are specified and fitted to time series data. The fits appear good, and the associated statistics and some further tests suggest that such linear systems do summarize accurately certain aggregate outcomes of the budgeting process.

In the second section the formal procedure of Congressional appropriation is described briefly. In Section 3 the alternative specifications of the Bureau of the Budget (or the agency) and the Congressional decision equations are proposed and discussed. Section 4 considers the criteria for determining a "best" specification for any agency from estimates of the alternative models. Empirical results are presented and their implications are discussed in Section 5. In the last section general conclusions are drawn and directions for future work indicated. Finally, an appendix contains a discussion of "best" estimating procedures for the dynamically unstable or evolutionary systems specified.

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2. A Brief Description of Congressional Appropriation

Fiscal power is one of the basic responsibilities granted by the Constitution to the legislative bodies of the United States Government. (3) Nevertheless, the Budgeting and Accounting Act of 1921 makes the President formally responsible for the initiation of an annual budget through his staff agency, the Bureau of the Budget. During the time that Congress is considering the budget for the imminent fiscal year (July 1 - June 30), the agencies are preparing estimates of their expenditures for the next year. These estimates are compiled by budget officers under the direction of agency and departmental heads. Of necessity, estimates are detailed, but they may incorporate modifications to take account both of the overall presidential program and possible Congressional reaction. When complete, they are submitted to the Bureau of the Budget. There they are examined in the light of presidential plans by examiners familiar with the respective agencies. Subsequently, hearings allow both agency defense and clarification of estimated requirements. During this part of the process, the Director of the Bureau of the Budget confers frequently with the President and endeavors to keep agency requests within presidential limits. By December, the Director presents to the President a consolidated account of expected revenues and requested expenditures. Next, under the direction of the President, the Bureau of the Budget and the Council of Economic Advisors prepare the budget message. In January, the President presents his budget to Congress.

After its formal presentation, the President's budget is considered first by the Appropriations Committee of the House of Representatives. This committee is divided into subcommittees which are specialized by department and agency. Each subcommittee holds formal hearings at which departmental and agency personnel explain and defend the requests incorporated in the budget. (4) Assisted by its permanent staff, each subcommittee drafts legislation in which it modifies the President's budget according to its own views and the agency testimony. The full committee then reviews the subcommittee reports and incorporates them (infrequently modified) into appropriations bills. Each bill is presented to the House by the Appropriations Committee, where it may enjoy debate. Bills are infrequently amended, but in any event they are subsequently passed and referred to the Senate. After presentation to the Senate, House legislation is reviewed by the Senate Appropriations Committee. This committee holds its own hearings so that agencies are allowed an opportunity to object to House actions. Since the Senate Appropriations Committee is somewhat smaller than its counterpart in the House, its capacity is more limited and its main recommendations to the Senate often concern only controversial issues. Subsequent Senate debate tends to be on broader issues than debate in the House, but any differences in the appropriations bills of the two legislative bodies must be resolved in a conference

committee. Finally, the President must sign each appropriations bill into law. Since no veto of individual items exists, he is usually powerless to do otherwise. Rarely, and in exceptional circumstances, he may impound an agency's funds.

If during the fiscal year an unforeseen need arises, an agency may request a supplemental appropriation. Since this request must pass through the hierarchy, it is used as an agency strategy to secure an original request only at considerable risk of future repercussions.

3. Model Specification

There seems to be general agreement on the fact that the various participants in the budgeting process have different goals. Quite naturally, as Wildavsky has observed, the role of each conforms with its own aims. First, agencies, convinced of the worth of their projects, invariably wish to increase their activities. A corresponding increase in appropriation appears universally to be expected. (5) Second, the principal goal of the Bureau of the Budget is to secure final appropriations in line with Presidential ends. It perceives its role primarily as watchdog for Presidential ceilings and secondarily as advocate for Presidential programs, although it occasionally acts as an agency advocate. (6) Third, the House Appropriations Committee sees its primary duty to be the guardian of the Federal Treasury. Consequently, its role is traditionally that of cutting the President's budget. (7) It is true, however, that this role occasionally conflicts with the goals of defending regional interests or of upholding national progress. (8) Fourth, the Senate Appropriations Committee considers itself to be a responsible body, and in practice it appears to consider mostly those items on which action differs from the recommendations in the President's budget. Due to time pressure, the Senate Committee's hearings often become a court of appeals at which affected agencies may appeal House cuts. Finally, observe that the roles of the agencies and the Senate Appropriations Committee are usually positive, while those of the Bureau of the Budget and the House Committee are essentially negative. However, these conclusions might vary according to program, agency, time period, and relative influence.

It is easily agreed that the modern budget is extremely complex. Furthermore, it is understandable that both observers and participants believe that exhaustive means-ends analysis of the various programs is impossible in the time available so that this complexity may mean that the participants in the budgeting process use simplifying "rules of thumb." Indeed, Fenno observes, "The absolute necessity that appropriation bills do ultimately pass gives urgency to the search for such methods." (9)

Wildavsky [32] has analyzed in detail the "calculations" and "strategies" of the participants in this process. Among other things, he points out that there is considerable stability of attitudes over time. One evidence of this fact is the notions of "fair share" and "base" which are widely held, and perhaps utilized, by the participants in the budgeting process. The "fair share" of an agency is that portion of the total or departmental budget which it "should" normally expect to receive. An agency's "base" is that level of expenditure which it not only currently receives but whose continuation it can reasonably expect in the future. Although these notions suffer for a lack of precision, they do indicate stability of attitude, of calculation, and hence, of process. Therefore, it seems reasonable to estimate process relationships on the basis of time series data.

Wildavsky also produces ample evidence that the decision-makers in the budgeting process think in terms of percentages. Agencies talk of expanding their bases. The Bureau of the Budget talks about growth rates. (10) The House Appropriations Committee is concerned with percentage cuts, and the Senate Appropriations Committee with the restoration of percentage cuts. These considerations indicate that the process relationships may be, at least approximately, linear. Other considerations also suggest the stability of the process. One may note in particular the specialization that occurs among the participants, the long service of committee members, the adoption of incremental practices such as previous year comparisons, the fragmentation of appropriations by program and item, the treatment of appropriations as continuously variable sums of money rather than as specific program costs, and, finally, the practice of allowing past decisions to stand without question while co-ordinating decision-making only in the face of difficulty.

Yet, there is no doubt but that temporary difficulties arise. Examples of possible sources of difficulty are the turn of world events, certain Presidential aims, pressure group influence, etc. In addition, unusual agency zeal might exert pressure upon the House and Senate. A rather interesting form of difficulty is a conflict of goals. Fenno has observed, for example, that the House Appropriations Committee makes a practice of "... assigning top, long-run priority to the budget-cutting task and making of the constituency service a permissible, short-run exception." (11) All in all, it does not seem too implausible to represent such transient events as random shocks to an otherwise deterministic system. (12)

The above considerations, along with those discussed immediately below, have influenced the selection of the following models of the decision-making structure of the budgeting process. Of course, it should be an understandable aim of any study such as this to estimate for each agency the complete decision-making structure, but these models concern only the behavior of an individual agency (or, more precisely, the Bureau of the

Budget for an individual agency) and the behavior of Congress as a whole with regard to the agency's appropriation. As may be seen from the development below, however, the number of possible decision rules which must be estimated grows rapidly as each new participant is added. Moreover, genuine restrictions are placed on the number of structural parameters which may be estimated not only by the fact that data simply are not now available for some participants, but also by the fact that for most United States Government Agencies only short time series are easily available and meaningful. For these simple models, note that if the decisions of an agency and those of the Bureau of the Budget depend linearly on the same variable, the decisions of the two treated as a single entity will depend linearly on that variable as well. Under similar assumptions, Congress may also be safely regarded as a single decision-making entity. Notice that positive and negative influences may be grouped together. In the estimation of the aggregate structure there may, unfortunately, be some aggregation bias, but this will not affect the linearity of the aggregate relations. (13)

In [32] Wildavsky has made a qualitative study of the strategies used by the various participants in the budgeting process in their efforts to realize their own ends. In some instances these strategies may appear to be exceedingly complicated. Some of the simpler of these strategic notions are used here in the construction of "behavioral" models. These are "as if" models in the sense that an excellent fit for a given model says only that the actual behavior of the involved participants is equivalent in effect to the behavior represented by the model. It will be seen that the net effect of this strategic behavior is equivalent to the effect of a set of temporally stable linear decision rules.

Since Wildavsky's study indicates, among other things, that the various agencies may use different strategies, and that Congress may respond in different ways, several alternative systems of equations are proposed. Consider the following variables:

y_t, the appropriation passed by Congress for any given agency for the year t. Supplemental appropriations are not included in y_t.

x_t, the appropriation requested by the Bureau of the Budget for any given agency for the year t. The x_t constitute the President's budget.

Also, certain symbols representing random disturbances are introduced throughout the paper. Each of these random variables is assumed to be serially independent and distributed normally with mean zero and a finite unknown variance. Where the meaning is clear, no further definition of these random variables is given in the text.

Consider first the equations representing Congressional behavior. Suppose Congress believes that some given agency makes requests which, after passing through the hands of the Budget Bureau, are relatively stable indices of the expenditures needed for the agency to carry out its programs to the extent desired by Congress. Further, presume that Congress responds by appropriating a relatively fixed percentage of the agency request which fluctuates each year only because of unforeseen circumstances. Then the appropriation may be represented as the sum of a fixed proportion of the request and a random disturbance with mean zero and finite but unknown variance. Thus the first Congressional decision rule is

$$y_t = \alpha_0 x_t + \eta_t \tag{3.1}$$

where α_0 represents the fixed mean percentage and the η_t term represents the disturbance.

Next, suppose that although Congress "on the average" grants a given agency a fixed percentage of the request before it, it sometimes happens that this amount represents an expenditure which extends the agency's programs either above or below the size desired by Congress. Such a situation could result from the agency and the Bureau of the Budget following Presidential aims which differ from those of the Congress, a suspicion by the Congress that the agency is "padding" the current year's request, etc. Suppose that in this situation Congress tends to appropriate a sum which differs from its usual percentage, and that in the following year invariably either the agency learns to make a more "normal" request or Congress shifts its desires more in line with those of the agency (or the President). In any event, presume that in the year following this deviation from the usual rule there is a tendency for Congress to try to make an allowance for the deviation out of the current year's appropriation. This behavior may be represented by the following scheme:

$$y_t = \alpha_1 x_t + v_t$$

where v_t is a value of a stochastic component which is generated in accordance with the first order Markov scheme

$$v_t = \alpha_2 v_{t-1} + \epsilon_t$$

and ϵ_t is a stochastic disturbance. Substitution gives

$$y_t = \alpha_1 x_t + \alpha_2 v_{t-1} + \epsilon_t \tag{3.2}$$

as a second Congressional decision rule. Note that $|\alpha_2| < 1$ is expected always. The case $\alpha_2 > 0$ represents, granting a deviation from its "usual" percentage, a tendency for Congress to try to decrease subsequent devia-

tions -- i.e., to try to move steadily back toward its usual percentage rule except for unforeseeable events. On the other hand $\alpha_2 < 0$ represents, granting an initial deviation, a predisposition of Congress to try to compensate for it out of the following appropriation. Congress thus would tend to move back to its usual rule (except for the disturbances) by making successively smaller allowances for the deviations which differ in sign. (14)

Finally, suppose that the Congress believes that it knows the decision rule of some given agency and that this decision rule may be represented by one of (3.4) - (3.6) below. Further, presume that the Congress attempts to take into account that (positive or negative) portion of the agency's request x_t which is not based on the previous year's appropriation or request. Such might be the case, for example, if the Congress believes that this remainder (positive or negative) represents "padding" or gaming behavior on the part of the agency or if the Congress desires to "smooth out" the agency's rate of growth. These considerations suggest

$$(3.3) \qquad y_t = \alpha_3 x_t + \alpha_4 \lambda_t + \nu_t$$

as a third Congressional decision rule where λ_t is a dummy variable representing in year t, ξ_t, $\beta_2 (y_{t-1} - x_{t-1}) + \phi_t$ or ψ_t, depending on the corresponding Agency-Bureau-of-the-Budget decision rule below, and ν_t is a stochastic disturbance. One might expect that Congress takes only "partial" account of the disturbance represented by λ_t so that $0 < |\alpha_4| < 1$.

Consider now the behavioral rules for the Agency-Bureau-of-the-Budget requests to Congress. It is obvious that at least one important piece of data for those actively engaged in formulating such a request is the last Congressional appropriation. In fact, the concept of the base, which was discussed briefly above, is an excellent indication that agency calculations are based upon past data. Two of the following decision equations involve the previous Congressional appropriation.

Suppose first that a given agency, while convinced of the worth of its programs, is acutely aware of Congressional reaction. Thus this agency sees no sense in making extraordinary requests since it does not believe that Congress would honor them. It simply believes that the best strategy is to ask for an amount which is a relatively fixed percentage of the last Congressional appropriation for the agency. Analogously to those concerning (3.1), these considerations suggest

$$(3.4) \qquad x_t = \beta_o y_{t-1} + \xi_t$$

as a first Agency-Bureau-of-the-Budget decision rule. Here β_o represents a fixed mean percentage.

Secondly, suppose that the agency or the Bureau of the Budget believes it desirable to take into account in its current request the difference between its previous appropriation and request. This behavior may be represented by

$$(3.5) \qquad x_t = \beta_1 y_{t-1} + \beta_2 (y_{t-1} - x_{t-1}) + \phi_t$$

where ϕ_t is a stochastic disturbance. It is to be expected that such an agency would be attempting to smooth its stream of appropriations so that $\beta_2 < 0$ is anticipated. Then an unusually large cut in the previous year's request would be followed by a "padded" estimate in order to make up for the loss in expected funds. Similarly, an unusual increase would be followed by a reduced estimate to avoid unspent appropriation. (15)

Finally, one can imagine a case in which either the agency, or the President through the Bureau of the Budget, is convinced of the worth of the agency's programs and is determined to attempt to expand them without regard to Congressional action. This behavior suggests

$$(3.6) \qquad x_t = \beta_3 x_{t-1} + \Psi_t$$

as a final decision equation. Note that if such an agency believes its programs to be worthy, $\beta_3 > 1$ is expected. (16)

Granting the generally correct notion that Congress cuts the President's budget, the widely held opinion that agencies do believe in the worthiness of their programs, and the concepts of agency base and of upwards biasing to allow for subsequent cuts, one is led to expect that β_0, β_1, and β_3 should all be greater than one, while β_2 should be negative.

4. Statistical Methods and Selection Criteria

The possible combinations of the equations of section 3 yield nine systems of stochastic difference equations. Three interrelated difficulties arise in the analysis of time series data x_t, y_t for a given agency with respect to these models. The first problem concerns the choice of techniques for estimating the parameters of the alternate schemes in some optimal fashion. Given these estimates and their associated statistics, the second problem concerns the selection criteria for choosing the model best specifying the data. Finally, one is faced with the problem of examining the variability over time of the underlying parameters of the best specification. The applicability of the selection criteria, of course, depends both on the parameter estimation technique and on the fact that the parameters of the underlying process are fixed over time. If an undetected shift in the underlying parameters occurs, "reasonable" criteria can

lead to plausible but incorrect specification. (17) Difficulties in the analysis are augmented here by small sample sizes and, since appropriations tend to increase over time, by the fact that the present models can be expected to define unstable stochastic processes. (18) Given the present state of econometric knowledge, we believe our solution to the problems outlined, while far from optimal, is satisfactory.

Fortunately, the necessity for simultaneous equation estimation is obviated by the very nature of the budget process. The sequential order of events is known and given. The Bureau of the Budget must state x for year t before Congress determines y for the same period; and Congress has stated y for year t-1 before the Bureau of the Budget is required to decide x for year t. Thus, while x_t for a given agency is likely to play a large part in the determination of the corresponding y_t, y_t can play no part (theoretically, at least) in the determination of x_t. The models of this paper incorporate this feature of the process and are therefore "recursive" in the sense of Wold. For such "causal chain" models, no account of the determination of the x and y variables by all explanatory variables simultaneously need be taken in the estimation procedure. (19)

Let the nine systems of equations be denoted as (4.rs), where the first (Congressional) equation of the system is (3.r), r = 1, 2, 3, and the second (Agency-Bureau-of-the-Budget) equation is (3.s), s = 4, 5, 6. Then the recursive systems (4.14-4.36) may be put in the general form

$$AY_t + BY_{t-1} = e_t \tag{4.1}$$

where $Y_t = \begin{bmatrix} y \\ x \end{bmatrix}_t$, $e_t = \begin{bmatrix} \eta \\ \xi \end{bmatrix}_t$, $A = \begin{bmatrix} 1 & -\alpha_{12} \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} -\beta_{11} & -\beta_{12} \\ -\beta_{21} & -\beta_{22} \end{bmatrix}$.

Indeed, the coefficient matrices for the partially reduced systems (4.rs) are

$$A_1 = \begin{bmatrix} 1 & -\alpha_0 \\ 0 & 1 \end{bmatrix} \qquad A_2 = \begin{bmatrix} 1 & -\alpha_1 \\ 0 & 1 \end{bmatrix} \qquad A_3 = \begin{bmatrix} 1 & -(\alpha_3 + \alpha_4) \\ 0 & 1 \end{bmatrix}$$

$$B_{14} = \begin{bmatrix} 0 & 0 \\ -\beta_0 & 0 \end{bmatrix} \qquad B_{24} = \begin{bmatrix} -\alpha_2 & \alpha_1\alpha_2 \\ -\beta_0 & 0 \end{bmatrix} \qquad B_{34} = \begin{bmatrix} \alpha_4\beta_0 & 0 \\ -\beta_0 & 0 \end{bmatrix}$$

$$B_{15} = \begin{bmatrix} 0 & 0 \\ \beta_2-\beta_1 & -\beta_2 \end{bmatrix} \qquad B_{25} = \begin{bmatrix} -\alpha_2 & \alpha_1\alpha_2 \\ \beta_2-\beta_1 & -\beta_2 \end{bmatrix} \qquad B_{35} = \begin{bmatrix} \alpha_4(\beta_1-\beta_2) & \alpha_4\beta_2 \\ \beta_2-\beta_1 & -\beta_2 \end{bmatrix}$$

$$B_{16} = \begin{bmatrix} 0 & 0 \\ 0 & -\beta_3 \end{bmatrix} \qquad B_{26} = \begin{bmatrix} -\alpha_2 & \alpha_1\alpha_2 \\ 0 & -\beta_3 \end{bmatrix} \qquad B_{36} = \begin{bmatrix} 0 & \alpha_4\beta_3 \\ 0 & -\beta_3 \end{bmatrix}.$$

Conditional on the previous observation vector, the density of the tth observation on the process (20) following (4.1) is

$$f(Y_t \mid Y_{t-1}) = f(e_t \mid Y_{t-1}) \mid \det \left(\frac{\partial e}{\partial Y}\right)_t \mid = f(e_t \mid Y_{t-1})$$

since $\left|\det \left(\frac{\partial e}{\partial Y}\right)_t\right| = \left|\det \begin{pmatrix} \partial\eta/\partial y & \partial\eta/\partial x \\ \partial\xi/\partial y & \partial\xi/\partial x \end{pmatrix}\right| = \left|\det A\right| = 1.$

Hence the joint density of a sample of n observations (the likelihood), conditional on the 0th, is

$$f(Y_1, \ldots, Y_n \mid Y_0) = f(e_1, \ldots, e_n \mid Y_0) .$$

Under the assumptions that the e_t's are serially independent and have a bivariate normal distribution (21), $N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_\eta^2 & 0 \\ 0 & \sigma_\xi^2 \end{pmatrix} \right]$,

$$f(Y_1, \ldots, Y_n \mid Y_0) = \tag{4.2}$$

$$(2\pi\sigma_\eta^2\sigma_\xi^2)^{-n} \exp\left[-\frac{1}{2}\Sigma(AY_t + BY_{t-1})' \begin{bmatrix} \sigma_\eta^{-2} & 0 \\ 0 & \sigma_\xi^{-2} \end{bmatrix} (AY_t + BY_{t-1})\right].$$

It follows that $f(Y_1, \ldots, Y_n \mid Y_0)$ may be factored into two parts, the first of these looking like the likelihood function (conditional on Y_0) of n observations on the first equation of the system when the independent variables are fixed variates, and the second analoguosly describing the second equation. Hence it may easily be seen that the maximum likelihood (ML) estimators of the equations of (4.1)

$$\begin{aligned} y_t &= \alpha_{12} x_t + \beta_{11} y_{t-1} + \beta_{12} x_{t-1} + \eta_t \\ x_t &= \qquad\qquad \beta_{21} y_{t-1} + \beta_{22} x_{t-1} + \xi_t \end{aligned} \tag{4.3}$$

are the ordinary least-squares (OLS) estimators.

An inspection of the matrices A_r, B_{rs} reveals a sufficient variety of form to make an analysis based on the "significance" of the OLS estimates of the equations (4.3) a possible procedure for selecting the scheme best specifying the data for a particular agency. For example, if for some agency the estimates a_{12}, b_{12} and b_{22} were "significant" and b_{12} was "not significantly" different from $a_{12}b_{22}$, while b_{21} was "significant" and b_{22} "not significant", the scheme (4.24) would be selected as "best" specifying the data. (22) The equations (3.2) and (3.4) would then be estimated by some appropriate technique in order to obtain estimates of the parameters that are of interest here, the structural parameters. Since all of the systems (4.14-4.36) are exactly identified with respect to the partially reduced

special cases of (4.1), one such technique might be to compute the estimates of the parameters of the "best" specification indirectly.

There are, however, several difficulties both with this selection criterion and the indirect estimation technique applied to the models of this paper. The most serious objection to the selection criterion is that for unstable processes following (4.1), while it is known that the OLS estimators are biased, even under the assumption of normally distributed, i.e. Gaussian, disturbances, neither the consistency of these ML estimators nor their asymptotic distribution, upon which parameter significance tests are based, has been established. (23) Moreover, even if the ML estimators could be shown to be consistent and their limiting distribution found to be multivariate normal, it is known that for unstable processes small sample bias leads to a high probability of incorrect inferences on the basis of parameter significance tests, especially in relation to the coefficients of the endogenous variables (here x_t). (24) If the assumption of Gaussian disturbances is dropped, one is usually interested in the properties of the quasi-maximum likelihood (QML) estimators, the solutions of the ML estimating equations when these equations are taken as given and the distribution of the disturbances is assumed to have certain moments finite. In the unstable case, current knowledge is even more sparse. Results on unstable processes related to (4.1) however, suggest that while the QML estimators are likely to be consistent, they may not have a multi-variate normal asymptotic distribution unless the disturbances are Gaussian, so that even for large samples, coefficient significance tests based on t-statistics would not be valid. (25) When the samples sizes are too small to test the assumption of Gaussian disturbances and when the possibility of shifts in the parameters must be admitted, making effective sample sizes even smaller, it would appear that distribution-free selection criteria may be of more use. (26) The principal criterion of this paper has this property. Collectively the criteria presented here appear to be a priori as good as any others available. Finally, the indirect estimation technique multiplies any bias in the (partially) reduced form. Since interest is centered here on the parameters which have behavioural interpretations, direct estimates of the structural parameters may be more appropriate.

The estimation procedures to be used in this paper are based on the simultaneous full information maximum likelihood (FIML) technique for estimating the structural parameters of the systems (4.14-4.36) under the assumptions that the disturbances are Gaussian and serially independent, and that the Bureau-of-the-Budget-Agency disturbance is independent of the Congressional disturbance. (27) In the appendix, consistent estimators are found for the parameters of all systems for which there was evidence in the analysed data. These estimators are consistent in both the stable and unstable cases, whether or not the assumption of Gaussian disturbances is made. Some results on asymptotic distributions are also given. In the

unstable cases, all these estimators are biased so that although knowledge of favourable asymptotic properties is reassuring, it is not entirely satisfactory. Unfortunately sampling distributions for such processes are extremely difficult to derive.

For the systems (4.14-4.16), the use of OLS to estimate the Agency-Bureau-of-the-Budget and the Congressional equation individually is justified. That is, for (4.14-4.16) OLS and FIML (QML) estimators coincide. This is not so, however, for systems (4.24-4.26) due to the presence of the auto-correlated disturbance in equation (3.2) and the consequent non-linearity of the ML estimating equations. For these schemes, several multi-stage OLS procedures for estimating this equation are proposed and discussed in the appendix. For systems (4.34) and (4.36), in spite of the appearance of the disturbance of the second equation as an explanatory variable in the first, the estimators given by a two-stage OLS procedure coincide with the FIML (QML) estimators. The equivalence of the two procedures fails for (4.35), however, due to the essential interaction of the two equations of the system (see B_{35} above). It may be seen nevertheless (by factoring the appropriate version of (4.2)) that the recursive property of the systems and the assumption of serial independence of the disturbances, together imply that the OLS and FIML (QML) estimators of the Agency-Bureau-of-the-Budget equation coincide for all systems. Hence special estimation techniques are needed only for the temporally later Congressional equation of the systems (4.24-4.36). In analysing the data for a given agency, therefore, an appropriate procedure is to estimate the second equations (3.4-3.6) by OLS, decide by the selection criteria which of the three best specifies the data, and then use the knowledge of this structure (under the assumptions) to estimate the first equation. The final step of the procedure is to decide, by the appropriate criteria, which of the three versions of the first equation appears to underlie the observations. The three selection criteria used in this paper involve the sample correlation between the dependent and explanatory variables, the d-statistic for residual auto-correlation, and the correlation between residuals of the two equations of the systems.

The principal selection criterion is the criterion of maximum (adjusted) correlation coefficient $\bar{R}$. (28) For a given dependent variable this criterion selects, among alternate specifications of the explanatory variables, that specification which leads to the highest sample correlation coefficient. The estimations of the alternate specifications must, of course, be made from the same data. Unbiased estimators for the squared multiple correlation coefficient R_0 have been proposed by Barten [3] for the case of fixed variates with a Gaussian disturbance, and by Kendall [18] for the jointly normal case of multiple regression. Here, however, these results do not apply. In fact, for unstable processes no parent correlation R_0 exists which is independent of time. (29) Moreover, as a measure of sample association,

the formula for the correlation coefficient involves the centering of the variables near their values at the mid-point in time and consequently, for trended time series, the discrimination of dependent fluctuations by the statistic diminishes toward either end. A more satisfactory measure of association for such time series might center the variables involved at some estimate of their current mean, but to our knowledge no such measure has been proposed to date. Under the other assumptions of this paper, whether or not the disturbances are Gaussian, the criterion of maximum sample correlation leads asymptotically to correct "on the average" selection among equations (3.4-3.6). Indeed, if any one of these equations is the true specification, then the explanatory variables of the others are independent of the true disturbance. It follows that for large samples the expected (multiple) correlation coefficient of the true specification is not less than that of the others. (30) The usual difficulties due to sampling fluctuation and small samples remain. We shall see that the selection procedure may sometimes be aided by the use of the remaining two selection criteria. Otherwise, the final selection must be made on the basis of maximum sample correlation for want of a better criterion or at least a better measure of association for trended time series. The Theil adjustment to the usual sample correlation coefficient R, $1 - \bar{R}^2 = (1 - R^2)\, n/n - k$, where k is the number of explanatory variables, was used in an attempt to compensate for the usual positive bias in R^2 due to the small sample underestimation of the variance by OLS for trended time series. Barten has noted that for a given set of data $\bar{R}^2$ has a lower value than the other standard corrections.

The second selection criterion involves the use of the d-statistic to test for serial correlation of the disturbances of a specification of a single equation. (31) This statistic was used to test the null hypothesis of residual independence against the alternative of positive or negative serial correlation. Theil and Nagar's significance points [30] for the distribution of the d-statistic under the null hypothesis were used for the test against positive serial correlation. These were calculated on the assumption that the first and second differences of the explanatory variables are small in absolute value compared with the range of the corresponding variable itself, for fixed explanatory variables and Gaussian disturbances. The time series of this study meet the former condition. Since the calculations of the significance points were approximations which ignored the effects of the explanatory variables, their use is probably equally valid for stochastic explanatory variables which do not include lagged endogenous variables, and for disturbances with a near-symmetric distribution. When, as in this study, the former condition is not satisfied and the system is unstable, it should be noted that the asymptotic bias in d under the alternative hypothesis reported by Nerlove and Wallis [23] makes a test based on these significance points conservative in the sense of increasing the critical region, i.e., increasing the probability of type II eror. When the number of explanatory variables of observations was less than those shown in the tables [31] (2 and

15 respectively), the significance points were taken from an extrapolated table. (32) The significance points for the test against negative serial correlation were taken from a table computed on the basis of symmetry of the distribution of the d-statistic about 2. (33) Since this distribution is slightly negatively skewed, the test procedure should actually have a smaller critical region than the nominal size used.

The third selection criterion is based on a test of the significance of the sample correlation between the residuals of (3.1) and the second equation selected previously for a given agency. David's significance points [12] for this statistic were used to make a two-tailed test at the five percent level of the null hypothesis that the residuals are uncorrelated. Consider testing this hypothesis H_0: $\rho(\xi,\eta) = 0$ against H_1: $\sim H_0$ in the model (4.14) for example. The natural test statistic is

$$r = \Sigma v_t w_t / (\Sigma v_t^2 \Sigma w_t^2)^{1/2},$$

where v and w denote the OLS residuals of (3.1) and (3.4), respectively. Under the assumption of Gaussian disturbances, if both x and y were regressed on the same variate (or variates, stochastic or not), the argument of Anderson [1], pp. 62-64, would then apply to show that under H_0, r would have probability density function $p_n(r)$ with mean 0 and variance 1/n-1 (see[1], (15), p. 64 and [12]). Here, however, the independent variables of (3.4) to (3.6) differ from that of (3.1). Nevertheless, in all three systems (4.14-4.16),

$$\operatorname*{plim}_{n\to\infty} r = \rho = 0 \text{ under } H_0. \tag{34}$$

Under H_1, $\operatorname*{plim}_{n\to\infty} r = \rho \neq 0$

and thus the statistic approaches the form required to justify a test based on $p_n(r)$. Since the convergence of r to ρ is independent of the assumption of Gaussian disturbances, under the contrary assumption the calculation of the statistic is still of some use. It might be remarked that the method of Zellner [34] for dealing with correlated residuals in two equation systems is inapplicable here.

The selection among equations (3.4-3.6) on the basis of the criterion of maximum sample correlation may be roughly aided by the use of the d-statistic. If the presence of auto-correlation of the residuals were indicated in the estimation of (3.4) and (3.6), then (3.5) would appear to be the proper specification. The selection among equations (3.1-3.3) can be made directly upon the application of the other two criteria to the residuals of the estimate of (3.1). Since (3.2) is merely (3.1) with auto-correlated disturbances, if the d-statistic calculated from these residuals is significant (small) and their sample correlation with the residuals of the second equation is not

significant, auto-correlation is present and equation (3.2) must be assumed to hold. Knowledge of the equation selected from (3.4-3.6) must then be utilized to form an estimate of the parameters of (3.2). If the residuals of (3.1) are not auto-correlated, but are significantly correlated with those of the Agency-Bureau-of-the-Budget equation, (3.3) would appear to be the best specification. The problem of estimating (3.3) in this event, since the disturbances of the second equation are unobservables, is discussed in the appendix. The residuals, the natural surrogates for the disturbances, are used in the FIML (QML) estimation procedure developed there. One cause of both auto-correlated and correlated residuals arising from the estimation of (3.1) might be the omission of the same trended variable in the specification of both equations of the system. To us, this event seems unlikely and did not seem to occur for the agencies studied. Another possible reason will be discussed below. If none of these three cases obtains, (3.1) best specifies the system, and the OLS estimation provides estimates of the parameters and associated statistics. Use of the criterion of maximum sample correlation is risky here, since, as will be discussed in the appendix, the small sample estimate of the variance of the disturbances and, hence, that of the multiple correlation coefficient, is biased for the estimation procedure of (3.2).

The above discussion has assumed the values of the parameters of the processes fixed over time. However, in light of the many important historical and political events occurring in the years 1946-63, it seems reasonable to suppose that the appropriations decision structure of many government agencies was altered at one or more specific points in this period. Consequently, the F-statistics of Chow [7] were used to test the null hypothesis that the structural parameters did not shift (against all alternatives) for certain of the equations individually. Suppose, in the usual OLS notation, the estimation structure of one of the equations (3.1) to (3.6) (represented as $y_t = x_t'\beta + \epsilon_t$, where β and x_t are k vectors, k = 1, 2) is given alternatively by

$$(4.4) \qquad y_1 = X_1 b_1 + u_1$$

$$(4.5) \qquad y_2 = X_2 b_2 + u_2$$

$$\text{i.e. } (4.6) \qquad y = \begin{bmatrix} X_1 & 0 \\ 0 & X_2 \end{bmatrix} \begin{bmatrix} b_1 \\ b_2 \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \end{bmatrix} \quad \text{where } y = \begin{bmatrix} y_1 \\ y_2 \end{bmatrix},$$

$$\text{or } (4.7) \qquad y = Xb + u \qquad \text{where } X = \begin{bmatrix} X_1 \\ X_2 \end{bmatrix},$$

for n_1, n_2 and $n = n_1 + n_2$ observations respectively. Then, under the

assumption of Gaussian disturbances, to test the hypothesis H_0: $\beta_1 = \beta_2 = \beta$ against H_1: $\sim H_0$, the statistic is, for $n_2 > k$,

$$(4.8) \qquad F_{k,n-2k} = \frac{n-2k}{k} \; \frac{||u||^2 - ||u_1||^2 - ||u_2||^2}{||u_1||^2 + ||u_2||^2}$$

and, for $n_2 \leqq k$,

$$(4.9) \qquad F_{n_2,n_1-k} = \frac{n_1-k}{n_2} \; \frac{||u||^2 + ||u_1||^2}{||u_1||^2}$$

where $||\cdot||$ is the Euclidean norm on the vector space of appropriate dimension. It may be shown that $||u||^2$, the residual sum of squares under H_0, is $||u_1 + u_2||^2 + ||u - u_1 - u_2||^2$, the residual sum of squares under H_1 plus the sum of squares of the differences between the residuals under the two hypotheses, so that these F-statistics make the usual analysis of variance test. (35) Although Chow derived the F-distribution of these statistics for the case of fixed explanatory variables, it may be shown that under the null hypothesis, the distributions of the test statistics are independent of the distributions of the explanatory variables, so that (under the assumption of Gaussian disturbances) the tests are valid here. Under H_1, the test statistics are distributed non-central F with strictly positive centrality parameter conditional on the observations of the explanatory variables. The power of the test has not been established exactly, but even without the assumption of Gaussian disturbances the test statistics would appear to be good discriminators.

Inspection of the equations of section 3 will reveal that (3.2) and (3.3) are modifications of (3.1) in order to allow for second order effects. Equation (3.5) is a similar modification of (3.4). Moreover it is clear that since the procedure selecting among these equations is appropriate only for parameters fixed over time, the tests for parameter shifts must precede any such selection. Thus it seems reasonable to estimate equations (3.1), (3.4) and (3.6) using the total number of observations available, and on the basis of maximum sample correlation, to select one of the last two. An inspection of the residuals of (3.1) and the equation selected, and the calculation of their d-statistics, should then reveal possible parameter shifts.

Indeed, a primary source of a significant d-statistic for the residuals of an estimate is an underlying parameter shift, since the residuals before (or after) the shift are of approximately the same magnitude, and therefore the sum of their successive differences is small relative to their sum of squares over the period. Another difficulty with temporal variability in the present systems is that a shift in a parameter corresponding to one time

series for an agency may cause an almost simultaneous shift in that of the other. Depending on the direction of this reaction, the sample correlation might be positive or negative when in fact the disturbances were uncorrelated. The residuals arising from the estimation of (3.1) would then appear both auto-correlated, and correlated with those of the second equation, while the true disturbances were neither. Of course, a shift response might occur several periods later, so that auto-correlation alone would be artificially produced.

Since the systems of this paper are all first-order Markov, the first observation on the suspected new process should enter the estimations involved in the calculation of the F-statistic only as a lagged variable. In this way the contamination of the estimation of the new scheme with a lagged observation on the old is avoided, but the effective number of observations is reduced by one. If for a given equation the suspected shift point is incorrect by one or more periods, an inspection of the residuals of both partial estimates, and subsequently the comparison of the two F-statistics, should lead to the identification of a second correct guess. Once the shift points (if any) are established, the procedure for the selection of the best specification must be carried out separately for each part of the time series. In other words, estimates of the alternative equations must be made for each shorter period, since it is possible that not just the parameters, but the scheme best specifying the data shifted. If a Congressional shift succeeded an Agency-Bureau-of-the-Budget shift, no difficulty (except small sample size) with the procedure for fixed-parameter systems is encountered. Otherwise, the Congressional equations (3.2) and (3.3) can only be estimated from the second equation shift point on. Finally, of course, the possibility of multiple shift points must be admitted. However, in the analysis of the data of this study the search was essentially restricted to finding a single shift point.

If an increase in the variance of the disturbances were to accompany a shift in the structural parameters (as might be expected for some of the processes studied, particularly for those strongly explosive), the test statistics (4.8) and (4.9) would be smaller in magnitude than if the variance remained constant. Indeed, the $||u||^2$ term in both numerators would be decreased and the $||u_2||^2$ term in the numerator and denominator of (4.8) increased, so that proceeding on the assumption of homoscedasticity, one is likely to accept H_0 when it is in fact false. An appropriate test of the compound hypothesis H_0: $\beta_1 = \beta_2 = \beta$, $\sigma_1^2 = \sigma_2^2 = \sigma^2$ may be devised (36), but for this study a large critical region (10%) was used and the parameter estimates and residual patterns of both halves of the time series compared with the F-statistic to place the process in one of the four temporal stability categories of the next section. Once a parameter shift is detected, of course, a corresponding shift in the variance of the disturbances causes no difficulty with parameter estimation for the current process, since all such

estimation is considered conditional on the first realization of this process.

In summary, it should be emphasized that the exact results on the F-statistic, the applicability of the d-statistic test, and the asymptotic applicability of the residual correlation test depend on the assumption of Gaussian disturbances. However, the results on the principal selection criterion, the criterion of maximum correlation (as a measure of sample association) do not. (37) Moreover, since the consistency of the QML estimators of the parameters is established in the appendix for all systems for which there was evidence in this study, and since no selections were made on the strength of tests of coefficient significance, the accuracy of the parameter estimates, while account must be taken of small sample sizes, is independent of the Gaussian assumption. The accuracy of the parameter estimates reported in the next section do, however, depend on the assumtion of homoscedasticity. Again, sample sizes were too small to make more than an heuristic analysis. Nevertheless, it appeared that upward changes in the variance usually accompanied an upward change in the magnitude of the process which (almost) simultaneously induced a parameter shift. Some heteroscedasticity was, of course, introduced by the practice of ignoring any shift points but the principal one. It should be noted that upward changes in the variance of the disturbances in a trended time series cause the OLS estimation procedure to put more weight on recent observations - a fact that for predictive purposes can only be applauded. It is our belief that the OLS or (near) generalized least-square nature of the estimates of this study may be their most important single property with regard to accuracy. (38)

5. Empirical Results

Time series data for the period 1947-1963 were studied for fifty-six non-defense agencies of the United States Government. The requests x_t of these agencies were taken to be the amounts presented to Congress in the President's budget. For eight sub-agencies from the National Institutes of Health, data for a shorter period of time were considered, and the requests x_t of these eight sub-agencies were taken to be their proposals to the Bureau of the Budget. (39) In all instances the Congressional decision variable y_t was taken to be the final appropriation before any supplemental additions. The total appropriations (without supplements) of the agencies studied amounted to approximately 27 percent of the non-defense budget in 1963. Over one-half of all non-defense agencies were investigated; the major omissions being the Department of State, the Post Office, and many of the independents. A minimum of three agencies was examined from each of the Treasury and the Departments of Justice, the Interior, Agriculture, Commerce, Labor, and Health, Education and Welfare.

The statistical procedures of section 4 and the appendix were programmed

for the Control Data G-21 electronic computer in the 20-Gate algebraic compiling language. The selection among alternate specifications according to the criteria of section 4 was not done automatically, but otherwise all computations were performed by the machine. The results for all agencies studied are given in Table A at the end of this paper. Although the raw data contain no measurement errors (40), estimates and statistics are reported for convenience to no more than three decimal places.

Table A presents estimates and associated statistics for the best specifications (according to the criteria) for the latest period during which the coefficients of the processes were judged to be fixed. As mentioned in the previous section, the shortness of the series allows one to search meaningfully for a most one "shift point" in each of the two equations for a given agency. However, an inspection of the residuals and the basic data tend to indicate that in most cases this is not a serious restriction. Most of the results presented in Table A require no comment as their interpretation is straightforward. The last observation (in millions of dollars) is presented in order to show the magnitude of the latest agency budget and to provide a comparison with the estimated standard deviation of the disturbance. In all cases, the mean of the residuals of the best specifications were negligible relative to these estimated standard deviations, so that the lack of constant terms in the specifications of the decision equations is justified. Estimated coefficient standard deviations are shown below coefficient estimates in the usual manner. The F-statistic reported here refers to the entire series (1947-1963) and is, unless otherwise noted, computed on the basis of the equation given under the column entitled "Eqn. No." The four stationarity categories of temporal stability, reported in the column titled "Temp. Stab.", are defined as follows:

VS (Temporally very stable): The F-statistic is small and the coefficients estimated from the first and last parts of the series are virtually the same (See Table B where such estimates are reported.).

S (Temporally stable): The F-statistic is small but the coefficients estimated from the first and last parts of the series appear to be different.

NS (Not temporally stable): The F-statistic is large but not significant at the 10 percent level and the coefficients estimated from the first and last parts of the series appear to be different.

US (Temporally unstable): The F-statistic is significant at the 10 percent level.

For the Congressional decision equations there were six that were tempor-

ally very stable, twelve that were temporally stable, twelve that were not temporally stable, and twenty-eight that were temporally unstable. Similarly, for the Agency-Bureau-of-the-Budget decision equations there were four that were temporally very stable, eighteen that were temporally stable, eighteen that were not temporally stable, and eighteen that were temporally unstable. (41)

Consider Table 1 below. This table presents a summary of the combinations of the Agency-Bureau-of-the-Budget and Congressional decision equations presented in Table A.

Table 1

Summary of Decision Equations

	3.4	3.5	3.6
3.1	20	2	5
3.2	7	0	0
3.3	20	3	1

It will be observed that, for those agencies studied, the most popular combinations of behavior are the simple ones represented by equations (3.1) and (3.4) respectively. This fact is even more evident when the eight sub-agencies, all of which are represented by the (4.14) combination, are added to the above data. Note also that when Congress uses a "gaming" strategy such as (3.2) or (3.3), then the Agency-Bureau-of-the-Budget decision equation is the relatively simple one (3.4). Finally, it should be observed that when on the average Congress grants exactly or almost exactly the amount requested by an agency, the agency tends to use decision equation (3.6).

The results reported in Table A are in good agreement and support the hypothesis that, up to a random error of reasonable magnitude, the budgeting process of the United States Government results in aggregate decisions in close agreement with those produced by a set of temporally stable linear decision rules. On the whole, the estimated correlation coefficients for the "best" specifications for each agency are high. Table 2 below presents the frequencies of the correlation coefficients reported in Table A. Notice that the fits for the Congressional decision equations are, in general, better than those for the Agency-Bureau-of-the-Budget equations. Of the sixty-four agencies and sub-agencies studied, there are only fourteen instances in which the correlation coefficient for the Congressional equation was lower than the one for the corresponding agency (or sub-agency) equation. One

Table 2

Frequencies of Correlation Coefficients

	1 - .995	- .99	- .98	- .97	- .96	- .95	- .94	- .93	- .90	- .85	- 0
Congressional	28	3	15	5	1	3	4	1	3	3	1
Agency-Bureau	8	2	2	9	4	3	4	3	5	11	10

may speculate that the reason that the estimated variances of the disturbances of the Agency-Bureau-of-the-Budget decision rules are usually larger than their Congressional counterparts is that the agencies are closer than Congress to the actual sources that seek to add new programs or expand old ones.

In section 3 it was suggested that one generally expects β_0, β_1, and β_3 to be greater than one, and β_2 to be negative. (42) One can observe in Table A that in fifty-six instances this expectation is satisfied, while there are six cases for which the estimated $b_0 < 1$ and two cases for which the estimated $b_3 < 1$. The latter two cases are easily understood. The fit for the Bureau of Employment Security is not very good. Given the decrease in the number of territories, the activities of the Office of the Territories necessarily must decline. For three of the former six cases, Congress tends to appropriate an amount greater than the request. Two of these three instances seem to represent something of a special phenomenon. When those parts of both requests and appropriations which are directly related to loans are omitted from the data for both the R.E.A. and the F.H.A., then the estimated coefficients are of the magnitudes expected with $b_0 > 1$ and $a_0 < 1$. However, when the data relating to loans are included, then $b_0 < 1$ and $a_0 > 1$. Apparently, Congress favors the loan programs more than do the agencies.

Finally, the widely held notion that Congress cuts the President's budget indicates that α_0, α_1, and α_3 should all be less than one. These estimates do not fully support this notion. The Bureau of Narcotics and the F.B.I. get exactly what they ask for ($a_0 = 1$ and $u_t = 0$). All eight subagencies from the National Institute of Health (for which x_t represents the agency requests to the Bureau of the Budget) have $a_0 > 1$. In addition, there are fourteen instances in which $a_0 > 1$ and three instances in which $a_3 > 1$ for the agencies studied (where x_t represents the requests published in the President's budget). Apparently, there are some programs which Congress supports more vigorously than does the Administration.

Table B at the end of this paper presents the estimates and associated statistics for the best specifications if it is presumed that there is one and

only one shift point in the series for each agency. When the best specifications for each part of the series do not change, these were the estimated relationships, along with the relationship estimated over the entire length of the series, which provided the basis for the computation of the F-statistic. When the estimated relationships fell in the "not temporally stable" or "temporally unstable" categories, the estimates reported in Table A are the same as the estimates reported for the latter period in Table B. Otherwise, the estimates reported in Table A refer to the entire series and those in Table B are the best specifications for the two parts of the series when a break point has been "forced", whether or not there is evidence of an underlying coefficient shift.

Table B illustrates the previous section's observation that not only may the value of the coefficient(s) shift at some point in the series, but the underlying behavior may also change. Table 3 below presents a summary from Table B of the combinations of the Agency-Bureau-of-the-Budget and Congressional decision equations for the best specifications when each series is broken into two parts in the manner described previously. Although the year when shift points occur may vary from agency to agency, these specifications are referred to as "first period" and "second period" respectively.

Table 3

First Period Decision Equations

	3.4	3.5	3.6
3.1	27	3	6
3.2	4	0	1
3.3	13	2	2

Second Period Decision Equations

	3.4	3.5	3.6
3.1	20	3	4
3.2	5	0	2
3.3	22	1	1

The most important point to note in Table 3 is that although the popular combinations of behavior are the simple ones represented by equations (3.1)

and (3.4) respectively, there is a marked tendency for Congressional behavior to become more sophisticated -- i.e., the incidence of the "gaming" behavior represented by (3.3) is increasing over time. (43)

A second inference which may be drawn from Table B is that the budgeting process seems to be becoming more linear over time in the sense that the deterministic parts of the decision equations have more explanatory power. Table 4 below presents frequencies of the correlation coefficients for the "first" and "second" periods.

Table 4

Frequencies of Correlation Coefficients

	1 - .995	- .99	- .98	- .97	- .96	- .94	- .92	- .90	- .80	- .60	- 0
First Period	11	4	10	7	1	9	8	4	16	21	21
Second Period	33	1	12	11	4	19	3	5	14	6	6

Although there is a different number of correlation coefficients in each period, 111 for the first period and 114 for the second (44), Table 4 shows that fits are better for the second period. This suggests that in recent years the influence of the special circumstances represented by the disturbances in the decision equations appears to be becoming smaller or less frequent in relation to the explanatory parts; i.e., the simple percentage rules. (45) It seems reasonable to expect an increasing use of simplifying "rules of thumb" as the budget expands and the pressure of time allows only a limited capacity to evaluate temporary influences.

There is another point which may be inferred from Table B. When exactly one shift point is presumed, most such shifts are found to occur during the first two budgets of the Eisenhower Administration (1954-1955). Table 5 below presents, for both Congressional and Agency-Budget-Bureau decision equations, frequencies of the shift points for the agencies of Table B, for which either (i) at least one equation has coefficients in the not temporally stable or unstable categories, and (ii) the decision rules of the participants appeared to change. For the Congressional decision equations an (actual or forced) shift point was identified for each agency as the year omitted from the estimations of the two parts of the series. For the Agency-Bureau-of-the-Budget decision equations an (actual or forced) shift point was identified for each agency to be the first year included in the estimation on the second part of the series. While it is certainly possible that shift points do not occur as dramatically and sharply as shown here, and that it may take several years for behavior actually to change, Table 5 nevertheless makes it clear that likely shifts are concentrated in the first period of the Eisenhower Ad-

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Table 5

Frequencies of Shift Points

Year	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	T
Congressional	0	2	3	1	0	1	17	16	1	1	3	0	0	1	0	46 (40)
Agency-Bureau	0	2	4	0	2	3	5	12	3	0	2	1	0	2	1	37 (36)

ministration. Finally, a study of actual appropriations for the agencies for which shift points were identified revealed that substantial changes in magnitude of appropriations or requests always preceded or coincided with shift points. Since these changes are introduced by the introduction or termination of specific programs, an accompanying adjustment in decision rules is an understandable phenomenon.

Inspection of both Tables A and B reveals that as a rule, the d-statistics resulting from fitting the "best" specifications were not significant. It would thus appear that all major underlying trended variables (with the possible exception of variables with the same trend) have been accounted for by these "best" specifications. When an exception to this rule did exist, the authors made a careful examination of the residuals in an effort to determine the reason for such a situation. It appeared that in most of these instances the cause was either (i) that, as was mentioned above, the coefficients shifted slowly over several years and not abruptly at one point in time, or (ii) that the restriction of searching for only one shift point left undetected an additional shift point either very early or very late in the series. Where appropriate, remarks to this effect are listed under the "Comments" column in both Tables A and B.

In an attempt to unmask the trended variable most likely (in the authors' opinion) to have been ignored, and to cast some light upon the notion of "fair share", final appropriations y_t for each agency were regressed on total non-defense appropriations z_t. (46) In other words, the model

$$(5.1) \qquad y_t = \gamma_1 z_t + \emptyset_t$$

where $\emptyset_t$ is assumed normally distributed with zero mean and constant variance was fitted by OLS. If, for a given agency, the fit was good (if the sample correlation coefficient between the two variates was high and the d-statistic not significant), the estimator of γ_1 would represent an estimate of the agency's "fair share" of the non-defense budget. While these results are not reported here, it should be mentioned that in general they are inferior to those reported in Tables A and B. Indeed, the sample correlations between y_t and z_t are usually poorer than those between y_t and x_t. More-

over, the d-statistics are usually highly significant and the residual patterns show the agency's proportion of the non-defense budget to be either increasing or decreasing over time. However, it should be noted that even those exceptional cases where the agency trend is close to that of total non-defense appropriation do not invalidate the explicit decision structure fitted here. A similar study (with similar results) was conducted at the departmental level by regressing y_t for the eight National Institutes of Health on y_t for the Public Health Service, the agency of which they are a part. Finally, the y_t for selected pairs of agencies with "similar" interests were regressed on each other with uniformly poor results. Thus it would appear that in practice the notion of "fair share" serves, at the very best, as only a rough guide to decision making. (47)

In an attempt to discover whether or not naive models would fit as well as the models presented here, the parameters of the third order autoregressive scheme

$$y_t = \alpha_5 y_{t-1} + \alpha_6 y_{t-2} + \alpha_7 y_{t-3} + \zeta$$

$$x_t = \beta_8 x_{t-1} + \beta_9 x_{t-2} + \beta_{10} x_{t-3} + \Psi$$

were estimated. In no case did this occur, and generally the fits for this model were very poor relative to those for the models above.

6. Concluding Remarks

On the whole the results of this study are encouraging in that they support the hypothesis that realized aggregate behavior of the budgeting process of the United States Government is in close agreement with that described by a set of temporally stable linear decision rules. It should be noted that these rules incorporate the principal aspects of budgeting behavior found previously [14], [32] by more traditional methods of political science analysis. In particular, the concept of an agency's base is an integral part of each of the models fitted. Hence, this study may also be taken as supporting the general view that, at least as a first approximation, the usual behavior of decision-making human beings in complex situations is to resort to the use of a set of simplifying "rules of thumb". (48)

It should be admitted, however, that to a certain extent the analysis and interpretation of the data in Tables A and B, and presented here in section 5, is summarizing, general, and not fully complete. Observe, for example, that although temporary influences affecting appropriations and requests have been treated as random disturbances in the models of this paper, anyone familiar with the facts available to the decision-makers at the time should be able to explain these special circumstances. Thus a more detailed analysis might include an examination of instances in which the esti-

mated values of the disturbances (i.e., the residuals) assume large positive or negative values. For a subset of the agencies examined here, such a study of the reasons why Congressional participants in budgeting "temporarily waive" their usual decision rules is reported in section 4 of Davis, Dempster and Wildavsky [10]. Of course, this additional and detailed analysis presumes that our models are correct. Since the fits presented here appear good, however, it is our belief that these models describe in the aggregate the budgeting process of the United States Government.

Another extension of the analysis of the data reported here might compare the estimated coefficients and statistics for selected agencies with similar interests. Also, it is of interest to determine what factors affect the relative values of the estimated coefficients and the growth rates of the various agencies. The authors hope to accomplish this additional analysis in the near future.

It is appropriate to point out possible deficiences of this study before discussing further the directions for future work indicated by the results of this analysis. The most obvious deficiency is the omission of certain agencies from the study. At least to us this does not seem too serious in view of the fact that over one half of all non-defense agencies were investigated. However, the omission of certain agencies may have left undiscovered examples of additional decision rules, and we are currently using the methods of this paper to analyse time series for the remaining non-defense agencies.

Possibly a more serious deficiency lies in the fact that the sample sizes are of necessity small and the processes generally unstable, precisely the conditions under which little econometric theory has been developed. Thus the criterion of maximum sample correlation lacks proper small sample justification, and is acceptable only because of the lack of a better criterion. Further, full information maximum likelihood estimators and especially biased ones, even when they are known to be consistent, are not fully satisfactory in such a situation, although they may be the best available. The remedy for these deficiencies must await the results of further theoretical research on "evolutionary" processes. (49) Since it is the aim of most economic and political systems to grow, the current state of knowledge concerning these processes is perhaps surprising. It is disappointing, in regard to full information estimators of structural parameters, from the point of view of positive theory, for often, as in this study, these parameters have behavioral or theoretical significance.

Although the models under consideration here are not predictive in nature, because of the possibility of coefficient shifts, one possible test of their usefulness is predictive ability. True predictive models of an agency's appropriations, however, would have to include predictions concerning the occurrence and magnitude of alterations in the decision rules. Thus, perhaps the

most interesting direction for future research would explore what determines these shifts and when they occur. Peacock and Wiseman [25] have attempted to explain the long run trend of national budgets, a major increase in periods of social disruption followed by a gentle rise, in terms of the susceptibility of the public to taxation. Behaviorally, it would appear that the new programs producing a major increase induce shift points in many agencies simultaneously, while the subsequent gentle rise can be explained in terms of our models and an ordinary rate of new program introduction (cf. table 5). Hence, while long run and highly aggregate (e.g. departmental) behavior may no doubt be explained in terms of total appropriations, gross national product and other aggregate economic, social and political variables, perhaps a descriptively more illuminating approach would use dummy variables to introduce political considerations such as supplemental and unspent appropriations, Congressional majority parties and Presidential pressure into the structural parameters of the present models. This approach should be particularly feasible, as should a more detailed study of the decision structure operating on an agency's request, for agencies which have been found to have a well defined shift point or to be temporally stable by the methods of this paper.

Finally, in view of the indication of considerable similarity in decision-making amongst federal government agencies presented here, it is interesting to consider the application of the present methods elsewhere. Two areas which immediately suggest themselves are the appropriations of other governments, municipal, regional or national, and the operating budgets of large firms or institutions. (50)

APPENDIX

This appendix contains discussions and derivations of estimation procedures for the processes of section 4. Results are given in detail only when the existing literature is either not immediately applicable or incomplete. The derivation of the estimation procedures for the systems (4.14-4.36) is based on the FIML method under the assumption of normally distributed disturbances. However, the optimal asymptotic properties of these estimators are discussed in both stable and unstable cases, with and without the Gaussian assumption. In the case of (4.24-4.26), when an auto-correlated disturbance is present in the first equation of the system (3.2), most of the asumptotic properties are undecided. In all cases the estimators are biased.

It can be argued that the many optimum properties of ML estimators, whether or not normality is assumed, justifies their use in spite of the usually increased burden of computation. For the models of this paper, although computational difficulties are negligible, none of the available results

apply directly to the unstable case. Hence the statements of two general theorems (51) useful in deciding the consistency of the FIML and QML estimators of the systems (4.14-4.36) follow.

Consider an arbitrary m-dimensional vector stochastic process involving an unknown k-dimensional vector of parameters θ. Suppose that the joint density $f_n(x_n|\theta)$ of n observations x_n is such that the k-vector

$$E^0\left(\frac{\partial \log f_n}{\partial\theta} \mid \theta = \theta_o\right) = E^0\left(\frac{\partial \log f_n}{\partial\theta^0}\right) = \frac{\partial}{\partial\theta^0}\int_{E_{mn}} f_n(x_n \mid \theta)dx = 0$$

where $E^0(\cdot)$ denotes expectation with respect to $f_n ds$ over Euclidean mn-dimensional space for the true value of the parameter, θ^0. Such a density is said to be <u>regular</u> with respect to its first derivatives at θ^0 and a sufficient condition for this is that

$$\frac{\partial}{\partial\theta_s^0} \log f_n \text{ be dominated by functions } g_s(t_n) \text{ integrable}$$

over E_{mn} for s = 1, ..., k. The symmetric, non-singular k x k matrix

$$I_n = E^0\left(\frac{\partial f_n}{\partial\theta^0} \quad \frac{\partial f_n}{\partial\theta^{0\prime}}\right)$$

is called the <u>information matrix</u> of the sample likelihood.

<u>Theorem 1</u>: For the process under consideration suppose that f_n is regular with respect to its first derivatives at θ^0 and that

$$\frac{\partial \log f_n}{\partial\theta}$$

is of the form $S(\theta)[T_1(x_n)\theta - T_2(x_n)]$ with only the functional dependencies indicated. (S and T_1 are non-singular (the latter with probability 1) k x k matrices and T_2 a k-vector.) Then if $tr(I_n^{-1}) \to 0$ and $T_1^{-1}S^{-1}I_n$ is a matrix of random variables bounded in probability, $\hat{\theta} = T_1^{-1}T_2$ is a vector of consistent ML estimators. If

$$tr\left(\frac{1}{n^2} I_n\right) \to 0 \text{ and } nT_1^{-1}S$$

is bounded in probability, a similar result holds.

A (square) matrix estimating equation $T_1\theta - T_2 = 0$ for θ^0 is said to be <u>unbiased</u> if $E^0(T_1\theta^0 - T_2) = 0$. This concept is due to Bartlett and Durbin.

In [13], Durbin obtained a Cramer-Rao bound for the covariance matrix of such an equation (normalized). When T_1 is a constant matrix and

$$E^0 T_2 = T_1 \theta^0, \text{ the estimator } \hat{\theta} = T_1^{-1} T_2$$

is unbiased. In general it is not. Denote the covariance matrix

$$E^0 (T_1 \theta^0 - T_2)(T_1 \theta^0 - T_2)' \text{ as } V_n.$$

Theorem 2: For the process under consideration, suppose that $T_1(x_n)\theta - T_2(x_n)$ is an unbiased estimating equation for θ^0 with only the functional dependencies indicated. (T_1 is a k x k matrix, non-singular with probability 1, and T_2 is a k-vector.) Then if $tr(V_n^{-1}) \to 0$ and $T_1^{-1} V_n$ is a matrix of random variables bounded in probability, $\theta = T_1^{-1} T_2$ is a vector of consistent estimators. If

$$tr(\tfrac{1}{n} V_n) \to 0 \qquad \text{and} \qquad n T_1^{-1} \text{ is bounded in probability,}$$

a similar result holds.

Often QML estimating equations satisfy the assumptions of theorem 2. These two theorems serve to reduce the problem of consistency of the FIML and QML estimators to a study of the properties of the sample moment matrix and its expectation, since T_1 is often a function of the former and I_n and V_n functions of the latter. Notice that no assumption about the stability of the process is required. Known consistency results will be shown in the forthcoming paper to follow easily from these theorems for stable systems (when the probability limits of $T_1^{-1} S^{-1} I_2$ and $T_1^{-1} V_n$ are constants). Their power, however, lies in their usefulness in the unstable case.

Returning now to the models of this paper, the notion of (dynamic) will be made precise. A process following the model (4.1) will be said to be stable if all roots of the characteristic equation $\det(A + B\rho^{-1}) = 0$ of the system are less than one in absolute value. Otherwise it is said to be unstable. In the first case the process would reach an equilibrium in the absence of the disturbances, in the second it would be trended and would not. For the systems of this paper, except for (4.24-26), there is only one characteristic root ρ and hence a system will be stable if $|\rho| < 1$ and unstable otherwise. Let the variance of the disturbances in equation (3.i) be denoted by σ_i^2 for i = 1, ..., 6. Then the log likelihood of a sample of n observations on the system (4.14), conditional on the 0th, is

$$(1) \quad \log f(Y_1, \ldots, Y_n \mid Y_0, \theta^0) =$$

$$\frac{n}{2}\log 2\pi\sigma_1^2 - \frac{1}{2\sigma_1^2}\Sigma(y_t - \alpha_0 x_t)^2 - \frac{n}{2}\log 2\pi\sigma_4^2 - \frac{1}{2\sigma_4^2}\Sigma(x_t - \beta_0 y_{t-1})^2$$

where the (true) parameter vector is $\theta^0 = (\alpha_0\beta_0\sigma_1^2\sigma_4^2)'$. Hence the FIML and OLS estimating equations coincide as

$$\left.\frac{\partial \log f}{\partial \theta}\right|_{\theta=\hat{\theta}} = \begin{pmatrix} -\frac{1}{s_1^2}\Sigma(y_t - a_0x_t)x_t \\ -\frac{1}{s_t^2}\Sigma(x_t - b_0y_{t-1})y_{t-1} \\ \frac{n}{2s_1^2} - \frac{1}{2s_1^4}\Sigma(y_t - a_0x_t)^2 \\ \frac{n}{2s_4^2} - \frac{1}{2s_4^4}\Sigma(x_t - b_0y_{t-1})^2 \end{pmatrix} = 0$$

Now

$$\frac{\partial^2 \log f}{\partial\theta^0\,\partial\theta^{0\prime}} = \begin{pmatrix} \frac{1}{\sigma_1^2}\Sigma x_t^2 & 0 & \frac{1}{\sigma_1^4}\Sigma\eta_t x_t & 0 \\ 0 & \frac{1}{\sigma_4^2}\Sigma y_{t-1}^2 & 0 & \frac{1}{\sigma_4^4}\Sigma\xi_t y_{t-1} \\ \frac{1}{\sigma_1^4}\Sigma\eta_t x_t & 0 & -\frac{n}{2\sigma_1^4} + \frac{1}{\sigma_1^6}\Sigma\eta_t^2 & 0 \\ 0 & \frac{1}{\sigma_4^4}\Sigma\xi_t y_{t-1} & 0 & -\frac{n}{2\sigma_4^4} + \frac{1}{\sigma_4^6}\Sigma\xi_t^2 \end{pmatrix}$$

so that $I_n = E\left[\frac{\partial \log f}{\partial\theta^0}\;\frac{\partial \log f}{\theta^{0\prime}}\right] = E\left[-\frac{\partial^2 \log f}{\partial\theta^0\partial\theta^{0\prime}}\right] =$

$$\text{diag}\left(\frac{1}{\sigma_1^2}\Sigma Ex_t^2,\ \frac{1}{\sigma_4^2}\Sigma Ey_{t-1}^2,\ \frac{n}{\sigma_1^4},\ \frac{n}{\sigma_4^4}\right)$$

since η_t and x_t and ξ_t and y_{t-1} are independent for all t under the assumptions. The relation between the first and second partial derivatives of (1) follows from the well-known fact that the distribution of a sample from a Gaussian process following model (4.1) is regular with respect to its second derivatives. In order to generate parametric forms for the sums in I_n, conditional on x_0 and y_0, the system (4.14) may be solved and expections taken to yield the following two difference equations:

$$Ey_t^2 = \beta^2 Ey_{t-1}^2 + k_1 \,,\; Ey_0^2 = y_0^2 \qquad \text{and}$$

$$Ex_t^2 = \beta^2 Ex_{t-1}^2 + k_4 \,,\; Ex_0^2 = x_0^2 \quad t = 1, 2, \ldots$$

where $\beta = \alpha_0\beta_0$, $k_1 = \sigma_1^2 + \alpha_0^2\sigma_4^2$ and $k_4 = \sigma_4^2 + \beta_0^2\sigma_1^2$. The solution of the second is

$$(2) \qquad Ex_t^2 = \begin{cases} B^{2t}x_0^2 + k_4\dfrac{1 - B^{2t}}{1 - \beta^2} & \text{if } |\beta| \neq 1 \\ x_0^2 + tk_4 & \text{otherwise} \end{cases}$$

so that

$$\Sigma Ex_t^2 = \begin{cases} \dfrac{\beta^2(1 - \beta^n)}{(1 - \beta^2)^2}[1 - \beta^2)\, x_0^2 + k_4] + \dfrac{nk_4}{(1 - \beta^2)} & \text{if } |\beta| = 1 \\ nx_0^2 + k_4\dfrac{n(n - 1)}{2} & \text{otherwise} \end{cases}$$

and n^{-1} times the sum converges if $|\alpha_0\beta_0| < 1$ and diverges otherwise. An analogous result holds for the second equation. For (4.14), as might be expected from these considerations, the characteristic root $\rho = \alpha_0\beta_0$. In the stable Gaussian case, when $|\alpha_0\beta_0| < 1$, since the system is identified, the results of Koopmans, Rubin and Leipnik [19], theorems 3.3.4, p. 135, and 3.3.6, p. 139, may be applied to conclude that the OLS (FIML, QML) estimators a_0 and b_0 are consistent and asymptotically independently normally distributed with means α_0 and β_0 and variances

$$\frac{1}{n^2\sigma_1^2}\,\Sigma Ex_t^2 \quad \text{and} \quad \frac{1}{n^2\sigma_4^2}\,\Sigma Ey_{t-1}^2 \,.$$

Using theorem 3.3.4, the consistency of the OLS variance estimators follows exactly as in Mann and Wald [21], pp. 184-85, and hence whether or not the process is Gaussian, the usual t-tests of coefficient significance are asymptotically valid.

Now, consider the unstable process, when $|\alpha_0\beta_0| \geq 1$. In the Gaussian

case, since I_n is a diagonal matrix, it is clear that the asymptotic properties of the FIML structural parameter estimators are the same whether or not σ_1^2 and σ_4^2 are known. In order to apply theorem 1 to

$$f_n(Y_1, \ldots, Y_n \mid Y_0, \alpha_0, \beta_0) \text{ in the former case,}$$

consider $I_n = \text{diag}\left(\frac{1}{\sigma_1^2}\Sigma Ex_t^2, \frac{1}{\sigma_4^2}\Sigma Ey_{t-1}^2\right)$

so that $tr(I_n^{-1}) = \sigma_1^2/\Sigma Ex_t^2 + \sigma_4^2/\Sigma Ey_{t-1}^2 \to 0$

by (2). Moreover, $S = \text{diag}(\sigma_1^{-2}, \sigma_4^{-2})$ and $T_1 = \text{diag}(\Sigma x_t^2, \Sigma y_{t-1}^2)$

so that $T_1^{-1}S^{-1}I_n = \text{diag}(\Sigma Ex_t^2/\Sigma x_t^2, \Sigma Ey_{t-1}^2/\Sigma y_{t-1}^2)$. To show that $T_1^{-1}S^{-1}I_n$ is bounded in probability, consider $\Sigma Ex_t^2/\Sigma x_t^2$. If $|\alpha_0\beta_0| > 1$, then from (2) $\lim_{n\to\infty} \beta^{-2n}\Sigma Ex_t^2 = [(\beta^2 - 1)x_0^2 - k_4]/(1 - \beta^2)^2 \neq 0$ and since the disturbances have a continuous distribution, so does $\beta^{-2n} x_t^2$. Hence $\lim_{n\to\infty} P_r\{\beta^{-2n}\Sigma x_t^2 = 0\} = 0$ and multiplying and dividing by $\beta^{-2n}\Sigma Ex_t^2/Ex_t^2$ is bounded in probability. If $|\alpha_0\beta_0| = 1$, then $\lim_{n\to\infty}\Sigma Ex_t^2/n^2 = k_4/2 \neq 0$ so that $\Sigma Ex_t^2/x_t^2$ is again bounded in probability. Similarly, $\Sigma Ey_{t-1}^2/\Sigma y_{t-1}^2$ is bounded in probability. It follows from theorem 1, that a_0 and b_0 are consistent. To show that s_1^2 is consistent, consider

$$s_1^2 = \frac{1}{n}\Sigma(y_t - a_0x_t)^2 = \frac{1}{n}\Sigma[(\alpha_0 - a_0)x_t + \eta_t]^2 =$$
$$\frac{1}{n}(\alpha_0 - a_0)^2\Sigma x_t^2 - \frac{2}{n}(\alpha_0 - a_0)\Sigma x_t\eta_t + \frac{1}{n}\Sigma\eta_t^2.$$

By the strong law of large numbers (SLLN), the last term $\to \sigma_1^2$ with probability 1. Moreover, since $\frac{1}{\sqrt{n}}(\alpha_0 - a_0)(\Sigma x_t^2)^{\frac{1}{2}} = -\left(\frac{\beta^{-n}}{\sqrt{n}}\Sigma\eta_t x_t\right)(\beta^{-2n}\Sigma x_t^2)^{-\frac{1}{2}}$

and the first factor has mean 0 and variance $\sigma_1^2 \frac{\beta^{-2n}}{n}\Sigma Ex_4^2 \to 0$ so that it $\to 0$ in probability by the Tshebyshev inequality, while the second is bounded in probability; the first term $\to 0$ in probability. So does the second on applying the Schwartz inequality to $\Sigma x_t\eta_t$ and using the SLLN and the previous result. A similar procedure yields the consistency of s_4^2.

To establish the consistency of the QML estimators of α_0 and β_0 in the unstable case, consider the covariance matrix of the estimating equation vector,

$$(\Sigma\eta_t x_t, \Sigma\, \xi_t y_{t-1}, \sigma_1^2 - \tfrac{1}{n}\Sigma\eta_t^2, \sigma_4^2 - \tfrac{1}{n}\Sigma\xi_t^2)',$$

formed by replacing the parameter estimates by their true values in the left-hand side of the unbiased estimating equations. Since, under the assumptions, the covariance terms between the first two elements and the last two are all zero, the asymptotic properties of the QML estimators of the structural parameters, as in the previous paragraphs, may be considered separately. In order to apply theorem 2, one must consider

$$V_n = \begin{pmatrix} E(\Sigma\eta_t x_t)^2 & E(\Sigma\eta_t x_t \Sigma\xi_t y_{t-1}) \\ E(\Sigma\xi_t y_{t-1}\Sigma\eta_t x_t) & E(\Sigma\xi_t y_{t-1})^2 \end{pmatrix}.$$

The first entry may be written $E(\Sigma\eta_t^2 x_t^2 + 2\sum_{\tau<t}\eta_t\eta_\tau x_t x_\tau) = \sigma_1^2 \Sigma Ex_t^2$ and similarly $E(\Sigma\xi_t y_{t-1})^2 = \sigma_4^2 \Sigma Ey_{t-1}^2$. The off-diagonal element may be written as $E(\Sigma\eta_t\xi_t x_t y_{t-1} + 2\sum_{\tau<t}\eta_t\xi_\tau x_t y_{\tau-1}) = \Sigma\, E\eta_t E(\xi_t x_t y_{t-1}) +$

$$2\sum_{\tau<t} E\eta_t E(\xi_\tau x_t y_{\tau-1}) = 0.$$

Hence $V_n = \mathrm{diag}\,(\sigma_1^2 \Sigma Ex_t^2, \sigma_4^2 \Sigma Ey_{t-1}^2)$ and it follows from theorem 2 by an argument analogous to that of the previous paragraph that the QML estimators a_0, b_0, s^2, and s_4^2 are consistent.

For the systems (4.15) and (4.16), the log likelihoods of a sample of n observations, conditional on the 0th, are

$$-\frac{n}{2}\log 2\pi\sigma_1^2 - \frac{1}{2\sigma_1^2}\Sigma(y_t - \alpha_0 x_t)^2 - \frac{n}{2}\log 2\pi\sigma_5^2$$

$$-\frac{1}{2\sigma_5^2}\Sigma[x_t - \beta_1 y_{t-1} - \beta_2(y_{t-1} - x_{t-1})]^2 \quad \text{and}$$

$$-\frac{n}{2}\log 2\pi\sigma_1^2 - \frac{1}{2\sigma_1^2}\Sigma(y_t - \alpha_0 x_t)^2 - \frac{n}{2}\log 2\pi\sigma_6^2 - \frac{1}{2\sigma_6^2}\Sigma(x_t - \beta_3 x_{t-1})^2,$$

while the characteristic roots ρ are $\alpha_0\beta_1 + (1 - \alpha_0)\beta_2$ and β_3. There is no difficulty in extending the arguments for the system (4.14) to (4.15) and (4.16), in order to conclude that the FIML and QML estimators of all the parameters are consistent, except that for (4.15) one must first find the parametric form for Ex_t^2 by substitution from the first equation and then using it to find Ey_t^2 and the parametric forms of ΣEx_t^2 and ΣEy_{t-1}^2. Nevertheless, it is clear that the leading root is $O(\rho^{-2n}/n)$ which is all that is required. Note that both (4.15) and (4.16) are identified.

Before discussing procedures for the systems (4.24) and (4.26) consider the log likelihood of a sample of n observations, conditional on the 0th, from the process of (4.34)

$$-\frac{n}{2}\log 2\pi\sigma_3^2 - \frac{1}{2\sigma_3^2}\Sigma(y_t - (\alpha_3 + \alpha_4)x_t + \alpha_4\beta_0 y_{t-1})^2$$
$$-\frac{n}{2}\log 2\pi\sigma_4^2 - \frac{1}{2\sigma_4^2}\Sigma(x_t - \beta_0 y_{t-1})^2$$

Hence the FIML estimating equations for the structural parameters,

$$\Sigma(y_t - (a_3 + a_4)x_t + a_4 b_0 y_{t-1})x_t = 0$$

$$\Sigma(y_t - (a_3 + a_4)x_t + a_4 b_0 y_{t-1})(x_t - b_0 y_{t-1}) = 0$$

$$\frac{a_4}{s_3^2}\Sigma(y_t - (a_3 + a_4)x_t + a_4 b_0 y_{t-1})y_{t-1} + \frac{b_0}{s_4^2}\Sigma(x_t - b_0 y_{t-1})y_{t-1} = 0,$$

are non-linear. However, using the first and second, it follows easily that b_0 is the OLS estimator for β_0 (when the independent variable is treated as a fixed variate). Moreover, the first two equations may be written

$$(3)\qquad \begin{aligned} a_3\Sigma x_t^2 + a_4\Sigma x_t u_t &= \Sigma x_t y_t \\ a_3\Sigma u_t x_t + a_4\Sigma u_t^2 &= \Sigma u_t y_t \end{aligned}$$

i. e., the normal equations for the LS regression of y on x and u, where $u_t = x_t - b_0 y_{t-1}$, the residual from the OLS estimation of (3.4). The remaining FIML estimators are just the usual OLS estimators of the variances σ_3^2 and σ_4^2. Thus for (4.34) FIML (QML) and OLS estimators coincide. It is clear that the demonstration of this equivalence for (4.36) is precisely analogous, with b_3, s_6^2 and x_{t-1} replacing b_0, s_4^2 and y_{t-1}. However, for the model (4.35), the demonstration breaks down due to the presence of two parameters in (3.5). For this system OLS and FIML estimators do not, in general, coincide, so that none of the above theorems are applicable. There was no evidence of this system in the empirical study. The characteristic roots ρ of systems (4.34) and (4.36) are, respectively, $\alpha_3\beta_0$ and β_3. Notice that the equations (3) are a set of unbiased estimating equations for the parameters of (3.3) in (4.34). Combining (3) with the OLS estimating equations for β_0, σ_3^2 and σ_4^2, it is easily seen that the covariance matrix of the unbiased estimating equation vector

$$(\Sigma\nu_t x_t \quad \Sigma\nu_t\xi_t \quad \Sigma\xi_t y_{t-1} \quad \sigma_3^2 - \frac{1}{n}\Sigma\nu_t^2 \quad \sigma_4^2 - \frac{1}{n}\Sigma\xi_t^2)'$$

is diagonal, so that one may consider the properties of the estimators of the structural parameters separately. It is clear that it suffices to establish the consistency of the QML estimators of all five parameters (assuming only

a continuous distribution of the disturbances with two moments finite), since $-\partial^2 \log f_n/\partial\theta^0\partial\theta^{0\prime}$ is an extremely complicated (matrix) function of the parameters and in the stable case the results [19] are of no use. Then, of course, the consistency of the FIML estimators follows as a special case. Note that the structural parameters of (4.34) are identified by virtue of the diagonal covariance matrix of the disturbances. No difficulty is encountered in extending the arguments for this system to the present system, since the covariance matrix V_n is diag $(\sigma_3^2 \Sigma E x_t^2,\ n\sigma_3^2\sigma_4^2,\ \sigma_4^2 \Sigma E y_{t-1}^2)$ and the parametric forms required to verify the conditions of theorem 2 are the same as (2) with different k's. To show that s_3^2 is consistent one must consider the probability limit of $s_3^2 = \Sigma(y_t - a_3x_t - a_4u_t)^2/n$, which upon substituting $(\beta_0 - b_0)y_{t-1} + \xi_t$ for u_t leads to terms such as

$$2a_4(\alpha_4 - a_4)(\beta_0 - b_0)\Sigma\ \xi_t y_{t-1}/n\ ,$$

as well as those of the form considered for (4.14). Using the Schwartz inequality on the sum, the SLLN and the facts that $a_4 \to \alpha_4$ and, for example, $(\beta_0 - b_0)\Sigma y_{t-1}^2/\sqrt{n} \to 0$ in probability, these terms are easily seen to converge to zero in probability. Hence by theorem 2, one may conclude that both the FIML and QML estimators of all the parameters of (4.34) are consistent in both the stable and unstable case. Naturally, a similar conclusion holds for the system (4.36).

Now consider the processes with auto-correlated disturbances. For these systems, (4.24-26), the first factor of the likelihood function is

$$(2\pi\sigma_2^2)^{\frac{n}{2}} \exp\ \{-\frac{1}{2\sigma_2^2}\Sigma(y_t - \alpha_1x_t - \alpha_2y_{t-1} \quad \alpha_1\alpha_2x_{t-1})^2\}$$

so that FIML estimates of the structural parameters of the first equation satisfy the third degree polynomial estimating equations

$$\Sigma(y_t - a_1x_t - a_2(y_{t-1} - a_1x_{t-1}))(x_t - a_2x_{t-1}) = 0$$

$$\Sigma(y_t - a_1x_t - a_2(y_{t-1} - a_1x_{t-1}))(y_{t-1} - a_1x_{t-1}) = 0$$

or letting $u_t = y_t - a_1x_t$ and $w_t = u_t - a_2u_{t-1}$

$$\Sigma(y_t - a_1x_t - a_2u_{t-1})x_t = a_2\Sigma w_t x_{y-1}$$

(4)

$$\Sigma(y_t - a_1x_t - a_2u_{t-1})u_{t-1} = 0$$

It is clear, upon substituting true parameter values, that these equations although non-linear are unbiased. In particular, $\alpha_2 E\ \Sigma\xi_t x_{t-1} = 0$, so that in the mean these equations look like the normal equations for the OLS regression of y_t on x_t and u_{t-1}, an unobservable. Since none of the above theorems apply to non-linear equations, this observation will be related to two heuristic

procedures for estimating α_1, α_2 and σ_2^2 with estimating equations similar to (4). First, however, consider the charasteristic equations of the systems (4.24) to (4.26). They are, respectively,

$$\rho^2 - (\alpha_1\beta_0 + \alpha_2)\rho + \alpha_1\beta_0\alpha_2 = 0$$

$$\rho^2 - (\alpha_1(\beta_1 - \beta_2) + \alpha_2(1 - \beta_2) + \beta_2)\rho + \alpha_1(\beta_1 - \beta_2)\alpha_2 = 0$$

$$\rho^2 - (\alpha_2 + \beta_3)\rho + \alpha_2\beta_3 = 0 ,$$

and

so that the characteristic roots of (4.24) are $\rho_1 = \alpha_1\beta_0$ and $\rho_2 = \alpha_2$ while those of (4.36) are $\rho_1 = \alpha_2$ and $\rho_2 = \beta_3$. In the empirical study it is to be expected that

$$|\alpha_1\beta_0| \geq |\alpha_2| \ , \ |\beta_3| \geq |\alpha_2| \text{ and } |\alpha_2| < 1.$$

This will be assumed in the sequel, so that the stability of the process will depend on the magnitude of $|\alpha_1\beta_0|$ for (4.24) and of $|\beta_3|$ for (4.26).

A natural procedure, ignoring auto-correlation at first, is to use the OLS estimating equation

$$\sum_{n=0}^{n} (y_t - a_1x_t)x_t = 0$$

to estimate α_1 and then to use the estimated residuals, $u_t = y_t - a_1x_t$, $t = 0, 1, \ldots, n$, to estimate α_2 from $\Sigma(y_t - a_1x_t - a_2u_{t-1})u_{t-1} = 0$, where a_1 has been found previously, and the variance of the disturbance σ^2 (v) (when this has meaning) as

$$s^2(v) = \sum_{t=0}^{n} u_t^2/n-1.$$

It is well known that s^2 (v) and the LS estimate of the variance of a_1 may be seriously biased downwards; especially here, since x_t in the present systems will be strongly positively auto-correlated. H. Wold has proposed a correction for the bias of $s^2(a_1)$ which has been shown to yield a consistent estimate under the most general conditions by Lyttkens [20]. For all such derivations, however, ergodicity, for which stability of the system is necessary, is assumed. (52) From heuristic considerations, the estimator a_2 may be biased upwards in the unstable case (i.e., the damping of the disturbance process may be underestimated) due to the growth of the fitting discrepancy as the x, y values move away from the origin over time. Notice that although all estimations of the parameters of the first equation of the systems (4.24) to (4.26) need be made conditional only on x_0, the properties of the estimators involved will, in general, depend on the distribution of v_0. If $v_0 = 0$ or is a random variable with mean 0 (in particular if the disturbance process is stationary) the estimating equations for α_1 and α_2 are unbiased. Then due to the assumed stability of the disturbance process, the LS estimate behaves asymptotically like that for the corresponding (4.1) system

and the arguments above may be extended to conclude the consistency of the estimators for α_1, α_2 and the limiting value of $\alpha^2(v) \cdot \sigma_2^2/1 - \alpha_2^2$, using theorem 2. For unstable (4.26), these conclusions were derived [11] for the case of a Gaussian disturbance process, without any particular assumption on v_0. For the empirical study, the only assumption on v_0 which seems unreasonable is that of 0 constant value. Since it has been noted that the estimators of α_2 and $\sigma^2(v)$ may be badly biased for small samples, and since the first estimating equation looks little like the GLS (FIML) first equation of (4), consider the following 2-stage extension of this procedure.

Use $\sum_{t=0}^{n-1} (y_t - \tilde{a}_1 x_t)x_t = 0$ to estimate α_1 and compute the residuals $u_0, u_1, \ldots, u_{n-1}$ as above. Then treating the u's as a given series, perform an ordinary multiple regression (through the origin) of y on x and u for $t = 1, \ldots, n$. The OLS estimating equations are then

$$\Sigma (y_t - a_1 x_t - a_2 u_{t-1})x_t = 0$$

$$\Sigma (y_t - a_1 x_t - a_2 u_{t-1})u_{t-1} = 0$$

Unfortunately, these equations are not unbiased due to the dependency of the u's on $\tilde{a}_1$, so that theorem 2 is not applicable. They might be expected, however, to distribute bias more evenly between the estimators of a_1 and a_2 and, in the usual OLS estimate of the variance of the disturbances, provide an estimator for σ_2^2. In [11], it was shown, using a method of T. W. Anderson, that for the case of unstable (4.26), with a Gaussian disturbance process in (3.2), these estimators are consistent. A similar result was conjectured for (4.24). In the empirical study, it was noticed that the estimates of α_1 given by the natural and extended procedure were in good agreement, while the estimate of α_2 fell in absolute value, and that of σ_2^2 rose (relative to $s^2(v)/1 - a_2^2$) for the latter.

Notice that since the systems (4.24) to (4.26) are recursive and the disturbance process is assumed stable, the usual arguments may be extended to show that the FIML and QML estimates of the parameters of the second equations are consistent. Again, the only difficulty is with the parametric form of $\Sigma E y_{t-1}^2$, which involves converging sums in α_2. In the stable case, the results of [19] may be applied to the FIML estimators of the structural parameters of the second equation to conclude asymptotic normality. Since (4.24) may be reduced, on elimination of x, to the second-order stochastic difference equation

$$y_t - (\alpha_1\beta_0 + \alpha_2)y_{t-1} + \alpha_1\beta_0\alpha_2 y_{t-2} = \epsilon_t + \alpha_1\xi_t - \alpha_1\alpha_2\,\xi_{t-1} \quad t=1,2,\ldots;$$

when $|\alpha_1\beta_0| < 1$, results of T. W. Anderson [2] may be used to conclude that the QML estimators c_1, c_2 and s^2 of the parameters involved are con-

sistent. When $|\alpha_1\beta_0| \geq 1$, an extension of a result of [26], see [10], may be used similarly, since continuous functions of consistent estimators are consistent estimators,

$$a_1 = 2c_2/b_0(c_1 - \sqrt{c_1^2 - 4c_2}),\ a_2 = (c_1 - \sqrt{c_1^2 - 4c_2}/2) \text{ and}$$
$$s_2^2 = s^2 - 2c_2^2[2(c_1^2 - c_1\sqrt{c_1^2 - 4c_2} - 2c_2)^{-\frac{1}{2}} - 1)\, s_4^2/b_0^2]$$

provide consistent estimates of α_1, α_2 and σ_2^2. In order to make these estimates comparable b_0 and s_4^2 must be estimated from the last n observations and the conclusion is reached conditional on x_1, y_0 and y_1, thus reducing the effective number of observations by one. In the empirical study, this procedure sometimes generated ridiculous results, so that, as might be expected, the stochastic convergence of the procedure appears slow.

Another procedure, suggested by Durbin in [13] for multiple regression with p^{th} order auto-correlation in which the estimators satisfy an asymptotically unbiased estimating equation, also generated absurd results in the empirical study. It consists of regressing (through the origin) y_t on x_t, x_{t-1} and y_{t-1}, using the estimated coefficient of y_{t-1} as an estimate of α_2 and utilizing this coefficient to obtain an estimate of α_1. In (4.24), x_t and y_{t-1} are linearly dependent up to the disturbance of ξ_t of (3.4), and hence the estimation of the coefficient of y_{t-1} might be expected to be badly biased. Similarly for (4.25). For (4.26), the estimate of this coefficient should probably be better, but the linear dependence of x_t and x_{t-1} up to ϕ_t could raise difficulties.

The results of this discussion of the properties of the full information estimators of the parameters of these systems are summarized in Table 6. A T entry is true, and F entry false and an O entry still open. The letter S denotes stable, U, unstable, and the symbol, e.g., F(U, 3.6), false for the estimators of (3.6) in the unstable case. All the FIML and QML estimators of these systems are GLS estimators biased in small samples.

Note that for the systems for which there was evidence in the empirical study, the estimators used (with the single exception of the extended procedure estimators for (4.24)) are known to be consistent.

TABLE 6

System	Procedure	Form	Consistent	Asymptotically normal structural parameters	Remarks
4.14	FIML	OLS	T	T(S) O(U)	
	QML	OLS	T	T(3.4) O	
4.15	FIML	OLS	T	T(S) O(U)	
	QML	OLS	T	T(3.5) O	
4.16	FIML	OLS	T	T(S) T(3.6) O(U)	
	QML	OLS	T	T(S, 3.6) F(U, 3.6)	
4.24	FIML	Nonlinear	O	T(S, 3.4) O(U)	
	QML	Nonlinear	O	O	
	Natural	2-stage	T	O	
	Extended	2-stage	O	O	
	Consistent	2-stage	T	O	Estimators converge slowly.
4.25	FIML	Nonlinear	O	T(S, 3.5) O(U)	
	QML	Nonlinear	O	O	
	Natural	2-stage	T	O	
	Extended	2-stage	O	O	
4.26	FIML	Nonlinear	O	T(S, 3.6) O(U)	
	QML	Nonlinear	O	F(U, 3.6) O	
	Natural	2-stage	T	O	
	Extended	2-stage	O	O	Consistent for unstable Gaussian.
4.34	FIML	OLS 2-stage	T	O	
	QML	OLS 2-stage	T	O	
4.35	FIML	Nonlinear	O	O	
	QML	Nonlinear	O	O	
4.36	FIML	OLS 2-stage	T	O	
	QML	OLS 2-stage	T	F(U, 3.6) O	

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TABLE A

Department and Agency	Period and No. of Obs.	Last Obs. ($ M)	Eqn. No.	Coefficient Estimates		R	Sample Std. Dev. of Dist. ($ M)	d	Temp. Stab. F-statistic	Temp. Stab. Cat.	Comments
TREASURY											
Bureau of Accounts	1956–63 8	30.30	3.1	0.986 (0.003)	----------	0.999	0.20	2.50	12.70	US	
	1949–63 14	30.81	3.4	1.089 (0.022)	----------	0.986	1.60	2.59	----------	US	
Bureau of the Public Debt	1955–63 9	47.75	3.1	0.994 (0.002)	----------	0.982	0.26	3.05	14.23	US	
	1947–63 16	48.00	3.4	0.997 (0.018)	----------	0.837	3.77	2.39	0.19	S	3.6 "operative" in early years.
Bureau of Customs	1950–63 14	64.78	3.1	0.987 (0.003)	----------	0.998	0.55	1.99	----------	US	No regular appropriation made in 1949.
	1950–63 13	66.00	3.4	1.055 (0.014)	----------	0.971	2.31	2.72	----------	US	
Internal Revenue Service	1955–63 9	486.00	3.3	0.949 (0.007)	−0.613 (0.052)	0.995	8.1	2.44	3.79°	US	°3.1 statistic 3.1 "operative" in early years.
	1955–63 9	513.00	3.4	1.145 (0.049)	----------	0.894	1.0	2.14	4.01	US	
Bureau of Narcotics	1952–63 12	4.580	3.1	1.000	----------	1.000	----------	----------	----------	US°	°Relation exact coeff. shifts 0.001 up.
	1953–63 10	4.580	3.4	1.050 (0.017)	----------	0.981	0.187	2.52	2.51	NS	
U.S. Secret Service	1955–63 9	7.060	3.3	0.982 (0.006)	−0.153 (0.083)	0.998	0.092	1.68	3.15°	US	°3.1 statistic. 3.1 "operative" in early years.
	1947–63 16	7.435	3.4	1.098 (0.019)	----------	0.970	0.317	2.10	0.82	S	
Bureau of the Mint	1956–63 8	6.480	3.3	0.984 (0.004)	−0.061 (0.035)	0.999	0.061	2.58	8.52°	US	°3.1 statistic.
	1956–63 7	6.680	3.6	1.905 (0.044)	----------	0.884	0.532	2.20	3.72	US	
JUSTICE											
Federal Bureau of Investigation	1948–63 16	130.7	3.1	1.000 (0.001)	----------	1.000	0.45	2.00	0.05	VS	Recently relation is exact. Coeff. stationary but disturbances decreasing var.
	1955–63 8	130.7	2.6	1.060 (0.014)	----------	0.973	4.23	2.56	0.03	S	
Immigration and Naturalization Service.	1955–63 9	64.05	3.3	0.985 (0.003)	−0.112 (0.050)	0.999	0.47	1.75	3.79°	US	°3.1 statistic. 3.1 "operative" in early years.
	1955–63 8	64.60	3.4	1.075 (0.018)	----------	0.955	2.66	1.76	4.01	US	
Federal Prison System	1956–63 8	56.06	3.3	0.925 (0.026)	−0.535 (0.145)	0.944	3.60	1.86	0.71	NS	
	1947–63 16	57.20	3.4	1.152 (0.050)	----------	0.864	6.92	2.00	0.47	S	

INTERIOR

South Eastern Power Admin	1956–63	0.800	3.1	0.999	----------	1.000	0.007	2.13	100.14	US	
	8			(0.002)							
	1959–63	0.800	3.6	1.020	----------	0.577	0.033	2.65	6.78	US	
	4			(0.021)							
South Western Power Admin	1956–63	8.660	3.1	0.999	----------	1.000	0.051	1.25	2.71	NS	
	8			(0.005)							
	1955–63	8.660	3.6	1.503	----------	0.322	2.405	1.95	0.14	NS	3.4 "operative" in early years.
	8			(0.467)							
Bonneville Power Admin	1956–63	42.51	3.1	0.973	----------	0.919	2.64	2.37	2.46	NS	
	8			(0.029)							
	1953–63	44.65	3.4	0.956	----------	0.871	7.10	1.04*	41.14	US	*coeff. shifting up in '63.
	10			(0.060)							
Bureau of Land Management	1955–63	42.51	3.2	0.961	−0.687	0.988	1.42	2.83	5.67	US	3.3 "operative" in early years.
	9			(0.018)	(0.283)				5.67		
	1955–63	44.55	3.4	1.177	----------	0.853	4.41	1.54	1.57	NS	
	8			(0.063)							
Bureau of Indian Affairs	1956–63	193.4	3.3	1.044	−0.443	0.947	13.7	2.17	9.42	US	3.1 statistic.
	8			(0.040)	(0.314)						
	1954–63	197.4	3.4	1.081	----------	0.908	16.0	1.78	2.65	NS	
	9			(0.050)							
Bureau of Reclamation	1955–63	333.7	3.1	0.957	----------	0.992	7.9	1.96	5.32	US	
	9			(0.010)							
	1954–63	344.0	3.4	1.143	----------	0.868	32.1	3.17	0.12	NS	3.6 "operative" in early years.
	9			(0.049)							
Geological Survey	1956–63	56.10	3.3	0.978	−0.355	0.996	0.99	2.79	10.08	US	
	8			(0.008)	(0.119)						
	1955–63	59.90	3.4	1.129	----------	0.955	3.17	2.23	7.70	US	
	8			(0.030)							
Bureau of Mines	1956–63	36.59	3.3	0.936	−0.895	0.974	1.52	2.11	0.00*	VS	*3.1 statistic.
	8			(0.017)	(0.112)						3.1 "operative" in early years.
	1955–63	37.49	3.4	1.154	----------	0.838	5.17	2.47	0.14	S	Coeff. stationary but var. of disturbances decreasing.
	8			(0.069)							
National Park Service	1955–63	117.3	3.3	1.032	−0.629	0.942	9.92	2.30	0.11	S*	3.1 "operative" in early years.
	9			(0.044)	(0.217)						
	1947–63	123.3	3.4	1.089	----------	0.902	13.69	1.83	0.02	S	*3.1 statistic.
	16			(0.063)							
Fish and Wildlife Service	1951–63	68.00	3.1	1.032	----------	0.998	1.21	3.04	15.99	US	
	13			(0.012)							
	1955–63	64.65	3.4	1.246	----------	0.951	5.51	2.45	1.02	NS	
	8			(0.069)							
Office of Territories	1956–63	20.37	3.1	0.908	----------	0.977	1.79	1.31	1.57	NS	
	8			(0.035)							
	1954–63	25.48	3.6	0.692	----------	0.878	7.11	0.67	6.79	US	
	9			(0.079)							

TABLE A—Continued

Department and Agency	Period and No. of Obs.	Last Obs. ($ M)	Eqn. No.	Coefficient Estimates		R	Sample Std. Dev. of Dist. ($ M)	d	Temp. Stab. F-statistic	Temp. Stab. Cat.	Comments
AGRICULTURE											
Agricultural Research Service	1959–63 5	212.7	3.1	1.069 (0.019)	----------	0.934	23.36	1.35	1.89	NS	
	1947–63 16	207.4	3.4	1.085 (0.025)	----------	0.978	11.6	1.63	0.16	VS	
Extension Service	1959–63 5	75.35	3.1	1.020 (0.010)	----------	0.953	1.53	1.56	1.48	NS	
	1955–63 8	72.41	3.4	1.057 (0.022)	----------	0.938	3.76	1.65	1.27	NS	
Soil Conservation Service	1956–63 8	188.5	3.3	1.031 (0.013)	−0.306 (0.201)	0.987	6.7	1.90	2.77°	NS	°3.1 statistic.
	1958–63 5	188.3	3.4	1.052 (0.023)	----------	0.969	7.37	1.92	1.13	NS	
Commodity Stabilization Service	1959–63 9	473.1	3.3	0.920 (0.030)	−0.420 (0.086)	0.983	32.1	3.09	0.03	VS°	°3.1 "operative" in early years 1st coeff. VS.
	1947–63 16	447.5	3.4	1.196 (0.100)	----------	0.877	91.4	1.06	0.05	S	
Agricultural Conservation Program.	1959–62 4	256.5	3.1	0.997 (0.002)	----------	1.000	0.92	0.869°	0.56°°S°°		°Big cut in '63 removed.
	1955–63 8	258.5	3.5	1.042 (0.013)	−0.624 (0.332)	0.951	7.8	1.61	0.42	NS	°°Stationary with '59 obs. removed.
Agricultural Marketing Service Program.	1948–63 16	271.2	3.3	0.900 (0.034)	−0.490 (0.146)	0.122	18.9	2.41	0.75	S	3.1 statistic.
	1961–63 2	273.4	3.5	1.000 (0.052)	−1.019 (0.250)	0.904	24.4	1.96	----------	S	
Foreign Agricultural Service	1948–63 16	20.90	3.1	0.840 (0.022)	----------	0.992	0.75	2.36	0.02	S	
	1947–61 14	25.84	3.4	1.299 (0.119)	----------	0.884	1.02	1.11°	5.84	US	°Lower Coeff. '58–'61. Big increase '62 removed.
Commodity Exchange Authority	1955–63 9	1.022	3.1	1.001 (0.001)	----------	1.000	0.003	2.42	3.31	US	°3.4 statistic.
	1955–63 8	1.022	3.6	1.050 (0.013)	----------	0.986	0.004	2.48	0.74°	S	3.4 "operative" in early years.
Rural Electrification Admin. (costs).	1956–63 8	10.02	3.3	0.987 (0.002)	−0.268 (0.173)	0.979	0.20	2.27	9.03°	US	°3.2 statistic.
	1955–63 8	10.32	3.4	1.050 (0.017)	----------	0.910	0.428	1.90	1.90	NS	
R.E.A. (Costs and Loans)	1955–63 9	491.0	3.2	1.372 (0.112)	−0.924 (0.353)	0.851	64.9	2.59	4.33	US	
	1947–63 16	490.3	3.4	0.893 (0.087)	----------	0.481	100.0	2.43	0.00	VS	Very large disturbances.
Farmer's Home Admin. (costs)	1955–63 9	34.58	3.3	0.986 (0.004)	−0.217 (0.046)	0.997	0.33	2.10	7.02°	US	°3.1 statistic.
	1955–63 8	35.00	3.4	1.058 (0.013)	----------	0.954	1.05	3.05	0.43	S	°Variance of residual greater in early period.

F.H.A. (Costs and Loans)	1957–63	374.6	3.3	1.144	−1.210	0.726	36.1	1.93	2.97	NS	3.1 "operative" in early years.
	7			(0.056)	(0.454)						
	1958–63	370.0	3.4	0.930	----------	0.997	26.9	1.21	3.24	US	3.1 statistic.
	5			(0.045)							
Federal Crop Insurance Corp.	1956–63	6.799	3.3	0.965	−0.806	0.913	0.088	1.61	0.00*	NS	3.1 statistic.
	7			(0.005)	(0.078)						
	1949–63	7.500	3.4	1.051	----------	0.603	1.164	1.45	0.00	VS	
	14			(0.048)							
Forest Service	1955–63	223.3	3.3	1.087	−1.348	0.959	15.4	2.19	2.11*	NS	3.1 "operative" in early years.
	9			(0.039)							
	1947–63	222.9	3.4	1.053	----------	0.974	10.3	2.55	0.17	S	
	16			(0.025)							
COMMERCE											
Bureau of the Census	1956–63	21.20	3.2	0.93	−0.098	0.999	1.35	0.86	14.91	US	*Census years '60–'61 exceptional.
	8		3.2	(0.013)	(0.067)						
	1947–63	23.04	3.4	0.649	----------	0.047	31.87	2.08	0.91	S	Census years '50, '51, '60 + '61 distorting.
	16			(0.243)							
Coast and Geodetic Survey	1955–63	37.15	3.2	1.060	−0.526	0.978	0.25	2.26	2.27	NS	
	9			(0.050)	(0.354)						
	1955–63	38.00	3.4	1.179	----------	0.910	4.07	2.16	1.82*	NS	*3.4 statistic. 3.6 "operative" in early years.
	8			(0.082)							
Patent Office	1948–63	26.01	3.1	0.991	----------	0.991	0.77	1.48	0.74	S	
	16			(0.011)							
	1951–63	27.80	3.4	1.064	1.195	0.980	1.17	1.93	1.72	NS	3.4 "operative" in early years.
	12			(0.017)	(0.470)						
National Bureau of Standards	1948–63	60.00	3.1	0.883	----------	0.998	1.19	1.69	0.02	VS	
	16			(0.010)							
	1947–63	68.10	3.4	1.288	----------	0.897	10.16	1.48	0.20	S	
	16			0.113							
Weather Bureau	1948–63	114.8	3.1	0.966	----------	0.995	2.6	2.00	0.33	S	
	16			(0.013)							
	1954–63	121.5	3.4	1.308	----------	0.944	13.2	1.20	0.20	S*	*Variance of residuals greater in early period.
	9			(0.097)							
LABOR											
Office of the Solicitor	1955–63	4.261	3.3	1.021	0.278	0.988	0.173	2.23	5.15	US	3.1 statistic.
	9			(0.022)	(0.192)						
	1947–63	4.293	3.4	1.112	----------	0.936	0.332	2.73	0.05	S	
	16			(0.041)							
Bureau of Labor Standards	1956–63	3.244	3.1	0.994	----------	0.988	0.175	2.10	5.21	US	
	8			(0.029)							
	1947–63	3.356	3.4	1.143	----------	0.899	0.461	2.48	0.24	S	
	16			(0.086)							
Bureau of Veterans' Reemployment Rights.	1956–63	0.633	3.1	0.999	----------	1.000	.00749	2.40	0.00	VS*	*Variance of residuals greater early period.
	7			(0.001)							
	1950–63	0.633	3.4	1.071	----------	0.947	.005012	2.50	----------	US	
	13			(0.032)							
Bureau of Apprenticeship and Training.	1958–63	5.026	3.1	1.029	----------	0.891	0.249	2.71	7.38	US	
	4			(0.028)							
	1955–63	5.026	3.5	1.064	−0.444	0.953	0.188	2.50	0.32	NS	
	8			(0.017)	(0.289)						

TABLE A—Continued

Department and Agency	Period and No. of Obs.	Last Obs. ($ M)	Eqn. No.	Coefficient Estimates		R	Sample Std. Dev. of Dist. ($ M)	d	Temp. Stab. F-statistic	Temp. Stab. Cat.	Comments
LABOR—Continued											
Bureau of Employment Security	1948–61 14	130.4	3.3	0.939 (0.011)	−0.093 (0.053)	0.995	12.5	1.31	0.22°°	S°	°statistic for '63 obs. Big grant in '62. °° 3.1 statistic.
	1956–63 7	132.7	3.5	0.865 (0.126)	−0.893 (0.371)	0.533	130.0	1.90	0.95	NS	
Bureau of Employee Compensation.	1962–63 2	65.92	3.1	0.989 (0.011)	----------	1.000	1.03	2.00	4.95	US	
	1953–63 10	65.92	3.4	1.016 (0.018)	----------	0.998	1.73	2.18	9.34	US	
Bureau of Labor Statistics	1951–63 13	15.49	3.1	0.968 (0.016)	----------	0.989	0.55	1.73	49.92	US	
	1952–63 11	16.63	3.4	1.148 (0.025)	----------	0.982	0.69	1.66	16.98	US	
Women's Bureau	1951–63 13	0.893	3.3	0.960 (0.018)	−0.368 10.108	0.979	0.033	2.23	1.69°	NS	°3.1 statistic.
	1952–63 11	1.035	3.4	1.152 (0.036)	----------	0.940	0.098	1.02	0.26°	NS°	°'63 increase masking earlier shift.
Wage and Hour Division	1955–63 8°	17.72	3.1	0.995 (0.003)	----------	1.000	0.10	2.32	32.29°	US	°Big grant in '62 removed.
	1955–63 8	17.77	3.4	1.051 (0.045)	----------	0.933	1.40	2.10	0.02	S°	°Variance of residuals in early period.
HEALTH, EDUCATION, AND WELFARE											
Public Health Service	1955–63 9	1504	3.3	1.106 (0.024)	−0.768 (0.143)	0.998	40	2.41	6.20	US	
	1947–63 16	1343	3.5	1.182 (0.105)	−0.854 (0.496)	0.974	84	1.44	0.23	NS	
Social Security Administration	1948–63 16	2623	3.2	0.978 (0.016)	−1.180 (0.580)	0.987	82	1.95	2.68	NS	
	1947–63 16	2859	3.4	1.105 (0.029)	----------	0.956	174	2.86	0.19	S	
Food and Drug Administration	1956–63 8	28.28	3.3	0.988 (0.019)	−0.316 (0.127)	0.996	0.88	1.94	0.20	S°	°3.1 statistic. 3.1 "operative" in early years, 1st coeff. stable.
	1955–63 8	28.40	3.4	1.257 (0.072)	----------	0.955	2.66	2.61	1.13	NS	
Office of Education	1954–63 9	658.9	3.2	1.052 (0.039)	−0.533 (0.343)	0.985	38.4	2.28	0.61	S	
	1947–63 16	597.6	3.4	1.101 (0.138)	----------	0.777	116.6	2.89	0.22	S	
Office of Vocational Rehabilitation	1956–63 8	102.9	3.3	0.986 (0.009)	−0.492 (0.092)	0.997	1.8	2.42	0.72	S°	3.1 statistic. 3.1 "operative" in early years, 1st coeff. stable.
	1955–63 7	101.3	3.4	1.172 (0.032)	----------	0.974	5.2	2.92	1.14	NS	

INDEPENDENTS

Federal Aviation Agency	1955-63 8	766.9	3.3	0.950 (0.011)	−0.205 (0.078)	0.998	17.9	2.31	15.26*	US	*3.1 statistic.
	1961-63 2	810.8	3.4	1.099 (0.020)	----------	1.000	20.4	2.00			
Civil Aeronautics Board	1955-63 8	88.71	3.2	0.9 8 (0.009)	0.249 (0.070)	0.997	1.82	2.70	0.02	S**	**3.1 "operative" in early years, 1st coeff. stable.
	1947-63 16	94.49	3.4	1.151 (0.142)	----------	0.796	23.35	2.14	0.00	VS	
National Labor Relations Board	1956-62 7	19.99	3.1	1.030 (0.040)	----------	0.952	1.39	2.17	1.61	NS	
	1950-62 12	18.88	3.4	1.098 (0.027)	----------	0.964	0.98	2.15	30.53	US	
Army Corps of Engineers	1954-61 8	929.1	3.3	1.009 (0.010)	0.527 (0.126)	0.996	19.9	1.07	24.42	US	*3.1 statistic.
	1954-61 7	930.3	3.4	1.081 (0.023)	----------	0.975	39.5	3.07	3.35	US	
Allergy, Infectious Disease Activities.	1954-62 8	44.000*	3.1	1.246 (0.046)	----------	0.988	2.417	1.476	----------	----------	*Congressional appropriation for 1961.
		50.063	3.4	1.097 (0.022)	----------	0.996	1.457	1.752			
Arthritis & Metabolic Disease Activities.	1954-1962	61.200*	3.1	1.312 (0.050)	----------	0.988	3.334	1.237	----------	----------	*Congressional appropriation for 1961.
	8	70.812	3.4	1.098 (0.025)	----------	0.995	2.164	1.762			
General Research and Services	1956-61 6	83.900*	3.1	1.635 (0.116)	----------	0.964	29.313	1.659			
	1952-62 10	95.767	3.4	1.004 (0.080)	----------	0.945	4.846	1.052			
National Cancer Institute	1952-1962	111.000*	3.1	1.206 (0.040)	----------	0.986	6.106	1.685			
	10	113.565	3.4	1.014 (0.017)	----------	0.996	3.227	2.604			
National Heart Institute	1952-62	85.900*	3.1	1.238 (0.062)	----------	0.981	6.457	1.008			
	10	102.255	3.4	1.106 (0.027)	----------	0.992	3.577	1.573			
National Institute of Dental Research.	1957-61 4	15.500*	3.1	1.223 (0.067)	----------	0.946	4.064	0.621			
	1952-62 10	14.800	3.4	1.051 (0.058)	----------	0.975	1.285	1.104			
Neurology and Blindness Activities.	1954-62	56.600*	3.1	1.334 (0.061)	----------	0.985	3.741	1.378			
	10	56.145	3.4	1.002 (0.016)	----------	0.999	1.349	1.385			
Mental Health Activities	1952 1962	100.900*	3.1	1.265 (0.065)	----------	0.982	7.368	1.398			
	10	90.657	3.4	0.986 (0.033)	----------	0.993	4.757	1.414			

TABLE B

Department and Agency	Period and No. of Obs.	Eqn. No.	Coefficient Estimates		R	d	Period and No. of Obs.	Eqn. No.	Coefficient Estimates		R	d	Comments
TREASURY													
Bureau of Accounts	1948–54 7	3.3	0.939 (0.015)	−0.162 (0.082)	0.598	1.40	1956–63 8	3.1	0.986 (0.003)	--------	0.999	2.50	
	1947–48 1	3.4	1.822	--------	--------	--------	1949–63 14	3.4	1.089 (0.022)	--------	0.966	2.59	
Bureau of Public Debt	1948–53 6	3.1	0.965 (0.009)	--------	0.984	1.36	1955–63	3.1	0.994 (0.002)	--------	0.982	3.05	
	1947–54 7	3.6	0.955 (0.035)	--------	0.639	2.26	1955–63 8	3.4	1.013 (0.010)	--------	0.527	3.32	
Bureau of Customs	1948 1	3.1	0.893	--------	--------	--------	1950–63 14	3.1	0.987 (0.003)	--------	0.998	1.99	No regular appropriation made in 1949.
	1947–48 1	3.4	1.836	--------	--------	--------	1950–63 13	3.4	1.065 (0.014)	--------	0.971	2.72	
Internal Revenue Service	1948–53 6	3.1	0.959 (0.016)	--------	0.980	1.69	1955–63 9	3.3	0.949 (0.007)	−0.613 (0.062)	0.995	2.44	
	1947–53 6	3.5	1.105 (0.041)	−0.811 (0.460)	0.901	2.48	1955–63 9	3.4	1.145 (0.049)	--------	0.894	2.14	
Bureau of Narcotics	1948–50 3	3.1	0.999 (0.002)	--------	1.000	2.79	1952–63 12	3.1	1.000	--------	1.000	--------	2nd period not run.
	1947–52 5	3.4	1.131 (0.032)	--------	0.923	2.27	1953–63 10	3.4	1.050 (0.017)	--------	0.961	2.52	
United States Secret Service	1948–53 6	3.2	0.954 (0.014)	−0.469 (0.117)	0.835 0.984	1.39 1.36	1955–63 9	3.3	.982 (0.006)	−0.153 (0.083)	0.998	1.68	
	1947–54 7	3.4	1.077 (0.023)	--------	0.899	1.70	1955–63 8	3.4	1.115 (0.027)	--------	0.942	2.29	
Bureau of the Mint	1948–54 7	3.1	0.861 (0.036)	--------	0.829	1.67	1956–63 8	3.3	0.964 (0.005)	0.061 (0.035)	0.999	.58	
	1947–55 8	3.6	0.923 (0.067)	--------	0.419	2.45	1956–63 7	3.6	1.095 (0.044)	--------	0.884	2.20	
JUSTICE													
Federal Bureau of Investigation	1948–54 7	3.1	1.000 (0.004)	--------	1.000	2.02	1956–63 8	3.1	1.000 (0.000)	--------	1.000	2.20	
	1947–54 7	3.6	1.073 (0.092)	--------	0.828	1.94	1955–63 8	3.6	1.060 (0.014)	--------	0.973	2.56	
Immigration and Naturalization Service.	1948–53 6	3.3	0.961 (0.013)	0.376 (0.202)	0.983	2.57	1955–63 9	3.3	0.985 (0.003)	−0.112 (0.050)	0.999	1.75	
	1947–54 7	3.4	1.146 (0.029)	--------	0.975	1.50	1955–63 8	3.4	1.075 (0.018)	--------	0.955	1.76	
Federal Prison System	1948–53 7	3.1	0.968 (0.007)	--------	0.987	2.55	1956–63 8	3.3	0.925 (0.026)	−0.535 (0.145)	0.944	1.86	
	1947–54 7	3.4	1.074 (0.019)	--------	0.905	2.40	1955–63 8	3.4	1.160 (0.080)	--------	0.629	2.00	

INTERIOR

South Eastern Power Admin	1951–55	3.3	0.245	0.166	0.813	3.33	1956–63	3.1	0.999	--------	1.000	2.13	
	5		(0.053)	(0.098)			8		(0.002)				
	1950–58	3.6	0.752	--------	0.456	1.57	1959–63	3.6	1.020	--------	0.577	2.65	
	8		(0.256)				4		(0.021)				
South Western Power Admin	1948–54	3.2*	0.707	0.373	0.927	1.88	1956–63	3.1	0.999	--------	1.000	1.25	*Consistent Estimates.
	7		(0.106)	(0.230)			8		(0.005)				
	1947–54	3.4	0.800	--------	0.105	1.70	1955–63	3.6	1.503	--------	0.322	1.95	
	7		(0.280)				8		(0.467)				
Bonneville Power Admin	1948–54	3.1	0.866	--------	0.953	1.84	1956–63	3.1	0.973	--------	0.919	2.37	
	7		(0.050)				8		(0.029)				*Coeff. shifting up 1963.
	1947–52	3.5	1.695	0.676	0.991	1.86	1953–63	3.4	0.956	--------	0.871	1.04*	
	5		(0.097)	(0.293)			10		(0.060)				
Bureau of Land Management	1947–53	3.3	0.839	−0.342	0.995	1.67	1955–63	3.2	0.961	−0.687	0.988	2.83	
	6		(0.014)	(0.081)			9		(0.018)	(0.283)			
	1947–54	3.4	1.417	--------	0.923	3.52	1955–63	3.4	1.177	--------	0.853	1.54	
	7		(0.084)				8		(0.063)				
Bureau of Indian Affairs	1948–54	3.3	0.832	−0.258	0.952	1.11	1956–63	3.3	1.044	−0.443	0.997	2.17	
	7		(0.034)	(0.139)			8		(0.040)	(0.314)			
	1947–53	3.4	1.321	--------	0.617	2.72	1954–63	3.4	1.081	--------	0.908	1.78	
	6		(0.163)				9		(0.050)				
Bureau of Reclamation	1947–53	3.2	0.914	−0.595	0.993	2.06	1955–63	3.1	0.957	--------	0.992	1.96	
	6		(0.027)	(0.277)			9		(0.010)				
	1947–53	3.6	0.982	--------	0.520	1.32	1954–63	3.4	1.143	--------	0.868	3.17	
	6		(0.132)				9		(0.049)				
Geological Survey	1948–54	3.3	0.937	−0.119	0.981	1.78	1956–63	3.3	0.978	−0.355	0.994	2.79	
	7		(0.024)	(0.166)	0.988		8		(0.008)	(0.119)			
	1947–54	3.5	1.328	−0.582	0.947	1.99	1955–63	3.4	1.129	--------	0.955	2.23	
	7		(0.075)	(0.316)			8		(0.030)				
Bureau of Mines	1948–54	3.1	0.915	--------	0.859	1.69	1956–63	3.3	0.936	−0.895	0.974	2.11	
	7		(0.039)				8		(0.017)	(0.112)			
	1947–55	3.4	1.116	--------	0.759	2.24	1955–63	3.4	1.154	--------	0.838	2.47	Big increase 1962.
	7		(0.070)				8		(0.069)				
National Park Service	1948–53	3.2	0.995	−0.439	0.979	4.37	1955–63	3.3	1.032	−0.629	0.942	2.30	
	6		(0.045)	(0.473)			9		(0.044)	(0.217)			
	1947–53	3.4	1.028	--------	0.414	1.50	1954–63	3.4	1.092	--------	0.819	1.84	
	6		(0.176)				9		(0.080)				
Fish and Wildlife Service	1948–49	3.1	0.728	--------	1.000	1.98	1951–63	3.1	1.032	--------	0.998	3.04	
	2		(0.083)				13		(0.012)				
	1947–54	3.4	1.086	--------	0.441	1.87	1955–63	3.4	1.246	--------	0.951	2.45	
	7		(0.089)				8		(0.069)				
Office of Territories	1948–54	3.1	0.775	--------	0.912	0.90*	1956–63	3.1	0.908	--------	0.977	1.31	*1953–54 cuts exceptional.
	7		(0.051)				8		(0.035)				
	1947–53	3.6	1.175	--------	0.788	1.73	1954–63	3.6	0.692	--------	0.878	0.666	
	6		(0.179)				9		(0.079)				

TABLE B—Continued

Department and Agency	Period and No. of Obs.	Eqn. No.	Coefficient Estimates		R	d	Period and No. of Obs.	Eqn. No.	Coefficient Estimates		R	d	Comments
AGRICULTURE													
Agricultural Research Service	1948–57 10	3.3	0.960 (0.010)	0.495 (0.123)	0.977	2.47	1959–63 5	3.1	1.059 (0.019)	--------	0.934	1.35	
	1947–54 7	3.4	1.083 (0.043)	--------	0.693	2.25	1955–63 8	3.4	1.085 (0.036)	--------	0.951	1.90	
Extension Service	1948–57 10	3.1	1.003 (0.010)	--------	0.993	1.58	1959–63 5	3.1	1.020 (0.010)	--------	0.953	1.53	
	1947–54 7	3.4	1.009 (0.005)	--------	0.989	2.62	1955–63 8	3.4	1.057 (0.022)	--------	0.930	1.65	
Soil Conservation Service	1948–54 7	3.1	0.962 (0.026)	--------	0.925	1.70	1956–63 8	3.3	1.031 (0.013)	0.303 (0.201)	0.937	1.90	
	1947–57 10	3.4	1.096 (0.035)	--------	0.877	2.84	1958–63 5	3.4	1.052 (0.023)	--------	0.939	1.92	
Commodity Stabilization Service	1948–57 6	3.1	0.922 (0.022)	--------	0.964	1.17	1959–63 9	3.3	0.920 (0.030)	0.420 (0.033)	0.983	3.09	
	1947–54 7	3.4	1.096 (0.056)	--------	0.789	1.19	1955–63 8	3.4	1.203 (0.150)	--------	0.746	1.03°	°4-fold increase '59.
Agricultural Conservation Program.	1948–57 10	3.1	0.970 (0.023)	--------	0.914	1.28	1959–62 4°°	3.1	0.997 (0.002)	--------	1.000	0.859°	°'49 obs. exceptional.
	1947–54 7	3.6	0.966 (0.087)	--------	0.330	1.61	1955–63 8	3.5	1.042 (0.013)	0.624 (0.332)	0.951	1.61	°°Big cut in '63 removed.
Agricultural Marketing Service	1948–54	3.3	1.023 (0.020)	−0.864 (0.443)	0.766	2.02	1956–63 8	3.3	0.927 (0.057)	−0.503 (0.218)	0.863	2.34	
	1947–60 13	3.5	(1.012) (0.026)	−0.443 (0.261)	0.145	1.79	1961–63 2	3.4	1.657 (0.007)	--------	1.000	2.00	
Foreign Agricultural Service	1948–54 7	3.1	0.901 (0.051)	--------	0.327	1.50	1956–63 8	3.1	0.839 (0.033)	--------	0.988	2.36	
	1947–61 14	3.4	1.299 (0.119)	--------	0.884	1.11	1963	3.4	1.626	--------	--------	--------	Big increase '62, lower coeff. '58–'61.
Commodity Exchange Authority	1948–53 6	3.3	0.966 (0.020)	−0.579 (0.203)	0.953	1.64	1955–63 9	3.1	1.001 (0.001)	--------	1.000	2.42	1948 obs. disturbing 1st period.
	1947–54 7	3.4	1.083 (0.043)	--------	0.695	2.25	1955–63 8	3.6	1.050 (0.013)	--------	0.936	2.48	
Rural Electrification Admin. (costs).	1948–54 7	3.2	0.906 (0.018)	−0.643 (0.378)	0.969	2.58	1956–63 8	3.3	0.981 (0.002)	−0.268 (0.173)	0.979	2.27	
	1947–54 7	3.4	1.134 (0.068)	--------	0.755	2.65	1955–63 8	3.4	1.050 (0.017)	--------	0.910	1.90	
R.E.A. (costs and loans)	1948–53 6	3.1	0.958 (0.098)	--------	0.864	1.72	1955–63 9	3.2	1.372 (0.112)	−0.924 (0.353)	0.851	2.59	
	1947–54 7	3.4	0.900 (0.176)	--------	0.365	2.60	1955–63 8	3.4	0.902 (0.090)	--------	0.639	1.11	

Farmer's Home Admin. (costs)	1948–53	3.1	0.889	--------	0.614	1.56	1955–63	3.3	0.994	−0.217	0.997	2.10	
	6		(0.049)				9		(0.004)	(0.046)			
	1947–54	3.4	1.093	--------	0.509	2.33	1955–63	3.4	1.058	--------	0.954	3.05	
	7		(0.058)				8		(0.013)				
F.H.A. (costs and loans)	1948–55	3.1	0.946	--------	0.709	1.16	1957–63	3.3	1.144	−1.210	0.725	1.93	
	8		(0.037)				7		(0.036)	(0.454)			
	1947–57	3.4	1.048	--------	0.731	2.02	1958–63	3.4	0.930	--------	0.997	1.21	
	10		(0.048)				5		(0.045)				
Federal Crop Insurance Corp.	1950–55	3.1	0.961	--------	0.991	1.72	1957–63	3.3	0.965	−0.806	0.833	1.61	
	6		(0.017)				7		(0.005)	(10.078)			
	1949–55	3.4	1.053	--------	0.618	1.23	1956–63	3.4	1.055	--------	0.411	1.95	
	6		(0.109)				7		(0.028)				
Forest Service	1949–53	3.3	0.921	0.352	0.801	1.96	1955–63	3.3	1.087	−1.348	0.959	2.19	
	6		(0.025)	(0.223)			9		(0.039)	(0.447)			
	1947–54	3.4	1.078	--------	0.432	1.72	1955–63	3.4	1.050	--------	0.955	2.80	
	7		(0.045)				8		(0.035)				
COMMERCE													
Bureau of the Census	1948–54	3.3	0.778	0.211	0.954	1.36	1956–63	3.2	0.993	−0.098	0.999	0.86	Census yrs. '50, '51, '60, '61, exceptional.
	7		(0.097)	(0.126)			8		(0.013)	(0.067)			
	1947–54	3.4	0.930	--------	−0.066	2.05	1955–63	3.6	0.557	--------	0.062	2.16	
	7		(0.464)				8		(0.321)				
Coast and Geodetic Survey	1948–53	3.1	0.779	--------	−0.294	2.53	1955–63	3.2	1.060	−0.526	0.978	2.26	Cut in '52 (Korea)—causing neg. cor.
	6		(0.150)				9		(0.050)	(0.354)			
	1947–54	3.5	1.080	1.022	0.811	2.17	1955–63	3.4	1.179	--------	0.910	2.16	
	7		(0.029)	(0.077)			8		(0.082)				
Patent Office	1948–54	3.1	0.969	--------	0.955	1.73	1956–63	3.1	0.994	--------	0.989	1.24	
	7		(0.012)				8		(0.017)				
	1947–50	3.4	1.181	--------	0.998	1.23	1951–63	3.4	1.077	--------	0.979	2.15	
	3		(0.065)				12		(0.020)				
National Bureau of Standards	1948–54	3.1	0.877	--------	0.896	1.16	1956–63	3.1	0.883	--------	0.998	1.89	
	7		(0.038)				8		(0.012)				
	1947–55	3.4	1.100	--------	0.026	2.31	1956–63	3.4	1.303	--------	0.871	1.46	Coeffs. shifting '61–'63.
	8		(0.127)				7		(0.181)				
Weather Bureau	1948–52		0.941	−0.592	--------	--------	1954–63	3.1	0.969	--------	0.995	2.09	
	5	3.3	(0.014)	(0.304)	0.138	2.58	10		(0.017)				
	1947–53	3.4	1.116	--------	0.942	0.662*	1954–63	3.4	1.308	--------	0.944	1.20	*Residuals AC due to coeff. shift—'48 and '49.
	6		(0.022)						(0.097)				
LABOR													
Office of the Solicitor	1948–54	3.1	0.908	--------	0.937	1.03*	1955–63		1.021	0.278			*'48 obs. exceptional.
	6		(0.043)				9	3.3	(0.022)	(0.192)	0.988	2.23	
	1947–56	3.4	1.105	--------	0.646	2.43	1957–63	3.4	1.101	--------	0.917	3.20	
	9		(0.079)				6		(0.051)				
Bureau of Labor Standards	1948–54	3.1	0.764	--------	0.441	0.89*	1956–63	3.1	0.994	--------	0.988	2.10	*Residuals AC due to coeff. shift in '48 and '49.
	7		(0.100)				8		(0.029)				
	1947–54	3.4	1.314	--------	0.610	0.80*	1955–63	3.4	1.132	--------	0.838	2.70	
	7		(0.179)				8		(0.122)				

TABLE B—Continued

Department and Agency	Period and No. of Obs.	Eqn. No.	Coefficient Estimates		R	d	Period and No. of Obs.	Eqn. No.	Coefficient Estimates		R	d	Comments
LABOR—Continued													
Bureau of Veterans' Reemployment Rights.	1948–55		0.900	−0.511	--------		1956–63	3.1	0.999	--------	1.000	2.40	
	7	3.3	(0.126)	10.045	0.886	2.28	7		(0.001)				
	1948–49	3.4		--------	--------	--------	1950–63	3.4	1.071	--------	0.947	2.50	
	1						13		(0.032)				
Bureau of Apprenticeship and Training.	1948–57		0.952	−0.315	--------	--------	1958–63	3.1	1.029	--------	0.891	2.71	
	11	3.3	(0.011)	(0.116)	0.974	2.24	4		(0.028)				
	1947–54	3.4	1.118	--------	0.587	1.07	1955–63		1.064	−0.444	0.953		
	7		(0.051)				8	3.5	(0.017)	(0.289)		2.53	
Bureau of Employment Security..	1948–61	3.3	0.939	−0.093	0.995	1.31	1963	3.1	0.963	--------	--------	--------	Big grant in 1962.
	14		(0.011)	(0.053)			1						
	1947–55	3.6	1.126	--------	0.880	1.95	1956–63	3.5	0.065	0.893	0.533	1.90	
	8		(0.096)				7		(0.126)	(0.371)			
Bureau of Employee Compensation.	1948–60	3.1	0.877	--------	0.971	2.48	1962–63	3.1	0.989	--------	1.000	2.00	Big grant in 1961.
	13		(0.045)				2		(0.011)				
	1947–52	3.4	1.378	--------	0.724	1.55	1953–63	3.4	1.016	--------	0.998	2.18	
	5		(0.186)				10		(0.018)				
Bureau of Labor Statistics.....	1948–49	3.1	0.520	--------	1.000	1.97	1951–63	3.1	0.968	--------	0.989	1.73	
	2		(0.021)				13		(0.016)				
	1947–51	3.4	1.502	--------	0.947	1.77	1952–63	3.4	1.148	--------	0.982	1.66	
	4						11		(0.025)				
Women's Bureau.....	1948–49	3.1	0.838	--------	1.000	2.00	1951–63	3.3	0.900	0.368	0.979	2.23	Coeffs. shifting '62 and '65.
	2		(0.025)				13		(0.017)	(0.018)			
	1947–51	3.4	1.237	--------	0.993	0.622	1952–63	3.4	1.152	--------	0.940	1.02	
	4		(0.025)				11		(0.066)				
Wage and Hour Division.....	1948–53	3.1	0.904	--------	0.984	1.94	1955–63	3.1	0.995	--------	1.000	2.32	*Big grant in 1962 removed.
	6		(0.020)				8*		(0.003)				
	1947–54	3.4	1.113	--------	0.551	2.56	1955–63	3.4	1.061	--------	0.933	2.10	
	7		(0.122)				8		(0.045)				
HEALTH, EDUCATION, AND WELFARE													
Public Health Service.....	1947–55	3.1	0.913	--------	0.983	1.12	1955–63	3.3	1.106	−0.768	0.986	2.41	
	6		(0.031)				9		(0.024)	10.143			
	1947–54	3.4	1.132	--------	0.769	1.25	1956–63	3.5	1.182	−0.854	0.974	1.95	
	7		(0.119)				8		(0.105)	10.496			
Social Security Administration....	1948–54	3.1	0.959	--------	0.961	1.58	1956–63	3.2	0.978	−1.180	0.987	1.95	
	7		(0.022)				8		(0.016)	(0.580)			
	1947–54	3.4	1.141	--------	0.821	2.34	1955–63	3.4	1.110	--------	0.952	2.76	
	7		(0.069)				8		(0.030)				

Food and Drug Administration	1948–54	3.1	0.953	--------	0.939	2.46	1956–63	3.3	0.988	−0.316	0.996	1.94	
	7		(0.012)				8		(0.019)	(0.127)			
	1947–54	3.4	1.085	--------	0.760	2.05	1955.63	3.4	1.257	--------	0.955	2.61	
	7		(0.036)				8		(0.072)				
Office of Education	1948–53	3.1	0.939	--------	0.997	1.07	1955–63	3.2	1.052	−0.533	0.985	2.28	Coeffs. shifting 1st and last 4 years.
	6		(0.024)				9		(0.039)	(0.343)			
	1947–54	3.4	0.920	--------	0.524	2.16	1955–63	3.6	1.139	--------	0.666	3.11	
	7		(0.256)				8		(0.209)				
Office of Vocational Rehabilitation	1948–54	3.1	0.936	--------	0.763	2.11	1956–63	3.3	0.986	−0.492	0.998	2.42	
	7		(0.022)				8		(0.009)	(0.092)			
	1947–55	3.4	1.085	--------	0.424	0.543*	1956–63	3.4	1.172	--------	0.974	2.92	*coeffs. shifting '48–'49.
	8		(0.063)				7		(0.032)				
INDEPENDENTS													
Federal Aviation Agency	1948–54	3.1	0.760	--------	0.619	1.43	1955–63	3.3	0.950	−0.205	0.998	2.31	
	7		(0.040)				8		(0.011)	(0.078)			
	1947–60	3.4	1.377	--------	0.931	2.40	1961–63	3.4	1.099	--------	1.000	2.00	
	13		(0.072)				2		(0.020)				
Civil Aeronautics Board	1948–54	3.1	0.914	--------	0.646	1.79	1955–63	3.2*	0.926	0.249	0.993	2.70	*extended procedure.
	7		(0.021)				8		(0.009)	(0.070)			
	1947–54	3.4	1.146	--------	0.855	0.80*	1955–63	3.4	1.140	--------	0.641	3.09	*estimates '48 exceptional.
	7		(0.039)				8		(0.124)				
National Labor Relations Board	1948–54	3.1	0.912	--------	0.562	1.42	1956–62	3.3	1.030	0.527	0.996	2.17	
	7		(0.053)				7		(0.040)	(0.126)			
	1947–49	3.4	1.919	--------	1.000	1.98	1950–62	3.4	1.098	--------	0.964	2.15	
	2		(0.036)				12		(0.027)				
Army Corps of Engineers	1947–52	3.1	0.866	--------	0.975	2.94	1954–61	3.1	1.013	--------	0.980	1.49	
	6		(0.023)				8		(0.019)				
	1946–53	3.4	1.226	--------	0.858	1.33	1954–61	3.4	1.081	--------	0.975	3.07	
	7		(0.082)				7		(0.023)				

NOTES

1. This research was sponsored by Resources for the Future. However, only the authors are responsible for any opinions reported herein, any errors, and the point of view of the paper. Although the authors are jointly responsible for the main text of the paper, Dempster has primary responsibility for the appendix. The respective institutional affiliations of the authors are: Carnegie Institute of Technology, University of Oxford, and the University of California at Berkeley.

   It should be noted that references are indicated by numbers enclosed by brackets. Numbers within parentheses refer to both footnotes and equations in the text, but equations generally are indicated by a number with a decimal point.

2. The major studies in the economics literature are Burkhead [5] and Smithies [28]. Neither of these authors use a quantitative approach.

3. This description is similar to that found in many texts in political science. See, e.g., Burns and Peltason [6], pp. 709-15. An account of the behavior of the various participants can be found in Wildavsky [32], and Fenno [14] describes various aspects of the House Appropriations Committee.

4. Departmental and agency personnel are "formally" required to support the President's budget although it may differ from their requests to the Bureau of the Budget.

5. See, for example, Wildavsky [32], pp. 18-30.

6. Wildavsky, [32], pp. 35-47.

7. Fenno [14], p. 312, for an account of the graphic terminology used by committee members.

8. Wildavsky, [32], pp. 47-62.

9. Fenno [14], p. 312.

10. See Wildavsky, [32], pp. 44-45, for a specific instance of this.

11. Fenno [14], p. 312.

12. This point is treated in more detail in Davis, Dempster and Wildavsky [10].

13. See, for example, Theil [29].

14. An obvious generalization of (3.2) is a higher order Markov scheme. Such a rule is not discussed here since the empirical investigation gave no evidence of such behavior.

15. See Wildavsky [32], pp. 31-2, for a brief discussion of the practice of the agencies attempting to "come out even" on spending.

16. Other gaming strategies are easily proposed. Suppose, for example, that a given agency believes that it knows the decision rule which Congress uses in dealing with it, and that this decision rule can be represented by one of (3.1-3.3) above. Presume, for reasons analogous to those outlined for (3.3), that this agency desires to take into account that (positive or negative) portion of the previous year's appropriation y_{t-1} which was not based on the previous year's request x_{t-1}. This consideration suggests

$$x_t = \beta_4 y_{t-1} + \beta_5 \Delta_{t-1} + \zeta_t$$

as an agency decision rule where Δ_{t-1} is a dummy variable representing in year t-1 the term not involving x_{t-1} in one of (3.1-3.3) above. If one believes that agency and Bureau of the Budget personnel are sufficiently well acquainted with the Senators and Congressmen to be able to predict the value of the stochastic disturbance, then it becomes reasonable to examine a decision rule of the form

$$x_t = \beta_6 y_{t-1} + \beta_7 \Delta_t + \delta_t$$

where Δ_t is defined above. No evidence of either form of behaviors was found among the agencies which were investigated.

17. As the authors, unfortunately, have learned through bitter experience.

18. A process is said to be unstable, evolutionary or explosive, if, heuristically, the expectations of the successive values of the variables of the process are increasing or decreasing without bound, i.e., the variables of the process have an upward or downward trend. A rigorous definition for the model (4.1) below will be given in the appendix. Since we are interested in structural parameter estimates in this study, the usual methods of dealing with trend are not useful here.

19. See Wold and Jureen [34], and for a summary, Johnston [17], pp. 264-6.

20. See Koopmans [19], Wold [34], or Johnston [17]. It is assumed throughout that the distribution functions of the disturbances are

absolutely continuous.

21. In the sequel Σ will denote summation over t from 1 to n unless there is explicit notation to the contrary.

22. A Latin counterpart of a Greek letter will be used to denote both an estimator of a parameter and a particular estimate in the sequel.

23. This is also the state of knowledge regarding other simultaneous estimation techniques, such as two-stage least-squares, for unstable processes. A survey of known results for these processes will be included in a forthcoming paper on estimation by M. A. H. Dempster.

24. See for example, Neiswanger and Yancey [22] and Johnston [17], Chapter 10, which report on Monte Carlo studies with Gaussian disturbances.

25. See Anderson [2] where the general case of the reduced form of (4.1) is studied.

26. Of course the only way to evaluate properly the relative merits of the selection criterion proposed above and the criteria used in this paper would be a Monte Carlo study of unstable processes following (4.1) with normal and several other different distributions of the disturbances. It should be stated that for the few agencies for which the first method was applied to select the first (Congressional) equation of the system, both methods led to the same decision.

27. These last two assumptions will be made throughout the remainder of the paper. Our methods include a test of their validity. Were the sample sizes large enough, a Kolmogorov-Smirnov test of the similarity of the sample distributions of the residuals to the normal distribution might have been made.

28. This statistic is of course a multiple correlation coefficient for equations (3.2), (3.3) and (3.5).

29. Indeed, consider for example (3.1) in (4.14). Then at time t

$$R_0^t = \alpha_0^2 E(x_t - Ex_t)^2 / \alpha_0^2 E^{1/2}(x_t - Ex_t)^2 E^{1/2}(\alpha_0^2(x_t - Ex_t)^2 + \sigma_1^2)$$
$$= \{1 + \sigma_1^2[\alpha_0^2 (Ex_t^2 - E^2 x_t)]^{-1}\}^{1/2} \to 1 \text{ as } t \to \infty$$

since (as will be shown in the appendix) $Ex_t^2 - E^2 x_t \to \infty$, where σ_1 is the variance of η and $E(\cdot)$ denotes the expectation operator.

30. See Theil [30], Section 6.2.4, pp. 213-214.

31. This statistic is known as the Durbin-Watson ratio and is a slight modification of an earlier statistic proposed by von Neumann [24]. See Theil and Nagar [31] for references to the work of Durbin and Watson and others. A description of the test may be found in Johnston [17], p. 92.

32. This table was constructed from table 2 of [31] by linear extrapolation of first differences, where $\Delta = 0.15$ and $\Delta T = 0.015$ for the one percent level, and $\Delta = 0.15$ and $\Delta T = 0.01$ for the five percent level.

33. This table was constructed by subtracting the values in table 2 from 4.

34. Indeed, for (4.14) for example, the numerator of r is

$$\Sigma[\eta_t \xi_t + \eta_t y_{t-1}(\beta_0 - b_0) + (\alpha_0 - a_0) x_t \xi_t + (\alpha_0 - a_0) x_t y_{t-1}(\beta_0 - b_0)]$$

while the denominator is

$$\{\Sigma[\eta_t^2 + 2\eta_t x_t(\alpha_0 - a_0) + (\alpha_0 - a_0)^2 x_t^2]\Sigma[\xi_t^2 + 2\xi_t y_{t-1}(\beta_0 - b_0) + (\beta_0 - b_0)^2 y_{t-1}^2]\}^{1/2}.$$

By the methods of the appendix (since the OLS estimators of a_0 and b_0 converge in probability to α_0 and β_0), their probability limits may be shown to be, respectively, σ_{14} (= 0 under H_0) and $\sigma_1\sigma_4$.

35. cf. Scheffe [27], Chapter 2.

36. One might, for example, after detecting a suspected structural parameter shift point, use the statistic $||v_1||^2/||v_2||^2 \sim F_{n'-k,\, n'-k'}$, where the v's are the residuals of a regression run on the basis of $n' = \min(n_1, n_2)$ observations on either side of this point, to test H_0: $\sigma_1^2 = \sigma_2^2$ against H_1: $\sigma_1^2 < \sigma_2^2$.

37. It should be mentioned that the residual correlation test criterion and the criterion of maximum sample correlation always agreed for the data analyzed. When the residuals were "significantly" correlated for an agency, (3.3) was the best specification by the latter criterion. The d-statistic test criterion and the criterion of maximum sample correlation agreed similarly, except for specifications for which an inspection of the residual pattern indicated that a possible shift point may have been overlooked.

38. On this point, and on the problem of the applicability of the models of

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mathematical statistics in general, the reader is referred to articles by Berkson[4] and Hotelling [15]. In the former, an interesting letter from Gauss to Bessel is cited in which the originator of the LS procedure "specifically repudiated the principle of maximum likelihood in favor of minimizing some function of the difference between estimate and observation", p. 2. See also [8], where Chow has shown that for any sample size the FIML estimators of the structural parameters of models of the form (4.1) are generalized least-squares estimators in that they minimize certain quadratic determinental functions of the difference between estimate and observations.

39. Agency proposals to the Bureau of the Budget are not reported to the public and could be obtained only for these eight sub-agencies.

40. There is, however, a problem caused by re-organizations which shift projects from one agency to another. When this difficulty was encountered, the project was "artificially" assigned to only one of the agencies and both requests and appropriations data were adjusted accordingly.

41. In a few instances an inspection of the residuals indicated that a shift point occurred so early or so late in the series that it was not possible to compute a meaningful F-statistic. In these few cases the deviant observations were dropped and the usual analysis performed on the shortened time series.

42. A Latin counterpart of a Greek letter will be used to indicate an estimate.

43. The apparent discrepancy between the latter part of Table 3 and Table 1 is caused by the fact that for two agencies, the Bureau of the Census and the Office of Education, although the Agency-Bureau-of-the-Budget decision equations are temporally stable and best specified as (3.4), when a shift point is forced, perhaps falsely, as was the case for Table B, the criteria indicate (3.6) for the latter period. On the other hand, for the Bureau of Public Debt the criteria indicate a change from (3.6) to (3.4). The agency decision equation for the Commodity Exchange Authority appeared to change from (3.4) to (3.6). These judgments were made on the basis of an examination of the residuals. The Congressional decision equation for the Civil Aeronautics Board appeared to change from (3.1) to (3.2). The Congressional equation appeared to change from (3.1) to (3.3) for the following agencies: Bureau of Mines, National Park Service, Commodity Stabilization Service, Food and Drug Administration, and the Office of Vocational Rehabilitation. These judgments were made on the basis of the "significance" of the coefficient of the additional term as well as the usual selection criteria. The

totals in parentheses in Table 5 exclude these agencies.

44. Some of the shift points appeared to occur so early in the series that it was not possible to calculate a correlation coefficient.

45. For more on this point see Davis, Dempster, and Wildavsky [10].

46. This time series was taken from the Statistical Abstract of the United States.

47. As an additional check, the model $y_t/z_t = \gamma_2 + \gamma_3 t + \tau_t$ where t is the usual index of time, was fitted by OLS for selected agencies. Not surprisingly, the results were in good agreement with those mentioned above in the sense that the estimates of γ_3 were generally significantly different from zero.

48. For descriptions of, and further references to other "rules of thumb" decision rules in economics, see Cyert and March [9].

49. As suggested in section 4, a Monte Carlo investigation of the present systems might be most useful in this regard.

50. Two dissertation studies of aspects of municipal and educational budgeting, involving heuristic computer simulations, are currently nearing completion at the Carnegie Institute of Technology.

51. The proofs will be given in a forthcoming paper, "Parameter Estimation for Linear Unstable Processes with Discrete Time".

52. Regarding the existence of a bias in $s^2(a_1)$, see Johnston [17], pp. 187-192. The techniques of spectral analysis have also been used to derive the consistency of certain corrections. However, stationarity, or at least ergodicity, is usually assumed. The reader is referred to Lyttkens [20] and a survey paper by Wold [33].

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A THEORY OF THE BUDGETARY PROCESS*

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There are striking regularities in the budgetary process. The evidence from over half of the non-defense agencies indicates that the behavior of the budgetary process of the United States government results in aggregate decisions similar to those produced by a set of simple decision rules that are linear and temporally stable. For the agencies considered, certain equations are specified and compared with data composed of agency requests (through the Bureau of the Budget) and Congressional appropriations from 1947 through 1963. The comparison indicates that these equations summarize accurately aggregate outcomes of the budgetary process for each agency.

In the first section of the paper we present an analytic summary of the federal budgetary process, and we explain why basic features of the process lead us to believe that it can be represented by simple models which are stable over periods of time, linear, and stochastic.[1] In the second section we propose and discuss the alternative specifications for the agency-Budget Bureau and Congressional decision equations. The empirical results are presented in section three. In section four we provide evidence on deviant cases, discuss predictions, and future work to explore some of the problems indicated by this kind of analysis. An appendix contains informal definitions and a discussion of the statistical terminology used in the paper.

I. THE BUDGETARY PROCESS

Decisions depend upon calculation of which alternatives to consider and to choose.[2] A major clue toward understanding budgeting is the extraordinary complexity of the calculations involved. There are a huge number of items to be considered, many of which are of considerable technical difficulty. There is, however, little or no theory in most areas of policy which would enable practitioners to predict the consequences of alternative moves and the probability of their occurring. Nor has anyone solved the imposing problem of the inter-personal comparison of utilities. Outside of the political process, there is no agreed upon way of comparing and evaluating the merits of different programs for different people whose preferences vary in kind and in intensity.

Participants in budgeting deal with their overwhelming burdens by adopting aids to calculation. By far the most important aid to calculation is the incremental method. Budgets are almost never actively reviewed as a whole in the sense of considering at once the value of all existing programs as compared to all possible alternatives. Instead, this year's budget is

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[1] See the Appendix for explanations of terms and concepts.

[2] The description which follows is taken from Aaron Wildavsky, *The Politics of the Budgetary Process* (Boston, 1964). Portions of the comments on the House Appropriations Committee are from Richard Fenno, "The House Appropriations Committee as a Political System: The Problem of Integration," this REVIEW, 56 (1962), 310–324.

based on last year's budget, with special attention given to a narrow range of increases or decreases.

Incremental calculations proceed from an existing base. (By "base" we refer to commonly held expectations among participants in budgeting that programs will be carried out at close to the going level of expenditures.) The widespread sharing of deeply held expectations concerning the organization's base provides a powerful (although informal) means of securing stability.

The most effective coordinating mechanisms in budgeting undoubtedly stem from the roles adopted by the major participants. Roles (the expectations of behavior attached to institutional positions) are parts of the division of labor. They are calculating mechanisms. In American national government, the administrative agencies act as advocates of increased expenditure, the Bureau of the Budget acts as Presidential servant with a cutting bias, the House Appropriations Committee functions as a guardian of the Treasury, and the Senate Appropriations Committee as an appeals court to which agencies carry their disagreements with House action. The roles fit in with one another and set up patterns of mutual expectations which markedly reduce the burden of calculation for the participants. Since the agencies can be depended upon to advance all the programs for which there is prospect of support, the Budget Bureau and the Appropriations Committees respectively can concentrate on fitting them into the President's program or paring them down.

Possessing the greatest expertise and the largest numbers, working in the closest proximity to their policy problems and clientele groups, and desiring to expand their horizons, administrative agencies generate action through advocacy. But if they ask for amounts much larger than the appropriating bodies believe reasonable, the agencies' credibility will suffer a drastic decline. In such circumstances, the reviewing organs are likely to cut deeply, with the result that the agency gets much less than it might have with a more moderate request. So the first guide for decision is: do not come in *too* high. Yet the agencies must also not come in too low, for the reviewing bodies assume that if agency advocates do not ask for funds they do not need them. Thus, the agency decision rule might read: come in a little too high (padding), but not too high (loss of confidence).

Agencies engage in strategic planning to secure these budgetary goals. Strategies are the links between the goals of the agencies and their perceptions of the kinds of actions which will be effective in their political environment. Budget officers in American national government uniformly believe that being a good politician—cultivation of an active clientele, development of confidence by other officials (particularly the appropriations subcommittees), and skill in following strategies which exploit opportunities—is more important in obtaining funds than demonstration of agency efficiency.

In deciding how much money to recommend for specific purposes, the House Appropriations Committee breaks down into largely autonomous subcommittees in which the norm of reciprocity is carefully followed. Specialization is carried further as subcommittee members develop limited areas of competence and jurisdiction. Budgeting is both incremental and fragmented as the subcommittees deal with adjustments to the historical base of each agency. Fragmentation and specialization are increased through the appeals functions of the Senate Appropriations Committee, which deals with what has become (through House action) a fragment of a fragment. With so many participants continually engaged in taking others into account, a great many adjustments are made in the light of what others are likely to do.

This qualitative account of the budgetary process contains clear indications of the kind of quantitative models we wish to develop. It is evident, for example, that decision-makers in the budgetary process think in terms of percentages. Agencies talk of expanding their base by a certain percentage. The Bureau of the Budget is concerned about the growth rates for certain agencies and programs. The House Appropriations Committee deals with percentage cuts, and the Senate Appropriations Committee with the question of whether or not to restore percentage cuts. These considerations suggest that the quantitative relationships among the decisions of the participants in the budget process are linear in form.

The attitudes and calculations of participants in budgeting seem stable over time. The prominence of the agency's "base" is a sign of stability. The roles of the major participants are powerful, persistent, and strongly grounded in the expectations of others as well as in the internal requirements of the positions. Stabiltiy is also suggested by the specialization that occurs among the participants, the long service of committee members, the adoption of incremental practices such as comparisons with the previous year, the fragmentation of appropriations by program and item, the treatments of appropriations as continuously variable sums of money rather than as perpetual reconsiderations of the worth of programs, and the practice

of allowing past decisions to stand while coordinating decision-making only if difficulties arise. Since the budgetary process appears to be stable over periods of time, it is reasonable to estimate the relationships in budgeting on the basis of time series data.

Special events that upset the apparent stability of the budgetary process can and do occur. Occasionally, world events take an unexpected turn, a new President occupies the White House, some agencies act with exceptional zeal, others suffer drastic losses of confidence on the part of the appropriations subcommittees, and so on. It seems plausible to represent such transient events as random shocks to an otherwise deterministic system. Therefore, our model is stochastic rather than deterministic.

The Politics of the Budgetary Process contains a description of strategies which various participants in budgeting use to further their aims. Some of these strategies are quite complicated. However, a large part of the process can be explained by some of the simpler strategies which are based on the relationship between agency requests for funds (through the Budget Bureau) and Congressional appropriations. Because these figures are made public and are known to all participants, because they are directly perceived and communicated without fear of information loss or bias, and because the participants react to these figures, they are ideal for feedback purposes. It is true that there are other indicators—special events, crises, technological developments, actions of clientele groups—which are attended to by participants in the budgetary process. But if these indicators have impact, they must quickly be reflected in the formal feedback mechanisms—the actions of departments, the Bureau of the Budget, and Congress—to which they are directed. Some of these indicators (see section IV) are represented by the stochastic disturbances. Furthermore, the formal indicators are more precise, more simple, more available, more easily interpreted than the others. They are, therefore, likely to be used by participants in the budgetary process year in and year out. Present decisions are based largely on past experience, and this lore is encapsulated in the amounts which the agencies receive as they go through the steps in the budgetary cycle.

For all the reasons discussed in this section, our models of the budgetary process are linear, stable over periods of time, stochastic, and strategic in character. They are "as if" models: an excellent fit for a given model means only that the actual behavior of the participants has an effect equivalent to the equations of the model. The models, taken as a whole, represent a set of decision rules for Congress and the agencies.

II. THE MODELS

In our models we aggregate elements of the decision-making structure. The Budget Bureau submissions for the agency are used instead of separate figures for the two kinds of organizations. Similarly, at this stage in our analysis, we use final Congressional appropriations instead of separating out committee action, floor action, conference committee recommendations, and so on. We wish to emphasize that although there may be some aggregation bias in the estimation of the postulated structure of decision, this does not affect the linearity of the aggregate relationships. If the decisions of an agency and the Bureau of the Budget with regard to that agency depend linearly upon the same variable (as we hypothesize), then the aggregated decision rule of the two, treated as a single entity, will depend linearly upon that variable. By a similar argument, the various Congressional participants can be grouped together so that Congress can be regarded as a single decision-making entity. While the aggregating procedure may result in grouping positive and negative influences together, this manifestly does not affect the legitimacy of the procedure; linearity is maintained.[3]

Our models concern only the requests presented in the President's budget for an individual agency and the behavior of Congress as a whole with regard to the agency's appropriation. The models do not attempt to estimate the complete decision-making structure for each agency from bureau requests to departments to submission through the Budget Bureau to possible final action in the Senate and House. There are several reasons for remaining content with the aggregated figures we use. First, the number of possible decision rules which must be considered grows rapidly as each new participant is added. We would soon be overwhelmed by the sheer number of rules invoked. Second, there are genuine restrictions placed on the number of structural parameters we can estimate because (a) some data, such as bureau requests to departments, are unavailable, and (b) only short time series are meaningful for most agencies. It would make no sense, for example, to go back in time beyond the end of World War II when most domestic activity was disrupted.[4]

[3] See H. Thiel, *Linear Aggregation of Economic Relations* (Amsterdam, 1954).

[4] Our subsequent discussion of "shift" or "break" points should also make clear that it is

Since the agencies use various strategies and Congress may respond to them in various ways, we propose several alternative systems of equations. These equations represent alternative decision rules which may be followed by Congressional and agency-Budget Bureau participants in the budgetary process. One important piece of data for agency-Budget Bureau personnel who are formulating appropriations requests is the most recent Congressional appropriation. Thus, we make considerable use of the concept "base," operationally defined as the previous Congressional appropriation for an agency, in formulating our decision rules. Since the immediate past exercises such a heavy influence on budgetary outcomes, Markov (simultaneous, difference) equations are particularly useful. In these Markov processes, the value of certain variables at one point in time is dependent on their value at one or more immediately previous periods as well as on the particular circumstances of the time.

We postulate several decision rules for both the agency-Budget Bureau requests and for Congressional action on these requests. For each series of requests or appropriations, we select from the postulated decision rules that rule which most closely represents the behavior of the aggregated entities. We use the variables

y_t the appropriation passed by Congress for any given agency in the year t. Supplemental appropriations are not included in the y_t.

x_t the appropriation requested by the Bureau of the Budget for any given agency for the year t. The x_t constitutes the President's budget request for an agency.

We will also introduce certain symbols representing random disturbances of each of the postulated relationships. These symbols are explained as they are introduced.

A. Equations for Agency-Budget Bureau Decision Rules. The possibility that different agencies use different strategies makes it necessary to construct alternative equations representing these various strategies. Then, for each agency in our sample, we use time series data to select that equation which seems to describe best the budgetary decisions of that agency. In this section we present three simple models of agency requests. The first states agency requests as a function of the previous year's appropriation. The second states requests as a function of the previous appropriation as well as a function of the differences between the agency request and appropriation in the previous year. The third states requests as a function of the previous year's request. In all three linear models provision is made for a random variable to take into account the special circumstances of the time.

An agency, while convinced of the worth of its programs, tends to be aware that extraordinarily large or small requests are likely to be viewed with suspicion by Congress; an agency does not consider it desirable to make extraordinary requests, which might precipitate unfavorable Congressional reaction Therefore, the agency usually requests a precentage (generally greater than one hundred percent) of its previous year's appropriation. This percentage is not fixed: in the event of favorable circumstances, the request is a larger percentage of the previous year's appropriation than would otherwise be the case; similarly, the percentage might be reduced in the event of unfavorable circumstances.

Decisions made in the manner described above may be represented by a simple equation. If we take the average of the percentages that are implicitly or explicitly used by budget officers, then any request can be represented by the sum of this average percentage of the previous year's appropriation plus the increment or decrement due to the favorable or unfavorable circumstances. Thus

$$x_t = \beta_0 y_{t-1} + \xi_t \tag{1}$$

The agency request (through the Budget Bureau) for a certain year is a fixed mean percentage of the Congressional appropriation for that agency in the previous year plus a random variable (normally distributed with mean zero and unknown but finite variance) for that year.

is an equation representing this type of behavior. The average or mean percentage is represented by β_0. The increment or decrement due to circumstances is represented by ξ_t, a variable which requires some special explanation. It is difficult to predict what circumstances will occur at what time to put an agency in a favorable or unfavorable position. Numerous events could influence Congress's (and the public's) perception of an agency and its programs—the occurrence of a destructive hurricane in the case of the Weather Bureau, the death by cancer of a friend of an influential congressman, in the case of the National Institutes of Health, the hiring (or losing) of an especially effective lobbyist by some interest group, the President's becoming especially interested in a program of some agency as Kennedy was in mental health, and so on. (Of course, some of them may be more or less "predictable" at certain times to an experienced observer, but this fact causes no

not realistic to expect meaningful time series of great length to be accumulated for most agencies in the United States government.

difficulty here.) Following common statistical practice we may represent the sum of the effects of all such events by a random variable that is an increment or decrement to the usual percentage of the previous year's appropriation. In equation (1), then, ξ_t represents the value which this random variable assumes in year t.

We have chosen to view the special events of each year for each agency as random phenomena that are capable of being described by a probability density or distribution. We assume here that the random variable is normally distributed with mean zero and an unknown but finite variance. Given this specification of the random variable, the agency makes its budgeting decisions as if it were operating by the postulated decision rule given by equation (1).

An agency, although operating somewhat like the organizations described by equation (1), may wish to take into account an additional strategic consideration: while this agency makes a request which is roughly a fixed percentage of the previous year's appropriation, it also desires to smooth out its stream of appropriations by taking into account the difference between its request and appropriation for the previous year. If there were an unusually large cut in the previous year's request, the agency submits a "padded" estimate to make up for the loss in expected funds; an unusual increase is followed by a reduced estimate to avoid unspent appropriations. This behavior may be represented by equation or decision rule where

$$x_t = \beta_1 y_{t-1} + \beta_2(y_{t-1} - x_{t-1}) + \chi_t \tag{2}$$

The agency request (through the Budget Bureau) for a certain year is a fixed mean percentage of the Congressional appropriation for that agency in the previous year plus a fixed mean percentage of the difference between the Congressional appropriation and the agency request for the previous year plus a stochastic disturbance.

χ_t is a stochastic disturbance, which plays the role described for the random variable in equation (1), the β's are variables reflecting the aspects of the previous year's request and appropriation that an agency takes into account: β_1 represents the mean percentage of the previous year's request which is taken into account, and β_2 represents the mean percentage of the difference between the previous year's appropriation and request $(y_{t-1}-x_{t-1})$ which is taken into account. Note that $\beta_2<0$ is anticipated so that a large cut will (in the absence of the events represented by the stochastic disturbance) be followed by a padded estimate and vice-versa.[5]

Finally, an agency (or the President through the Bureau of the Budget), convinced of the worth of its programs, may decide to make requests without regard to previous Congressional action. This strategy appeals especially when Congress has so much confidence in the agency that it tends to give an appropriation which is almost identical to the request. Aside from special circumstances represented by stochastic disturbances, the agency's request in any given year tends to be approximately a fixed percentage of its request for the previous year. This behavior may be represented by

$$x_t = \beta_3 x_{t-1} + \rho_t \tag{3}$$

The agency request (through the Budget Bureau) for a certain year is a fixed mean percentage of the agency's request for the previous year plus a random variable (stochastic disturbance).

where ρ_t is a stochastic disturbance and β_3 is the average percentage. Note that if the agency believes its programs to be worthy, $\beta_3>1$ is expected.[6]

These three equations are not the only ones which may be capable of representing the actual behavior of the combined budgeting decisions of the agencies and the Bureau of the Budget. However, they represent the agency-

[5] Since some readers may not be familiar with the notation we are using, a brief explanation may be in order. As a coefficient of the equation, β_2 is an unknown number that must be estimated from the data, and this coefficient multiplies another number $(y_{t-1}-x_{t-1})$ that may be computed by subtracting last year's request from last year's appropriation. We want the equation to say that the agency will try to counteract large changes in their appropriations by changing their normal requests in the next year. If the agency asks for much more than it thinks it will get and its request is cut, for example, the expression $(y_{t-1}-x_{t-1})$ will be a negative number written in symbolic form as $(y_{t-1}-x_{t-1})<0$. A rule of multiplication says that a negative number multiplied by another negative number gives a positive number. If an agency pads its request, however, it presumably follows a cut with a new request which incorporates an additional amount to make allowance for future cuts. In order to represent this behavior, that is to come out with a positive result incorporating the concept of padding, the unknown coefficient β_2 must be negative $(\beta_2<0)$.

[6] The agency that favors its own programs should increase its requests over time. In the absence of the stochastic disturbance (when the random variable is 0), the request in a given year should be larger than the request in the previous year so that $x_t>x_{t-1}$. Therefore, the unknown coefficient β_3 must be larger than one $(\beta_3>1)$ since it multiplies last year's request.

Budget Bureau budgeting behavior better than all other decision rules we tried.[7]

B. Equations for Congressional Decision Rules. In considering Congressional behavior, we again postulate three decision equations from which a selection must be made that best represents the behavior of Congress in regard to an agency's appropriations. Since Congress may use various strategies in determining appropriations for different agencies, different Congressional decision equations may be selected as best representing Congressional appropriations for each agency in our sample. Our first model states Congressional appropriations as a function of the agency's request (through the Budget Bureau) to Congress. The second states appropriations as a function of the agency's request as well as a function of the deviation from the usual relationship between Congress and the agency in the previous year. The third model states appropriations as a function of that segment of the agency's request that is not part of its appropriation or request for the previous year. Random variables are included to take account of special circumstances.

If Congress believes that an agency's request, after passing through the hands of the Budget Bureau, is a relatively stable index of the funds needed by the agency to carry out its programs, Congress responds by appropriating a relatively fixed percentage of the agency's request. The term "relatively fixed" is used because Congress is likely to alter this percentage somewhat from year to year because of special events and circumstances relevant to particular years. As in the case of agency requests, these special circumstances may be viewed as random phenomena. One can view this behavior as if it were the result of Congress' appropriating a fixed mean percentage of the agency requests; adding to the amount so derived a sum represented by a random variable. One may represent this behavior as if Congress were following the decision rule

(4) $$y_t = a_0 x_t + \eta_t$$

The Congressional appropriation for an agency in a certain year is a fixed mean percentage of the agency's request in that year plus a stochastic disturbance.

where a_0 represents the fixed average percentage and n_t represents the stochastic disturbance.

Although Congress usually grants an agency a fixed percentage of its request, this request sometimes represents an extension of the agency's programs above (or below) the size desired by Congress. This can occur when the agency and the Bureau of the Budget follow Presidential aims differing from those of Congress, or when Congress suspects that the agency is padding the current year's request. In such a situation Congress usually appropriates a sum different from the usual percentage. If a_1 represents the mean of the usual percentages, this behavior can be represented by equation or decision rule

(5) $$y_t = a_1 x_t + v_t$$

where v_t is a stochastic disturbance representing that part of the appropriations attributable to the special circumstances that cause Congress to deviate from a relatively fixed percentage. Therefore, when agency aims and Congressional desires markedly differ from usual (so that Congress may be said to depart from its usual rule) the stochastic disturbance takes on an unusually large positive or negative

[7] Other gaming strategies are easily proposed. Suppose, for example, that a given agency believes that it knows the decision rule that Congress uses in dealing with it, and that this decision rule can be represented by one of (4), (7), or (8), above. Presume, for reasons analogous to those outlined for (8), that this agency desires to take into account that positive or negative portion of the previous year's appropriation y_{t-1} that was not based on the previous year's request x_{t-1}. This consideration suggests

$$x_t = \beta_4 y_{t-1} + \beta_5 \Delta_{t-1} + \delta_t$$

as an agency decision rule where Δ_{t-1} is a dummy variable representing in year $t-1$ the term not involving x_{t-1} in one of (4), (7) or (8) above. If one believes that agency and Bureau of the Budget personnel are sufficiently well acquainted with the senators and congressmen to be able to predict the value of the current stochastic disturbance, then it becomes reasonable to examine a decision rule of the form

$$x_t = \beta_6 y_{t-1} + \beta_7 \Delta_t + \sigma_t$$

where Δ_t is defined as above. No evidence of either form of behavior was found, however, among the agencies that were investigated. We also estimated the parameters of the third order autoregressive scheme for the requests of an individual agency

$$x_t = \beta_8 x_{t-1} + \beta_9 x_{t-2} + \beta_{10} x_{t-3} + \tau_t$$

in an attempt to discover if naive models would fit as well as those above. In no case did this occur and generally the fits for this model were very poor. A similar scheme was estimated for the appropriations y_t of an individual agency with similar results with respect to qeuations (4), (7) and (8) above. Since the "d" statistic suggests that no higher order Markov process would be successful, no other rules for agency behavior were tried.

value. In order to distinguish this case from the previous one, more must be specified about the stochastic disturbance v_t. In a year following one in which agency aims and Congressional desires markedly differed, the agency makes a request closer to Congressional desires, and/or Congress shifts its desires closer to those of the agency (or the President). In the year after a deviation, then, assume that Congress will tend to make allowances to normalize the situation. Such behavior can be represented by having the stochastic disturbance v_t generated in accordance with a first order Markov scheme. The stochastic component in v_t is itself determined by a relation

$$v_t = a_2 v_{t-1} + \epsilon_t \tag{6}$$

where ϵ_t is a random variable. The symbol v_t therefore stands for the stochastic disturbance in the previous year (v_{t-1}) as well as the new stochastic disturbance for the year involved (ϵ_t). Substituting (6) into (5) gives

$$y_t = a_1 x_t + a_2 v_{t-1} + \epsilon_t \tag{7}$$

The Congressional appropriation for an agency is a fixed mean percentage of the agency's request for that year plus a stochastic disturbance representing a deviation from the usual relationship between Congress and the agency in the previous year plus a random variable for the current year.

as a complete description of a second Congressional decision rule. If Congress never makes complete allowance for an initial "deviation," then $-1 < a_2 < 1$ is to be expected.

To complete the description of this second Congressional decision rule, we will suppose $0 < a_2 < 1$. Then, granted a deviation from its usual percentage, Congress tends to decrease subsequent deviations by moving steadily back toward its usual percentage (except for the unforeseeable events or special circumstances whose effects are represented by the random variable ϵ_t). For example, if in a particular year $v_{t-1} > 0$, and if in the following year there are no special circumstances so that $\xi_t = 0$, then $v_t = a_2 v_{t-1} < v_{t-1}$. The deviation in year t is smaller than the deviation in year $t-1$. However, if $-1 < a_2 < 0$. after an initial deviation, Congress tends to move back to its usual rule (apart from the disturbances represented by the random variable ϵ_t) by making successively smaller deviations which differ in sign. For example, if $v_{t-1} > 0$, then apart from the disturbance ϵ_t it is clear that $v_t = a_2 v_{t-1} < 0$, since $a_2 < 0$. Finally, if $a_2 = 0$, decision rule (7) is the same as the previous rule (4).

The specialization inherent in the appropriations process allows some members of Congress to have an intimate knowledge of the budgetary processes of the agencies and the Budget Bureau. Thus, Congress might consider that part of the agency's request (x_t) which is not based on the previous year's appropriation or request. This occurs when Congress believes that this positive or negative remainder represents padding or when it desires to smooth out the agency's rate of growth. If Congress knows the decision rule that an agency uses to formulate its budgetary request, we can let λ_t represent a dummy variable defined as $\lambda_t = \xi_t$ if the agency uses decision rule (1); $\lambda_t = \beta_2(y_{t-1} - x_{t-1}) + \chi_t$ if the agency uses decision rule (2); and, $\lambda_t = \rho_t$ if the agency uses decision rule (3). Suppose that Congress appropriates, on the average, an amount which is a relatively fixed percentage of the agency's request plus a percentage of this (positive or negative) remainder λ_t. This behavior can be represented by the "as if" decision rule

$$y_t = a_3 x_t + a_4 \lambda_t + \nu_t \tag{8}$$

The Congressional appropriation for an agency is a fixed mean percentage of the agency's request for a certain year plus a fixed mean percentage of a dummy variable which represents that part of the agency's request for the year at issue which is not part of the appropriation or request of the previous year plus a random variable representing the part of the appropriation attributable to the special circumstances of the year.

where ν_t is a stochastic disturbance whose value in any particular year represents the part of the appropriation attributable to the agency's special circumstances of the year. One might expect that Congress takes only "partial" account of the remainder represented by λ_t, so $0 < a_4 < 1$.

III. EMPIRICAL RESULTS

Times series data for the period 1947–1963 were studied for fifty-six non-defense agencies of the United States Government. The requests (x_t) of these agencies were taken to be the amounts presented to Congress in the President's budget. For eight sub-agencies from the National Institutes of Health, data for a shorter period of time were considered, and the requests (x_t) of these eight sub-agencies were taken to be their proposals to the Bureau of the Budget.[8] In all instances the Congressional decision variable (y_t) was taken to be the final appropriation before any supplemental additions. The total appropriations (without supplements) of the agencies studied amounted to approximately twenty-seven percent of the non-defense budget in 1963. Over one-half of all non-defense agencies were investigated; the major omissions being the Post Office and many independent agencies. A minimum of three

[8] Agency proposals to the Bureau of the Budget are not reported to the public and could be obtained only for these eight sub-agencies.

agencies was examined from each of the Treasury, Justice, Interior, Agriculture, Commerce, Labor, and Health, Education and Welfare Departments.[9]

If the agency-Budget Bureau disturbance is independent of Congressional disturbance,[10] the use of ordinary least squares (OLS) to estimate most of the possible combinations of the proposed decision equations is justified. OLS is identical to the simultaneous full information maximum likelihood (FIML) technique for most of the present systems. This is not so, however, for some systems of equations because of the presence of an auto-correlated disturbance in one equation of the two and the consequent non-linearity of the estimating equations. In equation (6) the stochastic disturbance for year t is a function of the value of the disturbance in the previous year. In a system of equations in which auto-correlation occurs in the first equation, an appropriate procedure is to use OLS to estimate the alternative proposals for the other equation, decide by the selection criteria which best specifies the data, use the knowledge of this structure to estimate the first equation, and then decide, through use of appropriate criteria, which version of the first equation best specifies the data.

The principal selection criterion we used is that of maximum correlation coefficient (R). For a given dependent variable this criterion leads one to select from alternative specifications of the explanatory variables, that specification which leads to the highest sample correlation coefficient. The estimations of the alternative specifications must, of course, be made from the same data.[11] The second criterion involves the use of the d-statistic test for serial correlation of the estimated residuals of a single equation.[12] This statistic tests the null hypothesis of residual independence against the alternative of serial correlation. We used the significance points for the d-statistic of Theil and Nagar.[13] When the d-statistic was found to be significant in fitting the Congressional decision equation (4) to an agency's data, it was always found that equation (7) best specified Congressional behavior with respect to the appropriations of that agency in the sense of yielding the maximum correlation coefficient. A third criterion is based on a test of the significance of the sample correlation between the residuals of (4) and the estimated λ_t of the equation selected previously for a given agency. David's significance points for this statistic were used to make a two-tailed test at the five percent level of the null hypothesis that the residuals are uncorrelated.[14] When significant

[9] Three interrelated difficulties arise in the analysis of the time series data x_t, y_t for an agency. The first problem is the choice of a technique for estimating the parameters of the alternate schemes in some optimal fashion. Given these estimates and their associated statistics, the second problem is the choice of criteria for selecting the model best specifying the system underlying the data. Finally, one is faced with the problem of examining the variability of the underlying parameters of the best specification. We believe that our solution to these problems, while far from optimal, is satisfactory given the present state of econometric knowledge. See our presentation in "On the Process of Budgeting: An Empirical Study of Congressional Appropriations," by Otto Davis, M. A. H. Dempster, and Aaron Wildavsky, to appear in Gordon Tullock (ed.), *Papers on Non-Market Decision Making*, Thomas Jefferson Center, University of Virginia. See especially section 4 and the appendix by Dempster, which contains discussions and derivations of estimation procedures, selection criteria and test statistics for the processes in Section II of this paper.

[10] We make the assumption that these two disturbances are independent throughout the paper. Notice, however, that dependence between the disturbances explicitly enters decision equation (8) of section II and those of footnote 7. For these equations, the assumption refers to the disturbance of the current year. That is, we allow the possibility that special circumstances may affect a single participant (Bureau of the Budget or Congress) as well as both. When the latter case occurred, our selection criteria resulted in the choice of equation (8) as best specifying Congressional behavior.

[11] We are estimating the unknown values of the coefficients (or parameters) of regression equations for each agency. All of our estimators are biased. We use biased estimators for the simple reason that no unbiased estimators are known. The property of consistency is at least a small comfort. All of our estimators are consistent. It might be noted that all unbiased estimators are consistent, but not all consistent estimators are unbiased.

[12] This statistic is known as the Durbin-Watson ratio. A description of the test may be found in J. Johnston, *Econometric Methods* (New York, 1963), p. 92.

[13] H. Theil and A. L. Nagar, "Testing the Independence of Regressional Disturbances," *Journal of the American Statistical Association*, 56 (1961), 793–806. These significance points were used to construct further significance points when necessary. See Davis, Dempster and Wildavsky, *op. cit.*

[14] The test is described in T. W. Anderson, *An Introduction to Multivariate Analysis* (New York,

TABLE 1. BEST SPECIFICATIONS FOR EACH AGENCY ARE HIGH

	Frequencies of Correlation Coefficients										
	1	-.995	-.99	-.98	-.97	-.96	-.95	-.94	-.93	-.90	-.85	-0
Congressional	28	3	15	5	1	3	4	1	3	3	1
Agency-Bureau	8	2	2	9	4	3	4	3	5	11	10

correlation occurred, it was always found that Congressional decision equation (8), in which a function of the deviation from the usual relationship between request and the previous year's appropriation enters explicitly, best specified appropriation behavior with respect to the agency in question.

The statistical procedures were programmed for the Carnegie Institute of Technology's Control Data G-21 electronic computer in the 20-Gate algebraic compiling language. The selection among alternate specifications according to the criteria established was not done automatically; otherwise all computations were performed by machine. Since the results for each agency are described in detail elsewhere,[15] and a full rendition would double the length of the paper, we must restrict ourselves to summary statements.

The empirical results support the hypothesis that, up to a random error of reasonable magnitude, the budgetary process of the United States government is equivalent to a set of temporally stable linear decision rules. Estimated correlation coefficients for the best specifications of each agency are generally high. Although the calculated values of the multiple correlation coefficients (R's) tend to run higher in time series than in cross-sectional analysis, the results are good. We leave little of the variance statistically unexplained. Moreover the estimated standard deviations of the coefficients are usually, much smaller than one-half of the size of the estimated coefficients, a related indication of good results. Table 1 presents the frequencies of the correlation coefficients.

The fits between the decision rules and the time series data for the Congressional decision equations are, in general, better than those for the agency-Bureau of the Budget equations. Of the 64 agencies and sub-agencies studied, there are only 14 instances in which the correlation coefficient for the agency (or sub-agency) equation was higher than the one for the corresponding Congressional equation. We speculate that the estimated variances of the disturbances of the agency-Budget Bureau decision rules are usually larger because the agencies are closer than Congress to the actual sources that seek to add new programs or expand old ones.

Table 2 presents a summary of the combinations of the Agency-Bureau of the Budget and Congressional decision equations. For those agencies studied, the most popular combinations of behavior are the simple ones represented by equations (4) and (1) respectively. When Congress uses a sophisticated "gaming" strategy such as (7) or (8), the corresponding agency-Bureau of the Budget decision equation is the relatively simple (1). And, when Congress grants exactly or almost exactly the amount requested by an agency, the agency tends to use decision equation (3).

Our discussion thus far has assumed fixed values for the coefficients (parameters) of the equations we are using to explain the behavior underlying the budgetary process. In the light of the many important events occurring in the period from 1946 to 1963, however, it seems reasonable to suppose that the appropriations structure of many government agencies was altered. If this is correct, the coefficients of the equations—literally, in this context, the values represented by the on-the-average percentages requested by the agencies and granted by Congress—should change from one period of time to the next. The equations would then be temporally stable for a period, but not forever.

TABLE 2. BUDGETARY BEHAVIOR IS SIMPLE

Summary of Decision Equations				
Agency-Budget Bureau		1	2	3
Congress	4	28*	2	5
	7	7	0	0
	8	20	3	1

* including eight sub-agencies from the National Institutes of Health

1958) pp. 69–71. See Dempster's appendix to Davis, Dempster, and Wildavsky, *op. cit.*, for some justification of the use of the test.

[15] See Davis, Dempster, and Wildavsky, *op. cit.*

The year when the coefficient of an equation changes from one value to another is termed the "shift point". The time series we are using are so short that it is possible to find only one meaningful shift point in each of the two equations that describe the budget request and appropriation best fitting an agency. We, therefore, broke each time series into two parts and used Chow's F-statistic[16] to determine temporal stability by testing the null hypothesis that the underlying coefficients did not shift (against all alternatives) for the individual equations. We used four categories for the coefficients of a decision equation defined as follows:

Temporally very stable: The F-statistic is small and the coefficients estimated from the first and last parts of the series are virtually the same.

Temporally stable: The F-statistic is small, but the coefficients estimated from the first and last parts of the series appear to be different.

Not temporally stable: The F-statistic is large but not significant at the ten percent level and the coefficients estimated from the first and last parts of series appear to be different.

Temporally unstable: The F-statistic is significant at the ten percent level.

Of the Congressional decision equations, six were temporally very stable, 12 were temporally stable, 12 were not temporally stable, and 28 were temporally unstable. Of the agency-Bureau of the Budget decision equations, four were temporally very stable, 18 were temporally stable, 18 were not temporally stable, and 18 were temporally unstable.[17] Since a substantial majority of cases fall into the not temporally stable and temporally unstable categories, it is evident that while the process is temporally stable for short periods, it may not be stable for the whole period.

Table 3 presents a summary of the combinations of the agency-Bureau of the Budget and Congressional decision equations when each series is broken into two parts. These specifications are referred to as "first period" and "second period" for all agencies even though the years at which the time series were broken vary. While the most frequent combinations of behavior are the simple ones represented by equations (4) and (1) respectively, there is a marked tendency for Congressional behavior to become more sophisticated: the incidence of the gaming behavior represented by equation (8) increases over time.[18]

TABLE 3. CONGRESSIONAL BEHAVIOR TENDS TO BECOME MORE SOPHISTICATED

First Period Decision Equations			
	1	2	3
4	35	3	5
7	4	0	1
8	13	2	2

Second Period Decision Equations			
	1	2	3
4	28	3	4
7	5	0	2
8	22	1	1

The budgetary process seems to become more linear over time in the sense that the importance of the "special circumstances" appears to diminish. Table 4 presents frequencies of the correlation coefficients for the first and second periods. Although there is a different number of correlation coefficients in each period (111 in the first period and 114 in the second)[19] Table 4 shows clearly that fits are better for the second period, which is sufficient evidence of increasing linear tendencies. To us it seems reasonable to expect an increasing use of simplifying rules of thumb as the budget grows in size and the pressure of time on key decision makers increases. Yet this is

[16] G. C. Chow, "Tests of Equality between Sets of Coefficients in Two Linear Regressions," *Econometrica*, 28 (1960), 591–605, and the appendix to Davis, Dempster, and Wildavsky, *op. cit.*

[17] In a few instances an inspection of the residuals indicated that a shift point occurred so early or so late in the series that it was not possible to compute a meaningful stationarity F-Statistic. In these few cases the deviant observations were dropped and the usual analysis performed on the shortened time series. Thus we "forced" a break in every case in order to perform subsequent operations.

[18] The apparent discrepancy between the latter part of Table 3 and Table 1 is caused by the fact that for two agencies, the Bureau of the Census and the Office of Education, although the Agency-Bureau of the Budget decision equations are temporally stable and best specified as (1), when a shift point is forced, the criteria indicate (3) for the latter period.

[19] Some of the shift points appeared to occur so early in the series that it was not possible to calculate a correlation coefficient.

TABLE 4. THE BUDGETARY PROCESS IS BECOMING MORE LINEAR

		Frequencies of Correlation Coefficients									
		1 - .995	- .99	- .98	- .97	- .96	- .94	- .92	- .90	- .80	- .60 - 0
First Period	11	4	10	7	1	9	8	4	16	21	21
Second Period	33	1	12	11	4	19	3	5	14	5	6

TABLE 5. LIKELY SHIFT POINTS ARE CONCENTRATED IN THE FIRST YEARS OF THE EISENHOWER ADMINISTRATION

	Frequencies of Shift Points															
Year	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	T
Congressional	0	2	3	1	0	1	17	16	1	1	3	0	0	1	0	46 (40)
Agency-Bureau	0	2	4	0	2	3	15	13	3	0	2	1	0	2	1	37 (36)

only one of a number of possible explanations. For example, the data are not deflated for changes in the price level during the early years. Since there were larger increases in the price level during the early years, this might help explain why the fits are better during the second period.

When only one shift point is presumed, most shifts are discovered during the first two budgets of the Eisenhower Administration (1954–1955). Table 5 presents, for both Congressional and Agency-Budget Bureau decision equations, frequencies of the shift points for (a) those equations whose coefficients are in the not temporally stable or temporally un-stable categories and (b) those agencies for which the decision rules of the participants appeared to change. While it is certainly possible that shift points do not occur as dramatically and as sharply as shown here, and that it may take several years for actual behavior to change noticeably, Table 5 nevertheless makes it clear that likely shifts are concentrated in the first period of the Eisenhower administration.

We said, in Section II, that we expected β_0, β_1, and β_3, to be greater than one, and β_2 to be negative. In 56 instances this expectation is satisfied, but eight exceptions were noted. In the two cases where the estimated $\beta_3 < 1$, explanations are immediately available. First, the fit for the Bureau of Employment Security is not good. Second, the Office of Territories evidences most un-Parkinsonian behavior: its activities decline with a decrease in the number of territories. In the six other exceptions, the estimated coefficient is $\beta_0 < 1$. For three of these, Congress tends to appropriate an amount greater than the request, and two of the three represent an interesting phenomenon. When those parts of requests and appropriations directly related to loans are omitted from the data for both the Rural Electrification Administration and the Federal Housing Administration, the estimated coefficients are of the magnitudes expected with $\beta_0 > 1$ and $a_0 < 1$. However, when the data relating to loans are included, then $\beta_0 < 1$ and $a_0 > 1$. Apparently, Congress favors the loan programs more than do the agencies or the Budget Bureau.

As a rule, the d-statistics resulting from fitting the best specifications were not significant. It would thus appear that all major underlying trended variables (with the possible exception of variables with the same trend) have been accounted for by these specifications. When an exception to this rule did exist, the authors made a careful examination of the residuals in an effort to determine the reason for such a situation. It appeared that in most of these instances the cause was either (a) that the coefficients shifted slowly over several years and not abruptly at one point in time, or (b) that restricting the search to only one shift point left undetected an additional shift either very early or very late in the series.

In an attempt to unmask the trended variable most likely (in our opinion) to have been ignored, and to cast some light upon the notion of "fair share," final appropriations y_t for each agency were regressed on total non-defense appropriations z_t. This time series was taken from the *Statistical Abstract of the United States*. The results were poor. Indeed, the sample correlations between y_t and z_t are usually worse than those between y_t and x_t.

Moreover, the d-statistics are usually highly significant and the residual patterns for the regression show the agency's proportion of the non-defense budget to be either increasing or decreasing over time. However, it should be noted that even those exceptional cases where the agency trend is close to that of the total non-defense appropriation do not invalidate the explicit decision structure fitted here. A similar study, with similar results, was conducted at the departmental level by regressing y_t for the eight National Institutes of Health on y_t for the Public Health Service, the agency of which they are a part. Finally, the y_t for selected pairs of agencies with "similar" interests were regressed on each other with uniformly poor results.

Although empirical evidence indicates that our models describe the budgetary process of the United States government, we are well aware of certain deficiencies in our work. One deficiency, omission of certain agencies from the study, is not serious because over one-half of all non-defense agencies were investigated. Nevertheless, the omission of certain agencies may have left undiscovered examples of additional decision rules. We will shortly study all agencies whose organizational structure can be traced. We will also include supplemental appropriations.

A more serious deficiency may lie in the fact that the sample sizes, of necessity, are small. The selection criterion of maximum sample correlation, therefore, lacks proper justification, and is only acceptable because of the lack of a better criterion. Further, full-information maximum likelihood estimators, and especially biased ones, even when they are known to be consistent, are not fully satisfactory in such a situation, although they may be the best available. However, the remedy for these deficiencies must await the results of future theoretical research on explosive or evolutionary processes.

IV. THE DEVIANT CASES AND PREDICTION: INTERPRETATION OF THE STOCHASTIC DISTURBANCES

The intent of this section is to clarify further the interpretation of the stochastic disturbances as special or unusual circumstances represented by random variables. While those influences present at a constant level during the period serve only to affect the magnitude of the coefficients, the special circumstances have an important, if subsidiary, place in these models. We have indicated that although outside observers can view the effects of special circumstances as a random variable, anyone familiar with all the facts available to the decision-makers at the time would be able to explain the special circumstances. It seems reasonable therefore to examine instances where, in estimating the coefficients, we find that the estimated values of the stochastic disturbances assume a large positive or negative value. Such instances appear as deviant cases in the sense that Congress or the agency-Budget Bureau actors affected by special circumstances (large positive or negative values of the random variable) do not appear to be closely following their usual decision rule at that time but base their decisions mostly on these circumstances. The use of case studies for the analyses of deviant phenomena, of course, presupposes our ability to explain most budgeting decisions by our original formulations. Deviant cases, then, are those instances in which particular decisions do not follow our equations. It is possible to determine these deviant instances simply by examining the residuals of the fitted equations: one observes a plot of the residuals, selects those which appear as extreme positive or negative values, determines the year to which these extreme residuals refer, and then examines evidence in the form of testimony at the Appropriations Committees, newspaper accounts and other sources. In this way it is possible to determine at least some of the circumstances of a budgetary decision and to investigate whether or not the use of the random variables is appropriate.[20]

Finally, it should be pointed out that in our model the occurrence of extreme disturbances represents deviant cases, or the temporary setting aside of their usual decision rules by the decision-makers in the process, while coefficient shifts represent a change (not necessarily in form) of these rules.

From the residuals of one-half of the estimated Congressional decision equations, a selection of 55 instances (approximately 14 percent of the 395 Congressional decisions under consideration) were identified as deviant.[21] Table 6 shows the yearly frequency of

[20] The importance of analyzing deviant cases is suggested in: Milton M. Gordon, "Sociological Law and the Deviant Case," *Sociometry*, 10 (1947); Patricia Kendall and Katharine Wolf, "The Two Purposes of Deviant Case Analysis," in Paul F. Lazarsfeld and Morris Rosenberg (eds.), *The Language of Social Research*, (Glencoe, 1962), pp. 103–137; Paul Horst, *The Prediction of Personal Adjustment: A Survey of the Logical Problems and Research Techniques* (New York, 1941); and Seymour Lipset, Martin Trow, and James Coleman, *Union Democracy* (New York, 1960).

[21] We are indebted to Rose M. Kelly, a graduate student in the Department of Political Science,

TABLE 6. DEVIANT CASES CLUSTER IN YEARS OF POLITICAL CHANGE

Year	'48	'49	'50	'51	'52	'53	'54	'55	'56	'57	'58	'59	'60	'61	'62	'63
Number of Cases	8	2	1	1	1	4	6	4	1	1	2	3	4	2	8	7

the occurrence of deviant cases. It is apparent that deviancy grows in years of political change: in 1948 the Republican 80th Congress made a determined effort to reduce appropriations submitted by the Democratic President; the years 1953 through 1955 mark the beginning of Eisenhower's Presidency; the large number of deviant cases in 1962 and 1963 are related to the accession to office of Kennedy and Johnson. The latter category of deviant cases, we will explain later, may be mis-clasifications in the sense that the passage of time and the corresponding accumulation of additional evidence may reveal shift points, i.e., changes in the "average percentages" of the decision processes, rather than "exceptional circumstances." Nevertheless, this fact causes no particular problem in light of our purposes here, and the cases may be viewed as if they are appropriately classified.

Table 7 categorizes the cases according to

TABLE 7. DEVIANT CASES MAY BE VIEWED AS RANDOM EVENTS

Categories of Deviance	Number of Cases
Significant policy change	20
Fiscal policy change	8
Felt need of Congressional supervision	6
Amended estimate due to a time factor	6
Single event	5
Large new legislative program	4
Reorganization of agency	1
Non-identifiable	5
TOTAL N =	55

estimates of why deviance occurred. It should be noted that the largest category, significant policy change, involves the lack of a budgetary base for the agency in question. In order to highlight the meaning we give to random phenomena, an illustration of each category follows. This analysis explains why, although the deviant cases are understandable to an experienced observer or participant, an outsider would have to regard them as essentially random disturbances to an otherwise deterministic system. Indeed, no two events in the categories of Table 7 are likely, *a priori*, either to be the same or to occur in any particular year.

Significant Policy Change

The Southwestern Power Administration is typical of agencies whose appropriations fluctuate unduly because basic policy is being negotiated. Deviance was evident in 1948, 1949, 1954, and 1955. The SPA continually requested funds for the building of transmission lines, and Congress repeatedly eliminated the request from their appropriations, insisting that private enterprise would supply the necessary facilities. In 1948 the Bureau of the Budget recommended $7,600,000 of which only $125,000 was appropriated, with stringent and explicit instructions that printing and mailing of materials calculated to increase clientele among rural and municipal electrical cooperatives cease.

The Korean War increased demands for electric power. Deviance occurred in 1955 not because of appropriations cuts but because of House floor amendments and Senate Appropriations Committee increases. Public policy then became stabilized as Congress established a budgetary base. The following years fit our equations.

Fiscal Policy Changes

The Foreign Agricultural Service's 1963 appropriation is deviant in appropriation figures, but, because $3,117,000 was provided by transferring funds from Sec. 32, the total budget for FAS is close to the Budget Bureau's initial request.

Felt Need of Congressional Supervision

The House Committee reports on Office of Territories for 1953 show a lack of confidence in the agency. The tenor can be judged by House Report 1622: "The Department was advised last year that the Committee did not intend to provide appropriations for an endless chain of capital investment in the Alaska Railroads. Army testimony was conflicting as to the need for a road and railways. There is need for a coordinated plan before the Committee can act intelligently with regard to the railroad."

University of California, Berkeley, who did the research on the deviant cases and provided the data for Tables 6 and 7.

Amended Estimate Due to Time Factor

Typical of this type of deviance is the Commodity Stabilization Service's appropriation for 1958. On the basis of figures from County Agricultural Agents, Secretary Ezra Taft Benson scaled down his request from $465 million to $298 million. A more accurate estimate was made possible because of added time.

Large New Legislative Program

This is especially apt to affect an agency if it is required to implement several new programs simultaneously. The Commissioner of Education said in reference to the student loan program, "We have no way of knowing because we never had such a program, and many of the institutions never had them." The NDEA Act alone had ten new entitlements.

Reorganization of an Agency

The only example is the Agricultural Marketing Service's appropriation for 1962. Funds were reduced because of a consolidation of diverse activities by the Secretary of Agriculture and not through reorganization as a result of Congressional demands.

Non-identifiable

This applies, for example, to the Public Health Service where a combination of lesser factors converge to make the agency extremely deviant for 1959, 1960, 1961, and 1962. Among the apparent causes of deviance are publicity factors, the roles of committee chairmen in both House and Senate, a high percentage of professionals in the agency, and the excellent press coverage of health research programs. No one factor appears primarily responsible for the deviance.

Our models are not predictive but explanatory. The alternate decision equations can be tried and the most appropriate one used when data on requests and appropriations are available. The appropriate equation explains the data in that, given a good fit, the process behaves "as if" the data were generated according to the equation. Thus, our explanatory models are backward looking: given a history of requests and appropriations, the data appears as if they were produced by the proposed and appropriately selected scheme.

The models are not predictive because the budget process is only temporally stable for short periods. We have found cases in which the coefficients of the equations change, i.e., cases in which there are alterations in the realized behavior of the processes. We have no *a priori* theory to predict the occurrence of these changes, but merely our *ad hoc* observation that most occurred during Eisenhower's first term. Predictions are necessarily based upon the estimated values of the coefficients and on the statistical properties of the stochastic disturbance (sometimes called the error term). Without a scientific method of predicting the shift points in our model, we cannot scientifically say that a request or an appropriation for some future year will fall within a prescribed range with a given level of confidence. We can predict only when the process remains stable in time. If the decision rules of the participants have changed, our predictions may be worthless: in our models, either the coefficients have shifted or, more seriously, the scheme has changed. Moreover, it is extremely difficult to determine whether or not the observation latest in time represents a shift point. A sudden change may be the result either of a change in the underlying process or a temporary setting aside of the usual decision rules in light of special circumstances. The data for several subsequent years are necessary to determine with any accuracy whether a change in decision rules indeed occurred.

It is possible, of course, to make conditional predictions by taking the estimated coefficients from the last shift point and assuming that no shift will occur. Limited predictions as to the next year's requests and appropriations could be made and might turn out to be reasonably accurate. However, scholarly efforts would be better directed toward knowledge of why, where and when changes in the process occur so that accurate predictions might be made.

The usual interpretation of stochastic (in lieu of deterministic) models may, of course, be made for the models of this paper, i.e., not all factors influencing the budgetary process have been included in the equations. Indeed, many factors often deemed most important such as pressure from interest groups, are ignored. Part of the reason for this lies in the nature of the models: they describe the decision process in skeleton form. Further, since the estimations are made, of necessity, on the basis of time series data, it is apparent that any influences that were present at a constant level during the period are not susceptible to discovery by these methods. However, these influences do affect the budgetary process by determining the size of the estimated coefficients. Thus, this paper, in making a comparative study of the estimated coefficients for the various agencies, suggests a new way of approaching constant influences.

No theory can take every possible unexpected circumstance into account, but our theory can be enlarged to include several classes of events. The concentration of shift

points in the first years of the Eisenhower administration implies that an empirical theory should take account of changes in the political party controlling the White House and Congress.

We also intend to determine indices of clientele and confidence so that their effects, when stable over time, can be gauged.[22] Presidents sometimes attempt to gear their budgetary requests to fit their desired notion of the rate of expenditures appropriate for the economic level they wish the country to achieve. By checking the Budget Message, contemporary accounts, and memoirs, we hope to include a term (as a dummy variable) which would enable us to predict high and low appropriations rates depending on the President's intentions.

V. SIGNIFICANCE OF THE FINDINGS

We wish to consider the significance of (a) the fact that it is possible to find equations which explain major facets of the federal budgetary process and (b) the particular equations fitted to the time series. We will take up each point in order.

A. It is possible to find equations for the budgetary process. There has been controversy for some time over whether it is possible to find laws, even of a probabilistic character, which explain important aspects of the political process. The greatest skepticism is reserved for laws which would explain how policy is made or account for the outcomes of the political process. Without engaging in further abstract speculation, it is apparent that the best kind of proof would be a demonstration of the existence of some such laws. This, we believe, we have done.

Everyone agrees that the federal budget is terribly complex. Yet, as we have shown, the budgetary process can be described by very simple decision rules. Work done by Simon, Newell, Reitman, Clarkson, Cyert and March, and others, on simulating the solution of complex problems, has demonstrated that in complicated situations human beings are likely to use heuristic rules or rules of thumb to enable them to find satisfactory solutions.[23] Braybrooke and Lindblom have provided convincing arguments on this score for the political process.[24] Wildavsky's interviews with budget officers indicate that they, too, rely extensively on aids to calculation.[25] It is not surprising, therefore, as our work clearly shows, that a set of simple decision rules can explain or represent the behavior of participants in the federal budgetary process in their efforts to reach decisions in complex situations.

The most striking fact about the equations is their simplicity. This is perhaps partly because of the possibility that more complicated decision procedures are reserved for special circumstances represented by extreme values of the random variable. However, the fact that the decision rules generally fit the data very well is an indication that these simple equations have considerable explanatory power. Little of the variance is left unexplained.

What is the significance of the fact that the budgetary process follows rather simple laws for the general study of public policy? Perhaps the significance is limited; perhaps other policy processes are far more complex and cannot be reduced to simple laws. However, there is no reason to believe that this is the case. On the contrary, when one considers the central importance of budgeting in the political process—few activities can be carried on without funds—and the extraordinary problems of calculation which budgeting presents, a case might better be made for its comparative complexity than for its simplicity. At present it is undoubtedly easier to demonstrate that laws, whether simple or complex, do underlie the

[22] See Wildavsky, *op. cit*,. pp. 64–68, for a discussion of clientele and confidence. In his forthcoming book, *The Power of the Purse* (Boston, 1966), Richard Fenno provides further evidence of the usefulness of these categories.

[23] Geoffrey P. E. Clarkson, *Portfolio Selection: A Simulation of Trust Investment* (Englewood Cliffs, N. J., 1962); G. P. E. Clarkson and H. A. Simon, "Simulation of Individual and Group Behavior," *American Economic Review*, 50 (1960), 920–932; Richard Cyert and James March (eds.) *A Behavioral Theory of the Firm* (Englewood Cliffs, N. J., 1963); Allen Newell, "The Chess Machine: An Example of Dealing with a Complex Task by Adaptation," *Proceedings of the Western Joint Computer Conference* (1955), pp. 101–108; Allen Newell, J. C. Shaw, and H. A. Simon, "Elements of a Theory of Human Problem Solving," *Psychological Review*, 65 (1958), 151–166; Allen Newell and H. A. Simon, "The Logic Theory Machine: A Complex Information Processing System," *Transactions on Information Theory* (1956), 61–79; W. R. Reitman, "Programming Intelligent Problem Solvers," *Transactions on Human Factors in Electronics*, HFE-2 (1961), pp. 26–33; H. A. Simon, "A Behavioral Model of Rational Choice," *Quarterly Journal of Economics*, 60 (1955), 99–118; and H. A. Simon, "Theories of Decision Making in Economics and Behavioral Science," *American Economic Review*, 49 (1959), 253–283.

[24] David Braybrooke and Charles Lindblom, *A Strategy of Decision* (New York, 1964).

[25] Wildavsky, *op. cit.*, pp. 8–63.

budgetary process than to account for other classes of policy outcomes, because budgeting provides units of analysis (appropriations requests and grants) that are readily amenable to formulating and testing propositions statistically. The dollar figures are uniform, precise, numerous, comparable with others, and, most important, represent an important class of policy outcomes. Outside of matters involving voting or attitudes, however, it is difficult to think of general statements about public policy that can be said to have been verified. The problem is not that political science lacks propositions which might be tested. Works of genuine distinction like Herring's *The Politics of Democracy*, Truman's *The Governmental Process*, Hyneman's *Bureaucracy in a Democracy*, Neustadt's *Presidential Power*, Buchanan and Tullock's *The Calculus of Consent*, contain implicit or explicit propositions which appear to be at least as interesting as (and potentially more interesting than) the ones tested in this paper. The real difficulty is that political scientists have been unable to develop a unit of analysis (there is little agreement on what constitutes a decision) that would permit them to test the many propositions they have at their command. By taking one step toward demonstrating what can be done when a useful unit of analysis has been developed, we hope to highlight the tremendous importance that the development of units of analysis would have for the study of public policy.

B. The significance of the particular equations. Let us examine the concepts that have been built into the particular equations. First, the importance of the previous year's appropriation is an indication that the notion of the base is a very significant explanatory concept for the behavior of the agencies and the Budget Bureau. Similarly, the agency-Budget Bureau requests are important variables in the decisions of Congress. Second, some of the equations, notably (7) and (8) for Congress, and (2) for the agency-Budget Bureau, incorporate strategic concepts. On some occasions, then, budgeting on the federal level does involve an element of gaming. Neither the Congress nor the agencies can be depended upon to "take it lying down." Both attempt to achieve their own aims and goals. Finally, the budgetary processs is only temporally stable. The occurrence of most changes of decision rules at a change in administration indicates that alterations in political party and personnel occupying high offices can exert some (but not total) influence upon the budgetary process.

Our decision rules may serve to cast some light on the problem of "power" in political analysis. The political scientist's dilemma is that it is hardly possible to think about politics without some concept of power, but that it is extremely difficult to create and then to use an operational definition in empirical work. Hence, James March makes the pessimistic conclusion that "The Power of Power" as a political variable may be rather low.[26] The problem is particularly acute when dealing with processes in which there is a high degree of mutual dependence among the participants. In budgeting, for example, the agency-Budget Bureau and Congressional relationships hardly permit a strict differentiation of the relative influence of the participants. Indeed, our equations are built on the observation of mutual dependence; and the empirical results show that how the agency-Budget Bureau participants behave depends on what Congress does (or has done) and that how Congress behaves depends on what the agency-Budget Bureau side is doing (or has done). Yet the concept of power does enter the analysis in calculations of the importance that each participant has for the other; it appears in the relative magnitude of the estimated coefficients. "Power" is saved because it is not required to carry too great a burden. It may be that theories which take power into account as part of the participants' calculations will prove of more use to social science research than attempts to measure the direct exercise of influence. At least we can say that theories of calculation, which animate the analysis of *The Politics of the Budgetary Process* and of this paper, do permit us to state and test propositions about the outcomes of a political process. Theories of power do not yet appear to have gone this far.

In the field of economics, work has long been done on organizational units called industrial firms. In political science, however, despite the flurry of excitement over organization theory, there has been no empirical demonstration of the value of dealing with various public organizations as comparable entities. By viewing governmental bodies not as distinctly different agencies but as having certain common properties (here, in budgetary calculations and strategies), we hope to have shown the utility to empirical theory of treating organizations *qua* organizations. Despite the differences among the organizations studied—some follow different decision rules and are affected by different random disturbances—it is analytically significant to explain their behavior by virtue of features they share as organizations.

It should be clear that we are dealing with

[26] James March, "The Power of Power," in David Easton, editor, *Varieties of Political Theory* (Englewood Cliffs, N. J., 1966), pp. 39–70.

general models of organizations and not with individual policies. One cannot say anything directly about water, land, health, or other transportation policies, from inspection of our models of a given agency. But this limit is not inherent in our approach. It is possible, for example, to calculate from our data present and future estimated rates of growth for virtually all domestic agencies since World War II. Agencies with similar growth rates may be segregated and examined for common features. The growth rates of agencies in similar areas of policy, such as public health and natural resources, may be compared, and the fortunes of policies in those areas deduced. Individual agencies may be broken down into sub-units or the courses of certain policy programs charted to explain the differential treatment they receive. While pursuing this type of analysis, we hope to have one advantage. We shall be working from a general model of the budgetary process. It will, therefore, be possible for us to locate our efforts within this larger scheme. To know whether one is dealing with a normal or deviant case, to know one's position in this larger universe, is to be able to give more general meaning to the individual and particular circumstances with which one must be involved in handling small parts of the total process.

The general mode of analysis we have developed here may be pursued in many different contexts. Similar studies could be undertaken in state and local governments as well as foreign countries.[27] Private firms and public agencies may be conceptualized in parallel terms through their budgetary mechanisms.[28] By comparing the processes underlying budgeting in a variety of political and economic systems, it may be possible to state more elegantly and precisely the conditions under which different forms of behavior would prevail.

APPENDIX

On the Definition of Terms

Certain of the technical terms required in the paper are here given informal definitions.

Coefficient: A coefficient of an equation is a parameter or number that is said to have some given but usually unknown value. The α's and β's used in the models are the coefficients of the equations in which they appear. Since the values of the coefficients are usually unknown, they must be estimated statistically from available data. In this paper, the coefficients (α's and β's) are average representations of the real percentages of requests made by agencies and appropriations granted by Congress.

Linear: An equation is linear if it has no square or higher order terms. Thus $y=\alpha x$ is linear whereas $y=\alpha x^2$ is not linear. (Remember that for two variables linear means "in a straight line.")

Stochastic: A variable is stochastic, a term meaning random, if the particular value that it assumes is a matter of chance and the set of values that it can assume is capable of being described by a probability distribution or density. The distribution gives the probability of the random variable assuming the various allowable values.

Variance: The variance is defined as $E(x-\mu)^2$ where x is a random variable, μ is its mean, and E stands for "the expected value of." One can think of variance as a measure of the dispersion or spread of the probability distribution governing the random variable.

Linear Regression Equation: A linear regression equation is a particular model of the relationship between two or more variables. The model has the form

$$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki} + \epsilon_i$$

where β_0 is the unknown constant term, the other β's are unknown coefficients, and ϵ_i is a random variable. In this notation, y_i represents the value of the dependent variable on the ith observation and $x_{1i}, x_{2i}, \cdots, x_{ki}$ represents in a similar manner the values of the independent variables for the same observation. From a set of n observations, each of which consists of particular values for the dependent and independent variables, the regression operation estimates values for the unknown coefficients and the constant term; the regression operation also estimates n values of the random variable, which are called residuals. When the sets of observations on the dependent and independent variables refer to successive periods, the observations are called time series and we say that the values of y_i are generated by a stochastic process.

Stochastic Disturbance: This is a name for the random variable in a regression equation. It is also called the error term. Thus, in the equation $y_i=\alpha x_i+\epsilon_i$, the term ϵ_i represents a stochastic disturbance (or random variable), which is usually assumed to be normally distributed with mean zero and finite but unknown variance.

Difference Equation: An equation which describes the value of a variable in one period in terms of the value of either that variable or another variable in some previous period is a differ-

[27] See the forthcoming studies by John P. Crecine on budgeting in Pittsburgh, Detroit and Cleveland, and by Donald Gerwin on the Pittsburgh School District. Aaron Wildavsky will attempt to apply variations of the models in this paper to Oakland, California.

[28] Aaron Wildavsky, "Private Markets and Public Arenas," *The American Behavioral Scientist* vol. 9 no. 7, (Sept. 1965) pp. 33–39.

ence equation. For example, $x_t = \beta y_{t-1}$ is a difference equation. If a random variable is present, the equation is called a stochastic difference equation. Thus, if ϵ is a random variable, $x_t = \beta y_{t-1} + \epsilon_t$ is a stochastic difference equation and the successive values of x may be thought of as a stochastic process.

Unstable, Evolutionary or Explosive Process: A process is said to be unstable, evolutionary or explosive if the expected values of the successive values taken by the process are increasing. For example, the stochastic difference equation $y_t = \gamma y_{t-1} + \epsilon_t$, where $\gamma > 1$, generates an evolutionary process.

Serially Independent: If successive realizations of a random variable are serially independent, the value it assumes in one period is independent of the value it assumed in a previous period. This can be described mathematically as $E(x_t | x_{t-1}) = E(x_t)$, meaning that the expected value of random variable x at period t does not depend upon the value that the random variable x assumed at period $t-1$. It follows that the expected simple correlation between x_t and x_{t-1} will be zero, if the random variable x is serially independent. For example, in our models, the assumption of serial independence of the disturbances reflects the belief that special circumstances in one year either do not affect special circumstances in succeeding years or that their influence enters explicitly into our model (as in equation (8) and the equations of footnote 4).

The Meaning of a Markov Process

For our purposes, a Markov process generating some random variable x, is a process for which the value of x at time t depends upon the values assumed by that random variable at one or more earlier periods plus the value assumed by some stochastic disturbance at time t. A Markov process is "first order" if the variable x_t takes on a value that depends only upon the value of the variable x_{t-1} in the previous period plus the value of a stochastic disturbance at time t. Thus

$$x_t = \alpha x_{t-1} + \epsilon_t$$

is a first order Markov process where ϵ_t is a random variable with a given distribution and α is a non-zero constant. A second order Markov process can be described by

$$x_t = \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \epsilon_t$$

where both α_1 and α_2 are non-zero constants. The value of the variable x_t now depends upon its values in two previous periods.

On the Meaning of Goodness of Fit

An intuitive notion of good fit for a linear regression equation is that in a scatter diagram the observations should cluster about the fitted line. Probably the most popular measure of good fit is the square of the multiple correlation coefficient (R^2), which may often be interpreted as the percentage of the variance of the dependent variable that is explained by the postulated linear relationship (regression). For our models however, this interpretation is not valid, although the adjusted R gives a rough measure of the goodness of fit. The closer to 1 that the adjusted R is, the better the fit.

On Standard Deviations of Coefficient Estimates

Speaking roughly, these standard deviations measure the reliability of the estimates of the coefficients. The smaller the estimated standard deviation, the more accurate the estimated coefficient is likely to be. If we had another series of data generated from the same process, the smaller the standard deviation of the coefficient (estimated from the first data) in relation to the size of this coefficient, the more likely it is that a new estimate made on the basis of the hypothetical new series of data would be close to the estimate made from the original data. Generally, one hopes the estimated standard deviation of the coefficient is at least as small as one-half the size of the estimated coefficient.

On Biased and Unbiased Estimators

Think of the problem of trying to determine the average IQ of students at a large university. Suppose the administration would not allow access to records and one did not wish to give IQ tests to all students. One might select a certain number of students at random (a sample) and give them the tests. The test scores of these students are sample observations. One might compute the average of these test scores and claim that he has an estimate of the mean IQ of all students at the University. The estimator is the formula for the average of the sample observations. If he repeated the process, taking a new sample, it is possible that the estimator would produce a slightly different estimate of the mean. However, the estimator would still have a certain expected value. If the expected value of the estimator can be proven to equal the population parameter (the mean IQ of all the students example) then the estimator is said to be unbiased. Otherwise, it is said to be biased.

On Consistent Estimators

An estimator is consistent if it approaches nearer and nearer to the true value of a parameter (in our case, a coefficient) as the size of the sample is increased. A consistent estimator may be biased (it may approach closer to but never actually equal the parameter), but if the sample from

which it is estimated is large enough this bias will be small.

On Least-Squares Estimators and the Meaning of Temporally Stable Processes

This discussion specifically refers to process (4) although it is equally applicable to all processes. Consider

$$y_t = \alpha_0 x_t + \eta_t$$

where α represents the coefficient of the equation or the "on the average" percentage of the request that is granted by Congress and η_t is a stochastic disturbance (random variable) that represents the variation in the request over time that may be assigned to special circumstances. We assume that η_t is normally distributed with mean zero and finite but unknown variance. The coefficient is unknown and must be estimated on the basis of available data. The data are the requests x_t and the corresponding appropriations y_t. We do not know the values assumed by the stochastic disburbance. Our estimates of the values assumed by the stochastic disturbance are the residuals of the fitted regression equation. If, for a given agency, we observe the requests and appropriations over a specified period of time, we could plot the data in a scatter diagram (Fig. 1). The line drawn in Fig. 1 would be our estimated line (the line resulting from our estimate of α).

The vertical positive and negative distances of the points from the fitted line are the values of the residuals, our estimates of the values assumed by the stochastic disturbance. The least-squares estimates of the coefficients are those values of the coefficients which make the sum of the squares of these distances a minimum. In Fig. 1, there is no discernible pattern of departure of the points from the line.

Thus, we can say that the process is temporally stable (i.e., fixed over time) and presume that the true value of the coefficient (we know only its estimated value) remained constant during the period under consideration. A temporally stable process is one in which the value of the true coefficient does not change during the period under consideration. This should not be confused with a stable or non-evolutionary process, i.e., one whose

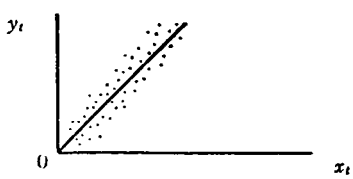

FIG. 1

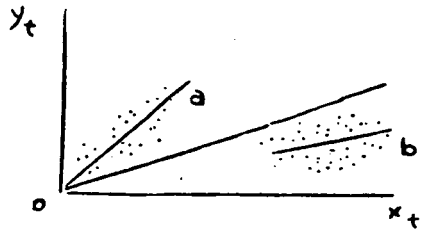

FIG. 2

values do not tend to grow, but fluctuate about some level.

If we again plotted the requests and appropriations data for an agency and found the results to be as in Fig. 2, the longest line would represent our first fitted equation (or the equation resulting from our first estimate of the value of the coefficient). The points (alternately the residuals) form a pattern of departure from the fitted line. In the early years (a) they fall mostly above the line and in the later years (b) they fall mostly below the line. The process must have been temporally unstable for the period as a whole, i.e., the coefficient had one true value during the first years of the period and a different true value during the last years.

A temporally unstable process is one in which the true coefficient assumes two or more values during the period under consideration. Since we only know the estimated coefficient, we must examine the residuals to determine whether such a pattern is present. Then, we select what appears to be the probable year of change, and fit two lines such as those drawn in above. We then compute the F Statistic to make our statistical test to determine, at a given level of significance, whether or not the true value of the coefficient shifted. If it was found to shift, the process was temporally stable for some period of time but not necessarily for the entire series of time periods examined.

The Meaning of a Shift Point and a Break Point

The two second lines fitted to Figure 2 represent the true process. The year during which the coefficient changes (the year when the pattern shifts from clustering about line (a) to clustering about line (b) is referred to as a shift point. If what appears at first to be a shift in the true value of the coefficient is actually an alteration in behavior so that one equation fits the first sub-period and another equation must be used for the second sub-period, we still refer to the year of the change in realized behavior as a shift point. Break point is the term used to describe a suspected shift point but for which the F-test indicates that the true coefficient value did not shift.

APPENDIX 4

PLANNING-PROGRAMING-BUDGETING FOR CITY, STATE, COUNTY OBJECTIVES

The appendix materials which follow are from the State-local finances project, under the direction of Dr. Selma J. Mushkin, *Project Director*. This project is part of a program of research and education on advance fiscal planning under a grant from the Ford Foundation to The George Washington University.

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NOTE 1. ANSWERING THE QUESTION: IS AN INTEGRATED PLANNING, PROGRAMING, BUDGETING SYSTEM USEFUL FOR OUR JURISDICTION?

A number of requests have been received from jurisdictions asking about PPBS—What is meant by the term? Would such a system be useful for our governmental unit? What type of work would it entail? Can we look to some immediate results?

The present note is one of a series designed to help answer the questions that have been raised. It concerns itself with a pre-examination of PPBS, namely, how a jurisdiction may go about the problem of making a decision as to whether or not to undertake the implementation of an integrated system of planning, programing, budgeting. In developing the materials, the note draws on the experience of several jurisdictions.

STEP ONE. A Top Staff Assignment.—A staff person (or personnel of a task force whose chairman reports directly to the chief executive) should be assigned to explore the feasibility and uses of PPBS for the jurisdiction, to familiarize himself with the processes and implications of the system, and to learn what other jurisdictions have done or are doing.

Among the tasks of such a staff person would be the following: (These items are discussed under Steps Two and Three below.)

(1) the preparation of a memorandum on the usefulness of PPBS for the jurisdiction

(2) the preparation of supplementary material on the staffing and financial implications of implementing PPBS.

Step Two. A Memorandum on: What's In It For Us?—While there are common structural and organizational problems, differences from one state to another, or one local jurisdiction to another are many, and the decision about inplementation of PPBS—when, and how—must be made in the light of these special characteristics.

In general an integrated system of planning, programming, and budgeting offers:

(1) An improved process for decision making.

(2) A systematic method of exploring alternative ways (more effective or less costly) for getting the public business done.

(3) A procedure for coordination of governmental programs in the light of identified common or single objectives.

(4) A better méthod of selection among federal aid offerings and of integrating federal aids into the jurisdiction's own service program.

(5) A strengthening of the initiative of the state and local government in policy formulation.

But each jurisdiction has special issues before it of immediate concern. An important end-product of a PPB system over a short haul, indicative of a potential quick payoff, may take the form of:

(1) An examination of fundamental objectives of the jurisdiction and the role of individual programs in meeting those objectives.

(2) Better guidelines for policy formulation on one or two major issues on which decisions must be taken immediately, e.g., form of an urban renewal project (site, rental groups, commercial-residential mix), scope of a summer-time job program for young persons in poor neighborhoods, deployment of new mass transportation facilities, etc.

(3) More information on the present budgetary allocations existing among program expenditures, that would display the relative expenditures for—

(a) preventing dependency on tax supported services;

(b) servicing the existing work load;

(c) developing the social and economic base of the community.

A memorandum on the usefulness of a PPB system should summarize the major issues on which an analysis would be immediately useful; and also compare, as an example, the information now presented the Governor, Mayor, City or County

Manager to the information that would become available if a PPB system were introduced.

STEP THREE: Assessment of Staffing and Fund Requirements.—An initial evaluation must be made to—

(1) Determine whether the professional capacity for program evaluation exists within the jurisdiction, or whether new personnel would be needed.

(2) Estimate the staff training that is needed to carry out effectively a PPS system.

(3) Cost the staff work involved in implementation of a PPB system.

(4) Specify various time schedules for implementing a program.

(5) Develop tentative priority list for areas in which systematic analysis should be undertaken in tially.

Few jurisdictions will be able to implement fully program analysis across-the-board at the outset of the new system. A summary statement should be prepared for the chief executive of the jurisdiction of staffing, recruitment possibilities, additional expenditure requirements in accord with various time schedules.

NOTE 5.

DEVELOPING AN OBJECTIVE ORIENTED

GOVERNMENTAL PROGRAM STRUCTURE

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I. Introduction

This note deals with the development of the set of output oriented categories -- the "program structure" -- one of the key parts of a Planning-Programming-Budgeting System. The structure provides the categories for the government's formal multi-year output and financial plan and for individual program analyses. The note is intended to assist state and local governments in developing such a program structure for their jurisdictions.

It is difficult, if not impossible, to be very specific about rules for developing a program structure. This note, therefore, is limited to identifying some general principles and setting some guidelines.

II. Basic Considerations

1. Classifications should focus on objectives.

A PPB system should enable the top managers in a government to focus their attention on the government's major resource allocation problems. The purpose of the program structure is to provide the framework for such allocation. It establishes the basic classification scheme for the marshaling of information required for program analysis and policy decisions. The program structure should highlight the government's fundamental objectives and the competing and complementary programs involved in carrying out such objectives.

2. Structures should be distinguished from budget categories.

As is indicated above, the function of the program structure is to aid in program planning, -- that is, to facilitate rational choices among program alternatives -- not to affect the management and control of current operations. It is not assumed here that the same set of categories is appropriate for a government's formal budget, which is submitted to the legislative branch of the government. Whether the same categories, or a similar set, should be used for the formal budget is a debatable issue, which is not taken up in this note. * If the program structure used for resource allocation planning differs from that used in the formal budget, a "crosswalk" between the two is necessary to assure that the program planning decisions and the formal budget are compatible.

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* It may be preferable for the formal budget to continue to emphasize the management control function rather than the program planning function. In that case, its emphasis might be on accounting object classes (such as: personal services, supplies, equipment, etc.) and organizational components rather than on objectives and programs.

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3. All functions should be included regardless of organizational placement.

All of the functions and activities of the government should be encompassed by the program structure. The categories of the program structure should emphasize the fundamental government objectives, the things to be done, rather than the things to be bought. Each governmental activity ideally should be placed in the program structure under the objectives to which it primarily contributes. Activities should be grouped in this manner regardless of their formal organizational placement. It will often be necessary to group together programs from more than one department or agency, since several agencies may administer programs that contribute directly to the same governmental objective. For example, the police vehicle maintenance activity, even if organizationally placed under a centralized garage in, say, the Public Works Department, should be included in the program structure under such a category as "Patrol Car Units for Crime Control". This does not mean that the centralized garage activity should be shown as a separate category for each program that it serves, but only that its applicable costs should be included in the costs for each of such programs.

4. Formal organization need not correspond to structure.

As "3" above suggests, a program structure will often group together activities of different agencies. This does not imply that changes in organization are necessary. For the management of operations it may be quite reasonable for similar activities, regardless of end use, to be organized together whereas for resource planning another way of viewing the activities may be preferred. The maintenance of police vehicles activity mentioned in "3", above, is an example of such activities. (However, the PPB system should be designed to provide each major organizational unit with a compilation showing the relation between the activities for which it is responsible and the program structure.)

5. A "non-perfect" structure is to be expected.

There is no "perfect" program structure. Many important programs have multiple purposes and could reasonably be classified in various ways. No one category scheme will fulfill all needs or satisfy all users. In addition, individual program analyses frequently may call for special groupings or other modifications to reflect the needed emphasis of the problem at hand. As a practical matter, for a government's formal program structure a single pattern should be chosen. The result necessarily will be a compromise. Special groupings can be made and will often be needed for individual special purpose analyses.

6. Inflexibility should be avoided.

The formal program structure, however, should not be allowed to become rigid or inflexible. New developments and changes in emphasis are bound to occur in future years, and they will suggest the need for revisions of the

formal program structure. (Of course, whenever a new program is created, provision must be made for it in the program structure.) Nevertheless, too frequent changes in the formal program structure, for insufficient reasons, are also undesirable since changes are likely to cause problems with existing data information systems.

7. Avoid spending excess effort on structure.

Because of the many options open for program structure classifications, it would be unwise to expend too much time and effort in perfecting the design of the initial program structure. After trial, the design can be revised as best suits the requirements of the particular jurisdiction and the needs of its policy decision makers. The program structure is only one of the several parts of the PPB system. If the fundamental objectives have been sufficiently identified, even a rough-cut program structure should be sufficient for forming the framework for the subsequent analytical efforts that are the essence of a PPB system. The test of a satisfactory program structure will be its usefulness for the on-going processes of choice and decision.

III. Some General Guidelines For Preparation of a Program Structure

The preparation of a governmental program structure can be considered to entail the following three major tasks:

1. Identification of the fundamental governmental objectives of the jurisdiction.

2. Development of the specific categories.

3. Formulation of descriptive statements to explain the scope, coverage, and content of each category. These are needed in order to make clear what types of activities and what costs should be included under each program and under each grouping of programs.

These tasks, though on the surface sequential, will probably be performed concurrently since the process of undertaking any one of them will occasionally suggest necessary revisions to the others.

Each of the major tasks is discussed in the following sections.

A. Identification of Fundamental Governmental Objectives *

This is a basic step toward a rational grouping of programs on the basis of their objectives. The aim is to define as sharply as possible why the government exists. One procedure would be to explore first the following key questions without being inhibited by the scope and nature of the government's current activities.

What is to be done?

For whom?

A second step would be to examine current (and proposed) activities and ask:

Why is each activity currently performed being done?

And for whom?

Are there aims with which the government is concerned even though there may be no recognizable current activities related to those aims (and therefore should be allotted a place in the program structure)?

These questions should be concerned with fundamental objectives and not just with the immediate outputs of those activities. For example, a housing inspection activity provides such "outputs" as number of inspections of housing and number of violations uncovered, but the fundamental objective is the provision of opportunity for safe and satisfactory homes.

The "For whom?" question is intended to identify the clientele, the target groups, aimed at. For example, the target group might be the general public or a particular segment of it such as the "poor", and can be considered as part of the objective.

Exhibit 1 is an illustration of a summarized sample set of objectives. The statements of objectives should be worded so as to avoid specifying particular "means" as definite targets before evaluation takes place. For example, an objective worded "To provide a central public recreational facility" assumes that it is necessary to have a central facility in order to meet the objective of providing "adequate" recreational facilities. However, there are such alternatives as the use of smaller decentralized facilities that should also be considered. These alternatives are different means for reaching the

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* For the purpose of this note, the terms "aims", "purposes", "missions", and "goals" are synonymous with "objectives".

EXHIBIT 1. SAMPLES OF FUNDAMENTAL GOVERNMENTAL OBJECTIVES

I. Personal Safety *

To reduce the amount and effects of external harm to individuals and in general to maintain an atmosphere of personal security from such external events.

A. Law Enforcement

To reduce the amount and effects of crime and in general to maintain an atmosphere of personal security from criminal behavior.

B. Fire Prevention and Control

To reduce the number of fires and the loss due to fires.

II. Health

To provide for the physical and mental health of the citizenry including reduction of the number, length and severity of illnesses and disabilities. To provide access to health services of a "satisfactory" quality.

III. Intellectual Development

To provide satisfactory opportunities for intellectual development to the citizenry.

IV. Satisfactory Home and Community Environment *

To provide satisfactory homes and living conditions.

A. Satisfactory Homes

To provide opportunities for satisfactory homes to the citizenry including provision of a choice, at affordable prices, of decent, safe, and sanitary dwellings in pleasant surroundings.

B. Satisfactory Water Supply

To provide sufficient water of sufficient quality.

V. Economic Satisfaction and Satisfactory Work Opportunities for Individuals

To enable each family, each person, to meet basic economic-physical needs, while maintaining dignity and self-respect. To enable any employable person desiring employment to obtain satisfactory employment without loss of dignity and self-respect.

VI. Leisure-Time Opportunities

To provide leisure-time opportunities for the citizenry that are accessible, permit variety, are safe, physically attractive, avoid uncomfortable crowding and are in general enjoyable.

VII. Transportation - Communication - Location

To provide for the "transport" of needed amounts and types of "traffic" quickly, safely and, for persons, pleasurably.

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* For illustration, two samples of "second level" objectives are included in each of these two program areas.

real objective. *

B. Development of the Specific Categories

There are as many different ways of putting together a program structure as there are people who will attempt it. It is very difficult to formulate generally acceptable specific "rules" for constructing one. Some guidelines are presented below, but even these guidelines probably can be violated without dire consequences to the PPB system.

The basic principle of an objective oriented program structure is the grouping of activities that serve the same purpose. The program structure consists of a number of levels, with some or all categories of one level possibly being further subdivided. Exhibit 2 represents the general hierarchical arrangement of a program structure. (An example of the first three levels of a program structure is presented in Attachment 1 of "PPB Note 3.")

The topmost level of a program structure should consist of the broad categories directed toward the fundamental objectives of the jurisdiction. The second and lower levels will be progressively narrower groupings serving more limited objectives. As the categories become narrower in scope at the lower levels, they should be viewed as complementary and/or substitute approaches to the fundamental objectives at the highest level in the structure. The lowest level in any structure would be comprised of the programs that have been implemented as the specific means for moving toward the end objectives.

1. Need for a classification theme for the upper levels.

In establishing the classifications, the groupings for the structure, a variety of patterns can be used. For the first (the highest) level, some type of underlying principle or theme should be followed. A rationale is needed for soundness and so that persons other than those initially creating the structure will understand where various sorts of programs should be placed. Identification of fundamental government objectives as called for in Section III-A of this note (page 4) will suggest some basic underlying principles.

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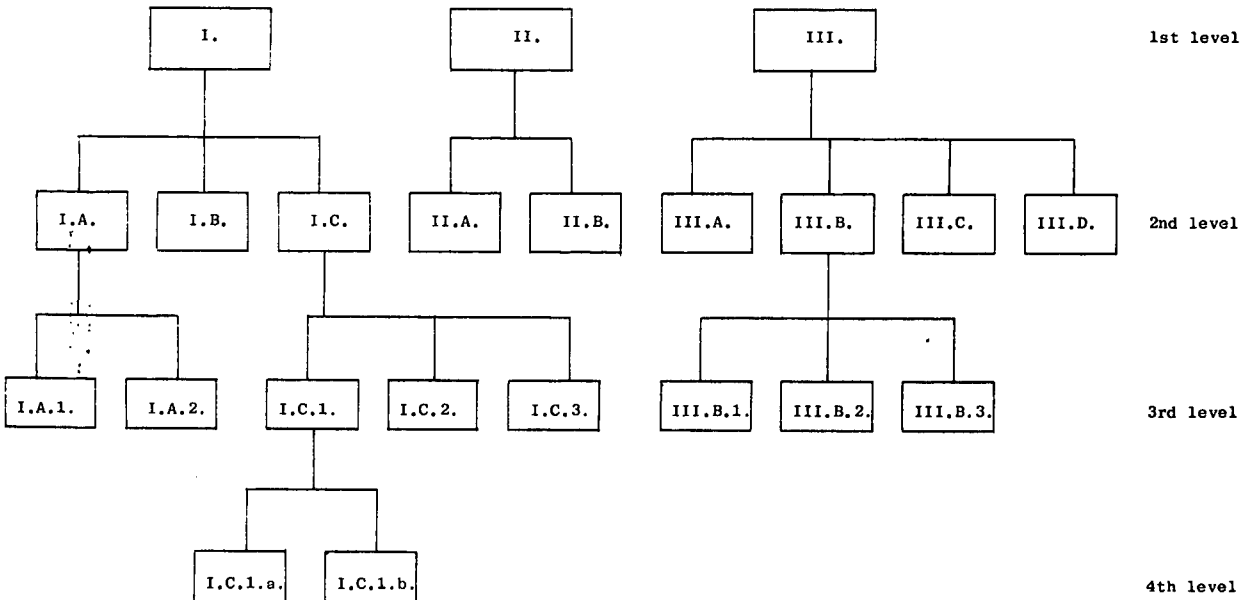
* Statements of objectives should also avoid inclusion of specific numerical magnitudes. For example, a statement of objectives "to reduce crime rates ten percent" should be avoided. The specific amount of improvement that should be sought should generally not be determined until after the alternatives have been evaluated as to the costs and benefits of each and these tradeoffs are understood.

EXHIBIT 2. VISUAL REPRESENTATION OF A PROGRAM STRUCTURE FORMAT



NOTE: This is not an organization chart. A program structure is intended to display the relationship among programs and governmental objectives. For many reasons, a government may not want its organization structure to conform to the program structure.

Exhibit 3 offers two examples of first level categories. Option A in Exhibit 3 shows the first level categories used for the illustrative program structure in Attachment 1 of "PPB Note 3" (the objectives shown in Exhibit 1 are also those associated with these categories). The rationale for this program structure is to show the purposes of the jurisdiction from the viewpoint of meeting the needs of the individual citizen. Option B of Exhibit 3 gives an alternative set of categories. It focuses on the jurisdiction as the basic entity rather than the individual citizen. This leads to emphasis upon such things as economic development of the jurisdiction, whereas the example in Option A emphasizes what the economic development function does for the individual. Actually, however, there is considerable similarity between the two examples given in Exhibit 3.

Other approaches are possible. For example, a government might prefer to put first emphasis upon clientele groupings and place categories such as those in Exhibit 3, Option A, under each clientele group. The important point is to find a theme of attack on the classification problem that will highlight the program planning issues and the comparisons of most significance over the long run to the governmental decision makers.

2. Lower-level categories, the program "building blocks"

Costs and outputs will be estimated for each of the program structure categories. The lowest level categories, the individual programs, represent the basic program "building blocks" which can be accumulated in various combinations to yield the higher level categorizations.

Each of the lowest level categories should be a complete "system", or program, which can, of itself, contribute something to the jurisdiction's objectives. As such, the activities and their costs contained within each such program should be all those required to develop, procure, operate and maintain the program. For example, a program might be labeled "psychiatric attention for emotionally disturbed children". As a program, it should be considered to include the activities covered by grants from other governments for specific services, plus the capital costs, the administration, and the operating activities, both direct and indirect, that are needed to operate the program, even if more than one agency or more than one source of funds supports the program.

Accounting system "object classes" should not be categories of the program structure. The costs to be shown for each program in the structure should, however, include the costs of all the object classes. In back-up data it will be appropriate to permit identification of each program's activities and of their costs, by agency, by funding source, and by object class, as desired. The costs estimated for each program will probably have to be built up from such basic detail in order to derive the needed cost factors

EXHIBIT 3: FIRST LEVEL OF ILLUSTRATIVE PROGRAM STRUCTURES

Option A*

I. Personal Safety

II. Health (Physical and Mental Well-Being)

III. Intellectual Development and Personal Enrichment

IV. Satisfactory Home and Community Environment

V. Economic Satisfaction and Satisfactory Work Opportunities for the Individual

VI. Satisfactory Leisure-Time Opportunities

VII. Transportation - Communication - Location

VIII. General Administration and Support

Option B

I. Economic Development of the City

II. Effective Use of Natural Resources in the City

III. Development of Human Resources

IV. Promoting Personal Safety and Security of Property

V. The City as a Cultural and Educational Center

VI. General Administration and Support

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* Option A is from the more detailed Illustrative Program Structure presented in Attachment I to "PPB Note 3". The objectives shown in Exhibit 1 are related to the categories here.

and cost estimates. *

The concept of "program" as used in PPB systems will generally not be directly compatible with current accounting systems. As has been noted above, identification of all costs generated by an output oriented program, regardless of source of funding, organization, or object class is necessary in PPB systems. These costs should be included, as far as is practicable, with the program generating them. Current accounting categories should not be allowed to affect significantly the choice of PPB system program categories. There will be many ways in which program costs can be at least roughly estimated from existing accounting systems. In the long run, however, some changes in the financial information systems will probably be desirable.

3. Classification bases

In grouping programs many different bases can be used. At the upper levels of the program structure, the groupings as already noted should be related to the major fundamental governmental objectives that have been identified. One possible major basis for classification at the upper levels lies in the characteristics of the "clientele" or "target" groups being served. Some of the characteristics that might be appropriate to distinguish are: age, sex, race, income level, geographical segment, and type of disability. Another major classification basis is to distinguish "preventive" programs from programs that service the existing conditions.

Exhibit 4 illustrates how one segment of governmental services might be structured. The example shows the path that might be constructed from the main objective, "To provide a 'Satisfactory Home and Community Environment' down to 'foster home programs for dependent children.'" More category levels are shown than may be practical to include on the formal, government-wide, multi-year plan. However, all of these categorizations are likely to be pertinent for individual program issues. Therefore, such detail should probably be provided for by the department concerned, such as the jurisdictions' Department of Public Welfare.

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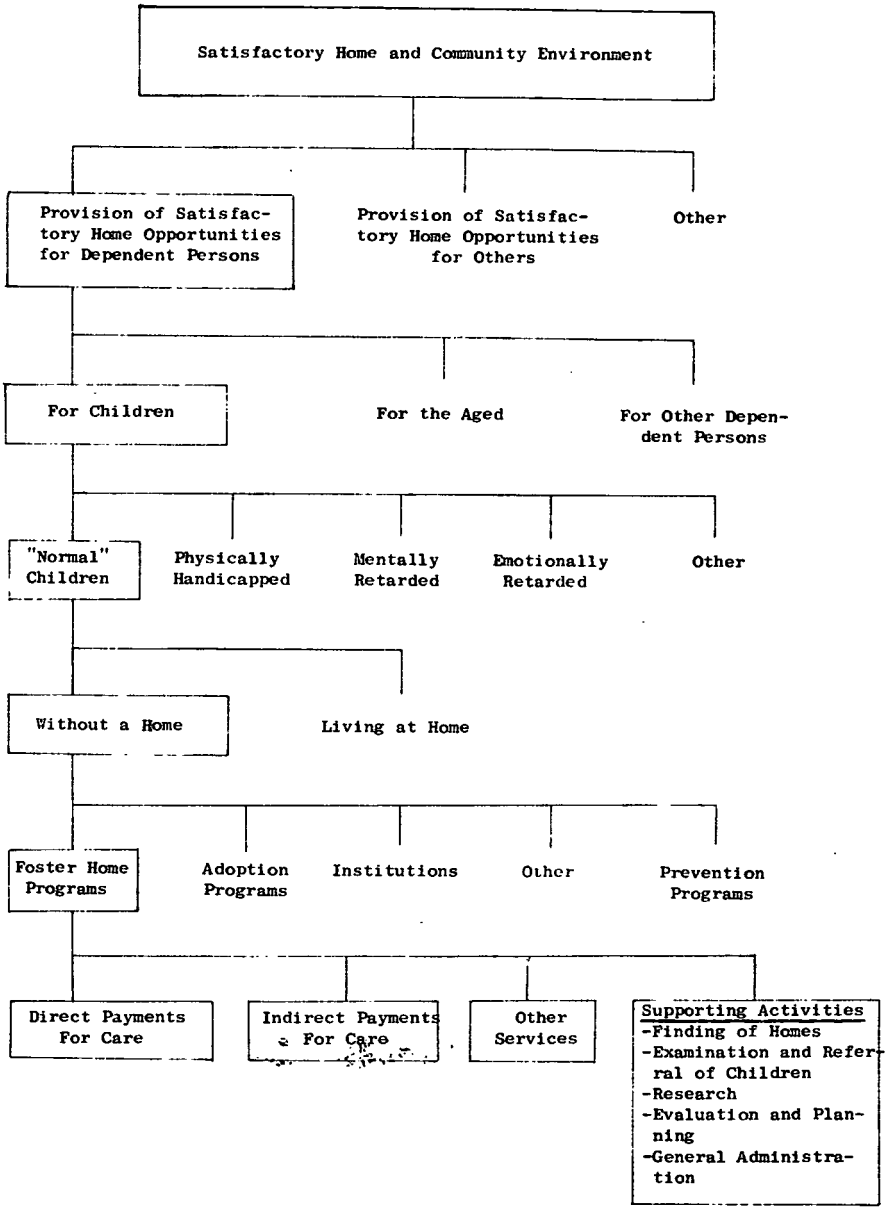
* Since the cost estimates required for program planning (as the term is used in PPB) are in general less precise than for budgeting, it is likely to be desirable in many instances, particularly for the later year estimates, to develop cost factors, such as the "cost per patrol car unit", which aggregates the costs for several object classes and perhaps for more than one agency. Such cost factors are very useful for developing and evaluating program options.

EXHIBIT 4: FOSTER HOME CARE IN THE CONTEXT OF A PROGRAM STRUCTURE



Clientele groups provide the basis for the groupings at levels 2 through 5. (The characteristics distinguished are: dependency, age, type of handicap, and whether the children are without homes or not.) Levels 6 and 7 contain the specific programs, the specific "means". The lowest level, level 7, itself could probably be further subdivided for the department's internal purposes.

Various other classifications could be proposed. For example, perhaps children with special handicaps should not be separately classed until a lower level (if at all). A second option would be to insert a level (between say, 5 and 6) to distinguish programs for "emergency care" from those for "temporary care", from those for "long term care". The classification scheme in Exhibit 4 does not contain this distinction.

The category "Prevention programs" at level 6 in Exhibit 4 is an important one. Prevention will often have very high returns over the long run. In the example shown, many programs to prevent the abandonment of children might be possible and would, in the long run, reduce the need and public expense, for the care of children without homes. For example, such efforts as: assistance in family planning, direct financial aid and home-making services to families, and assistance to unwed mothers, might reduce the number of abandonments. Many other possibilities exist.

The supporting activities such as "research", "evaluation and planning", and "general administration" are shown in Exhibit 4 at level 7. Though shown in the exhibit only at one level, these activities may exist at all levels. Such support-type activities are discussed further below.

To a great extent the classification bases chosen and their specific order will be determined according to the individual government's own view as to the important issues that confront it and the priorities it attaches to them. However, in order to achieve a reasonably stable program structure, it will be preferable if these priorities are set in accordance with a long range view.

Bases that should <u>not</u> be used to group programs are:

a. Accounting object classes (discussed in "2" above).

b. Cost elements such as "operations, activity Y" vs. "maintenance, activity Y" vs. "capital costs, activity Y".

Costs for these items should be included with the costs of the specific programs that generate them but should not be distinguished in the program structure. It is not the purpose of the multi-year plans of program analyses to display these types of detail; the focus of PPB is upon whole

programs, not on the cost components. *

One highly desirable feature of the program structure and the words used for the categories is understandability. The users should understand why the categories are grouped as they are (even if they do not fully agree with the approach) and what each category is meant to encompass. Obscure or overly subtle classification schemes and overly fancy language are to be avoided.

Categories that are grouped together (at any level of the structure) will be either "complementary" or "competing", and perhaps some of both. (In the broad sense all groupings and all individual programs compete with each other for funds.) At the upper levels of the structure, where category groupings represent different governmental objectives, the groupings will be complementary. At the lower levels, the groupings contain different means to accomplish the objectives; there will be more of a tendency for categories within such groups to be "competitive" with each other.

4. Multiple-purpose programs

The grouping and classification of programs will seldom be neat and tidy. Many programs will have simultaneous applicability to more than one program grouping. For example, street lighting probably serves both to help traffic safety and to reduce crime, and perhaps also has a beautification function. But traffic safety, law enforcement, and physical beautification may each be separate objective oriented categories in different parts of the program structure. Where then should the street lighting activity be placed?

Probably the most frequent solution will be to place it with that grouping to which it seems to contribute most. Another and possibly better solution is to place it also with the other groupings to which it makes a significant contribution. When this is done, it will be necessary to identify the program as a "non-add" entry in these other groupings so that when grand totals are calculated, such programs are not double-counted. However, the too frequent use of these multiple, non-add entries will add too much length to the program structure and thereby adversely affect the ease with which the information can be comprehended. Therefore, multiple entries should be used selectively.

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* This does not mean that advanced quantitative analytical techniques should not be applied to, say, central garage maintenance activities as a whole for the purpose of reducing costs and improving efficiency. But this, in general, is not the thrust of PPB systems which aim at comparisons among end-oriented programs. Methods improvement and cost reduction in current operations are not the objective of a PPB system.

Regardless of the placement of a program in the formal program structure, if a program is relevant to an individual program analysis, it should be considered in the analysis.

A related type of problem arises with "support-type" activities; this is discussed in the next section.

5. Multiple-application support activities

As was previously stated, activities and also the costs that are generated by a program should, in general, be considered part of the generating program. No special category in the program structure is needed, nor should be provided explicitly in the program structure, for each such activity. However, a major problem arises with activities of the support type, which serve more than one program. For example, public-building maintenance, employee benefit programs, departmental administration activities, and general research and planning activities, are all likely to provide support to many individual programs. Such activities primarily support other governmental activities (i.e., programs), and do not in themselves require program decisions (in the sense used in PPBS).

There are various ways of handling such activities. The problem is to provide for them in the program structure in such a way as to give the reader of the multi-year program and financial plan or of the program analysis (the principal places where the program structure is used) a reasonable perspective as to the costs and other resources involved in the various programs.

Three types of approach can be identified:

(a) Assign all the costs of the activity to the individual programs supported and not show the activity explicitly in the program structure.

(b) Establish a separate program category for the activity, placing it in the program structure at a level that suggests which programs it supports.

(c) Attempt to identify (perhaps statistically) the portion of activity that "varies" with the size of the programs it supports, and assign this portion of the activity to each supported program -- as in "a", above. The remaining portion of the activity, that which is "fixed", would be allotted a separate program category -- as in "b", above.

Both the second and third approaches require establishing separate categories in the program structure for the support activities; the first approach does not.

Inevitably there will be activities for which there is not a reasonable basis for cost allocation, and little would be gained by the attempt to assign their costs to individual programs. The program structure should provide separate program categories for such activities. For example, the Department of Health's overall administration should probably be included in a separate support activity category under the "Health" program grouping. The administration of a mental hospital could be included in a separate support activity under a "Mental Health" program grouping (which itself would be a sub-grouping under "Health"). General, government-wide, administration activities would be given a special category as shown by the "General Administration and Support" category in both options of Exhibit 3.

6. How many levels should be provided?

It is impossible to specify the exact number of levels that should be provided in a program structure. There should be at least three, and probably more will be desirable. As is illustrated in Exhibit 2, different parts of the program structure may have different numbers of levels. At some point, additional category levels will make the structure too cumbersome. Too much detail may overload the presentation and make the information indigestible. Many levels would be needed just to provide explicit recognition to all possible clientele class characteristics of potential interest. The formal structure cannot be expected to take up all questions. It will be necessary to select the groupings that are believed to be of the most interest.

Before a separate level for a group of programs is established (or, for that matter, before any program is assigned a separate category), each program involved should pass one of two tests: (1) The individual program should entail a substantial commitment of resources over the planning period, or, if it does not, (2) the program should be of substantial importance. For example, an air pollution control program might be small in terms of the currently approved dollars in the plan but it probably should be included as a separate, identifiable program category, if it is believed of substantial public concern or political importance.

Programs which do not meet either of these two tests should be grouped with related programs into a combined program category with an appropriate label (such as "Other Preventive Health Programs", "Miscellaneous Indoor Recreation Programs", etc.).

The government's formal program structure may be a summary of more detailed displays at departmental levels. For example, though the Department of Public Welfare may need all seven levels shown in Exhibit 4, and perhaps more, for the formal program structure it might be appropriate to compress it to perhaps four or five levels. (Note that Exhibit 4 covers only one portion of the programs that would be of interest to a Department of Public Welfare.)

7. Provisions for future changes

The program structure should contain provisions not only for current programs but also for programs that are planned or being considered for possible inclusion in future years. The program categories should, in a sense, be all-inclusive (exhaustive). For example, it may appear that there are no government programs currently in being or planned in the area of abatement of community noise. If this is recognized as a significant problem of interest to the government, it would be appropriate to include a "Noise Abatement" category in the program structure even though the current multi-year financial plans would not show any funding. Such inclusions would help to highlight what may be deficiencies in current governmental planning.

8. Need for special groupings

As has been indicated already, the formal program structure cannot be expected to deal with all questions; it will be necessary to select the groupings that are believed to be of most interest. Often issues will arise that necessitate the examination of program groupings other than those immediately available in the government's formal program structure. These would be prepared on an "as-needed" basis.

For example, if the program structure Option A of Exhibit 3 was being used, a multi-year financial plan could not directly provide information on all programs intended solely for senior citizens. To obtain this information, the individual programs for senior citizens under Health, Satisfactory Homes, Leisure-Time Opportunities, and so forth, would have to be pulled out and aggregated.

At times a government may have important reasons to highlight certain particular problems for a prolonged period. For example, a model city program might focus upon one segment of the community, or the jurisdiction might have a particularly difficult problem with juvenile delinquency. The basic program structure would not necessarily highlight these specific problems. That is, programs focusing on the segment of the community emphasized in the model city program or for dealing with the problems of juvenile delinquency might be scattered throughout the program structure.

One way to handle this, without revamping the whole program structure, would be to leave the basic structure intact but to pull out and group separately certain related programs. Until the need for separate identification is dissipated, programs could be shown in both places, with the special grouping treated as a "non-add" entry (to avoid double-counting when totaling).

C. Formulation of Descriptive Statements

Preparation of a description of each category in the program structure is a necessary part of constructing a program format. The descriptions should indicate the fundamental governmental objectives that are aimed at (for the upper levels) and the intent, scope, and content of each category at all levels. The descriptions are needed to make clear what types of activities and what costs should be included under each program or grouping of programs.

Titles used for program categories seldom will be sufficient to convey the full intent of the category. Which activities and which costs are meant to be included under each category will have to be provided in some detail. Also, it is necessary that, as future program proposals are made, guidelines be reasonably clear as to where in the structure the programs would be placed.

The more detailed and exhaustive the program structure is, the less the need for some of this descriptive information. Nevertheless, no program structure will be free of ambiguities.

For example: Is the category "Programs For Job Training" meant to include vocational rehabilitation programs or are the latter to be included under "Programs To Help the Disabled?" Such intentions should be spelled out.

Another example: the intended means for handling support-type activities, such as centralized garage maintenance, employee benefit programs, public-building maintenance, and departmental administration, should be indicated. (Note that, as was indicated previously, the recommended procedure is to assign as much of the cost of these activities as is practicable to the individual programs using them.)

Exhibit 5 gives an example in summarized form, of a portion of a program structure (that portion covering health programs) with associated objectives and definitions. Note that this is a "special purpose" program structure. That is, it contains a number of categories, particularly under I and II, that in a formal government-wide structure would be included under other-than-health categories. A structure such as that shown in Exhibit 5 would provide an appropriate framework for comprehensive analyses of health. The descriptive statements contained in Exhibit 5 are illustrative only. They are not as extensive or as comprehensive as would be required for a jurisdiction's complete needs.

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EXHIBIT 5. AN ILLUSTRATIVE PROGRAM STRUCTURE FOR "HEALTH"

I. Promotion of General Health and Vigor

Objectives: To promote a state of well-being by patterns of living.
Definition: Programs other than direct health programs that elevate the health status and vigor of a people and are not merely concerned with the absence of disease and injury.

- -- Satisfactory nutrition
- -- Satisfactory educational attainment
- -- Leisure for physical and emotional fitness
- -- Employment satisfaction
- -- Income maintenance
- -- Satisfactory social and intergroup relations
- -- Satisfactory home and community environment

II. Environmental Health

Objectives: To prevent and control the potential dangers to health in the environment of man's own action upon nature.
Definition: Educational, regulatory, inspectional, and monitoring activities and services and research that contribute to maintaining and restoring the natural environment to a healthful state and to controlling within a safe margin the degree of pollution or health hazards in the environment.

- -- Air pollution control
- -- Safe water supplies
- -- Regulation of drugs and foodstuffs
- -- Solid waste disposal
- -- Monitoring and control of radiological materials and wastes
- -- Water pollution control
- -- Safe food handling
- -- Industrial hygiene and safety
- -- Control of vectors
- -- Housing enforcement
- -- Highway safety
- -- Noise abatement

III. Preventive Health Care

Objectives: To prevent the occurrence of impairments and diseases and their spread to the community.
Definition: Programs of education, vaccination and immunization, communicable disease detection, and case finding that avert the occurrence of disease or impairment of function, either by generalized mass relationship between providers and health services and the individual, or by individual relationship between providers and the individual.

A. General population: Programs of disease prevention not associated with special target groups.

- -- Health education
- -- Disease screening
- -- Epidemological investigations
- -- Biological laboratories
- -- Case finding and follow-up
- -- Imminizations and vaccinations
- -- Other infectious and communicable disease control

EXHIBIT 5 (Continued)

B. Special target groups: Programs of disease prevention associated with specific clientele groups including programs associated with specific disease categories.

- Low income families
- Mothers and children, e.g.,
  - maternal health programs
  - well-baby clinics
  - health programs for pre-school and school children
- Mental health & mental retardation, e.g.
  - family counseling - detection - case-finding - follow-up
- Special disease categories, e.g.,
  - Tuberculosis
  - VD, Other

IV. Diagnostic Services, Treatment, and Rehabilitation Care

Objectives: To provide access for the individual and his family to quality medical services, to halt the progression of disease and injury, prevent complications or sequallae of disease and injury, and reduce impairment of function.
Definition: Secondary prevention including health examinations, diagnosis and case finding; referral services; family counseling; treatment, rehabilitation; patient supervision.

A. General population.

- Complex hospital and non-hospital services: Programs consistent with the medical professions' team approaches to care of the patient and his family and with current medical science and the technology of "medicine", e.g.,
  - inpatient hospital care
  - home health care
  - ambulatory care
  - rehabilitation centers and clinics
  - nursing homes, convalescent care, half-way houses, etc.
  - dental health care
- Planning for and monitoring of access to an organized system of quality services, including developmental programs, e.g.,
  - health personnel
  - health services organization
  - health facilities

B. Special target groups

- Low income families, e.g.,
  - medical assistance
  - neighborhood clinics
  - migratory workers
- Mothers and children, e.g.,
  - maternal child health
  - crippled children
  - preschool and school children
  - child care centers
- Mental health & mental retardation, e.g.
  - hospitals and other institutions
  - community mental health clinics
  - drug addiction program
  - smoking control
  - alcoholism clinics
- Other special targets, e.g.,
  - heart, stroke, and cancer
  - TB, VD

V. General Support

Definition: This category contains programs of a general, supporting, or administrative nature which can not be reasonably associated with any of the preceding categories.

- Birth and death registration
- Licensing of health institutions
- Licensing of health practitioners
- Research and statistical activities
- Other regulatory activities

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NOTE 6.

THE ROLE AND NATURE OF COST ANALYSIS IN A PPB SYSTEM

This note is based upon materials developed for a training program for personnel of the city of Philadelphia.

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I. Why is Cost Analysis Needed?

If there were an unlimited amount of resources available to governments, there would be little need for a planning-programming-budgeting system, or even for budgeting. Of course, this is not the case; resources are scarce. It is necessary to make selections as to which projects, which programs, should be undertaken and carried out. Therefore, in choosing among competing programs it is important to estimate how much of each scarce resource each alternative is likely to require.

In our present day society, dollar costs usually are a good representation for measuring usage of resources. Therefore, budgeting as well as program cost analysis is done primarily in terms of dollars. The remainder of this note will use dollars as the unit in which to measure resources. Nevertheless, it is to be recognized that such physical units as manpower and land may on occasion be major resource constraints. In such cases, estimates of the need for each such resource for each program option should also be explicitly made in the program analysis.

The crux of a PPB system is program analysis. The term "program analysis" as used in a PPB system essentially consists of the process of determining the relevant objectives, synthesizing alternative means toward these objectives, and identifying the costs and effectiveness (i.e., the "benefits" or "returns") of each alternative. Estimation of the costs for alternatives and the estimation of how the costs are likely to vary with changes in significant programs characteristics are major parts of the analysis.

II. Where is Cost Analysis Used?

Cost estimates are required for each of the three primary products of a PPB system:

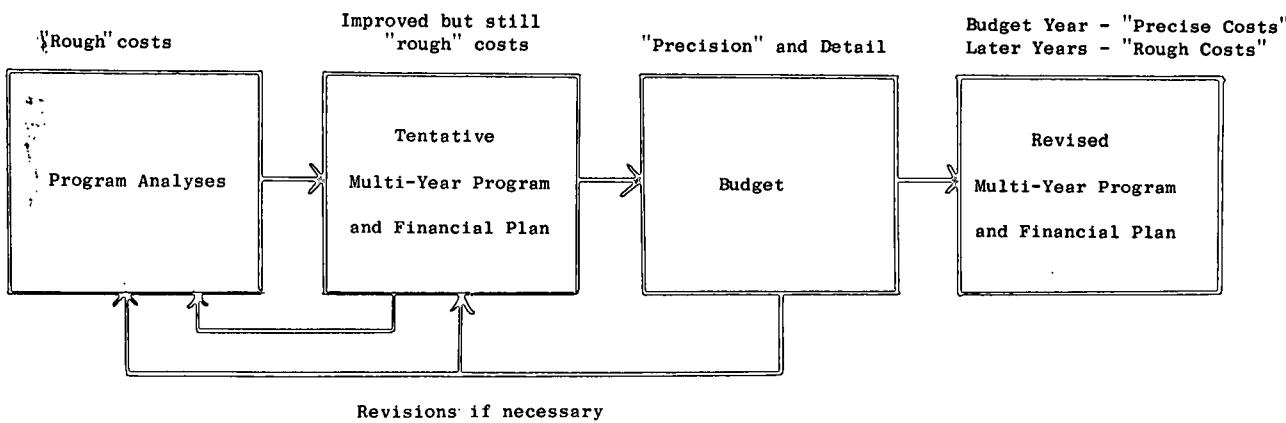
(a) The Budget

(b) The Multi-Year Financial Plan

(c) Program Analyses

Exhibit 1 represents the information flow in a PPB system in regard to these three products. Individual program analyses are performed leading to a tentative multi-year program and financial plan which includes all parts of the government's operation. This comprehensive

EXHIBIT 1: PPB System Cost Requirements



multi-year plan permits examination of the total set of tentative decisions to determine overall reasonableness and feasibility. Should problems arise, individual program decisions may have to be revised. The first year of the resulting multi-year plan becomes the guide for the preparation of the budget. During the preparation of the budget, certain previously unforeseen constraints may arise which lead to the need for "second looks" at the program analyses and multi-year plans. After the budget has obtained final approval, the tentative multi-year plan is revised as necessary to be compatible with the approved budget. Either executive or legislative action may necessitate revisions. The final approved plan represents the "base" from which program proposals are made in the subsequent planning-programming-budgeting cycle.

It is important to recognize that there are major differences in requirements for cost estimates for each of these PPB products.

Failure to recognize these differences may lead to considerable confusion.

(a) The Budget:

(1) Cost estimates are required for only a single future year (or two years if the budget covers a biennial period).

(2) The cost estimates need to be as precise as possible.

(3) The budget, and therefore the categories in which costs are presented, should reflect the needs of the management control process. Neither the multi-year financial plan nor individual program analyses are intended for management control purposes as is the budget. A jurisdiction may find it appropriate and necessary to use organizational and accounting object class categorizations (such as personal services, supplies, equipment, etc.) in its budget. Others may find it more meaningful to use a "program budget" with its program oriented categories. While program budgeting is helpful in evaluation of the budget, it is not essential to a PPB system as long as there is a "cross-walk" to assure compatibility between the categories used for planning programs and the budget categories.

(b) The Multi-Year Financial Plan:

The purpose of the multi-year financial plan is to provide improved perspective as to the dollar implications of the approved programs.

After the budget has been approved, figures based upon the approved budget can be incorporated into the multi-year plan. However, the tentative multi-year plan (as shown in Exhibit 1) is proposed prior to the budget. The cost estimates prepared to this tentative plan are our concern here.

Cost estimates for this plan, particularly for the years beyond the coming budget year, does not have to be and in fact cannot be, considered very precise. However, more care should be taken in estimating costs for the budget year to reduce the need for major modifications of the plan after budget costs have been prepared. Nevertheless, it does not appear necessary to provide in the multi-year plan the apparent precision or detail that might be needed for the budget.

(c) Program Analyses:

The cost estimates needed for program analyses is the main subject of this presentation. The emphasis is on the ability to estimate the complete cost implications of each of the wide variety of program alternatives which might be proposed. All relevant cost implications, both immediate and future, need to be considered. A requirement for great accuracy or precision in cost estimating for planning is both impossible to achieve and unnecessary. The considerable uncertainties that are encountered when trying to predict future costs and effectiveness, particularly for new, untried, programs, are such as to abort attempts at real accuracy. Thus, for PPB analyses, total program cost estimates accurate within, say, plus or minus ten percent would usually be considered quite accurate. When comparing program alternatives involving major uncertainties, a difference in cost between them of only ten percent would essentially make them a "toss-up" on the issue of costs.

III. What Costs Should Be Included?

One of the fundamental characteristics of a PPB system, and more particularly of the PPB program analysis process, is the consideration of all relevent costs. The following basic concepts are involved:

(a) First, the "marginal" or "incremental" costs are the relevant costs (these are essentially equivalent terms for the purpose here). This simply means that if we are estimating the costs for a specific program, only the additional costs that are incurred are relevent. "Sunk" costs, those which have already been spent (or at least can be presumed to have

been spent prior to the beginning of the time period being considered) are irrelevant. 1/ For example, the fact that last year, $1,000,000 was spent on a facility is not relevant to the cost analysis. There, of course, may be psychological and political reasons why the government will be concerned about the previous expenditure. Nevertheless, approving an inferior alternative because of the $1,000,000 expenditure is from a technical, cost point-of-view "throwing good money after bad." Only the future costs of the facility, for example, those for operation, maintenance, and rehabilitation are pertinent.

Another example of the marginal concept is the following: suppose we are concerned about whether one or two more swimming pools should be added in a community. To evaluate whether one or two pools is preferable, the appropriate cost to relate to the value of the second pool is the additional cost of the second unit -- not the average cost of the two (quantity discounts, for example, might reduce the unit cost of the second swimming pool). If one pool could be obtained for $100,000 and two for $180,000, the relevant cost of the second pool is $80,000 not $90,000 (the average cost of the two).

Closely related to this incremental cost concept, is the need to distinguish between "fixed" and "variable" costs. A major part of cost analysis will be spent in attempting to determine which costs are fixed and which costs are variable in the context of the particular program alternatives being considered. For example, if we are considering switching from one type of refuse and garbage collection and disposal operation to another, it is necessary to identify which of the current on-hand vehicles and facilities can be used in the revised operation. Certain other costs, such as certain supervisory and facility costs, might not be affected or might only be partially affected by the change. Only that portion of the costs which are affected in the switch-over from one system to the other represent true incremental costs.

In the long run no cost is actually fixed. For example, even the cost of departmental leadership is likely to increase as more and more programs are added to the department. This might take the form of added staff and clerical assistance or possibly even the need to increase the department head's salary and his employee benefits in recognition of his increased responsibilities.

1/ However, if there is a potential salvage value, e.g., for facilities, this return would be pertinent to any program alternatives which could consider disposal of the facilities as part of the alternative.

The basic cost analysis problem is to determine, for each situation, what costs will change and to what degree.

(b) It is the difference in total cost required that is generally relevant when comparing alternative programs. Less emphasis need be given to estimating the total, absolute, costs of each alternative. However, the government will need to consider the total costs when assessing these program alternatives in relation to other parts of the government.

(c) An important consideration is to consider all costs. In costing out a program, cost should be considered regardless of accounting object class, organizational unit, or source of funding. Exhibit 2 shows a generalized set of cost elements that might apply to any type of government program. 2/

For a program, costs are likely to come from more than one department and more than one funding source or account. A common example is that of vehicle maintenance which is performed in a centralized garage in a "Department of Public Works" or "Department of Public Property". The costs for this maintenance should for program analysis purposes be included in the costs for the individual programs that use the vehicles. Some governments currently charge minor, though usually not major, vehicle maintenance to the department (but not to the individual programs) incurring the charge. "Public building maintenance" is a similar example, e.g., police programs should be charged with relevant police precinct building maintenance costs. Another case is employee benefits; these benefits are typically charged in local governments to separate accounts. For program cost analysis, it is highly desirable to include associated employee benefit costs (which may add 10 - 15% or more to personal services costs) along with the individual programs that generate them. Also, relevant capital costs, even though handled in other funds and in a separate budget document, are costs just as any other for purposes of program analyses. (Though, of course, special revenue considerations may be involved which may need to be considered before making final decisions.)

2/ The proper way to treat borrowing costs in individual program analyses is not clear. Initially, it seems best to include the costs as they are needed rather than including possible interest charges and the altered time phasing due to payments of principal. The question of how needed funds might best be raised probably can, at least initially, be separated from the choice of individual program alternatives.

EXHIBIT 2. Illustrative List of Elements of Program Cost

I. One-time, fixed, costs--costs which are essentially invariable with size and duration of program.

Research
Planning
Test and evaluation

II. Investment costs--costs which vary with size of program but not duration.

Land
Building and facilities
Equipment and vehicles
Initial training

III. Recurring costs: ("Operating and Maintenance" costs)--costs which vary with size and duration.

Personnel salaries, wages and employee benefits for direct operations.
Maintenance of equipment, vehicles and buildings.
Direct contributions and payments to citizens, e.g., welfare payments to the needy.
Payments to extra-governmental institutions for services for citizens; e.g., payments to agencies for foster home services.
Miscellaneous materials and supplies.
Miscellaneous support ("overhead") costs.

All of these costs, including the capital costs, should be included together in the multi-year financial plans. As noted earlier, the budget document presentation may be another matter.

One caution: it will, of course, take time and effort to develop and maintain procedures which permit assignment of such costs as vehicle maintenance and employee benefits to the appropriate individual programs. If preliminary indications suggest that certain of such costs will be an insignificant component of total cost, it may not be worthwhile to include them for purposes of program evaluation.

(d) Program selection is not only affected by costs during the immediate budget year but also must be concerned with the future year cost implications. Thus a decision to build a facility or buy a piece of equipment in the budget year, clearly implies that operating and maintenance costs will be generated in future years. Another example is a federal grant that covers certain portions of the costs, say, part of facility costs. The local government needs to recognize the many additional current and future costs, currently implied by the acceptance of the facility grant, such as the future operating and maintenance costs. A further example: avoiding the rehabilitation of certain facilities this year may lead to the need for greater expenditures in the future.

It is vital to make current decisions that will permit the government to meet adequately the needs for services to its citizens in future years. The current and future cost implications of current plans to meet these needs must be properly considered to avoid inefficient and infeasible future dollar requirements. The formal multi-year program and financial plans should consider enough years into the future to allow a reasonably satisfactory perspective as to the future implications of the government's programs -- both of individual programs and in aggregate. But each additional year included in the display means added effort. Cutoffs of about five or six years have usually been used for the multi-year financial plans. Many local governments are already annually projecting their capital improvement needs five, six, or more years.

For program analysis purposes, the cost estimates should cover as many years into the future as necessary to provide the relevant information required for the current decisions. In certain cases such as mass transit and highway systems the number of years to be considered will probably far exceed the time span of a multi-year financial plan.

The issue as to the "time-value" of money arises when considering a multi-year span. However, it is sufficient at this point to say that most cost analyses involve the identification of the year-by-year cost implication of the alternatives. The "time-value" of money problems is discussed later.

(e) A special problem arises with revenues associated with the carrying out of a program. Golf course fees, bridge and highway tolls, and charges for water and sewers are examples. In addition, such revenues as grants from the federal government or state governments may also be associated with particular programs. If their magnitudes are likely to be significant, program associated charges and fees, and inter-governmental aids need to be considered and their magnitudes estimated for each alternative proposed.

Because we are speaking here of a procedure for clarifying program costs and comparing alternative programs, the relevant total costs should first be estimated for each alternative. The relevant revenues should then be considered either as offsets to these costs or as "side benefits". In general, where the receipts are specifically identified with and are collected in the course of program operation (such as may be the case with golf course fees, and water and sewer charges), these revenue items may be considered as offsets to total costs. (Of course, the setting of the specific fees, tolls, and charges, etc., is itself a complicated problem.) It may not always be clear whether to treat the associated revenues as a cost offset or a side benefit, but this choice should not significantly affect the program decision, since in either case, the revenues will have been explicitly considered.

The multi-year financial plan, and the summary tables in the individual program analysis reports should probably display three lines for each program category of the program structure: the total costs, any offsetting revenues, and the net cost to the government. (In program analyses this would be done for each major program alternative being evaluated.)

(f) Thus far, we have been talking about costs in a somewhat limited sense. We have been talking about those costs which would be more or less directly incurred by the particular program -- the "program costs." Many problems will be complicated by various "secondary" but perhaps very meaningful cost implications. For example, a slum clearance program might result in future years in reductions in fire and crime protection services for the cleared area; on the other hand it might also lead to increased demand for park and recreation services.

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In addition, financial repercussions of a program might be expected to occur outside the government. For example, changes to transportation systems or in housing may have considerable effect on many types of business in the area -- some effects favorable, some unfavorable. Another example, is the gain in future earnings to individual citizens due to improved health or education programs (which also may mean increased tax revenue to the government). These outside-the-government cost effects should be distinguished from the inside government costs.

These secondary financial effects whether affecting the government's own budget or other sectors of the economy are important considerations. The estimation of such effects is often very complex and particularly difficult but nevertheless essential for program analysis.

(g) A term encountered in the economic literature is "opportunity costs". It is meant to convey the very important notion that if resources are put into one program, other opportunities for use of the same resources have been foregone. The "value" of these foregone opportunities are the opportunity costs of putting resources into the selected program. This "value" is, therefore, relevant to program selection.

In program analysis, considerable emphasis is placed upon the identification of the relevant alternatives. In effect, the explicit identification and assessment of alternatives is a practical way of taking account of opportunity costs. To illustrate, Philadelphia might use land which it already owns to build a golf course. It would not incur any additional land costs, but would be giving up the opportunity to use the land for other purposes. The alternative use of the land is an important consideration. We may attempt to impute a dollar "value" to this land (perhaps using current market value) and include this imputed value as a cost, or we may avoid this imputation which does not represent actual dollar outlays and instead consider alternative land uses as explicit alternatives, which are each explicitly evaluated. The latter approach will probably be most practical in most situations. At the very least, it would be necessary to explicitly indicate as a "negative benefit" the loss of the land for other future uses.

IV. How Are the Cost Analyses Performed?

The basic problem in program cost analysis is to estimate what will happen over the planning period to costs for each of the alternatives being considered. This cost analysis problem is much more than a cost accounting problem. Several special considerations are involved:

(a) As already noted, the emphasis is upon estimating the total cost implications of each alternative, necessarily involving many accounting object classes, many different organizational units, and possibly different financing sources.

(b) Second, the estimate is directed to quantifying what will happen in the future, not what has happened in the past. The importance of historical information is to provide clues as to what the costs are likely to be in the future.

(c) Third, many program alternatives will contain components for which there is no historically identical component. For example, new types of equipment, new types of training programs, or new types of facilities will often be proposed.

(d) Fourth, cost analysis not only requires cost information but also requires the estimation of various physical characteristics (which affect unit costs) and various physical quantities which indicate the size and quality of the needed program. For example, if we are estimating the costs of a new helicopter-assisted traffic control system, the cost analysis will probably need such varied information as:

(1) The number of helicopters needed, and likely frequency of use, to do the designated traffic control job;

(2) The various characteristics of the helicopters and the plan of operation so that the per-flying hour operating and maintenance costs can be estimated; and

(3) The various characteristics of the plan of operations so that the number of personnel of each major type required can be estimated. When multiplied by the appropriate pay and benefit per-man rates, total personnel costs can be estimated.

A second example is that of a proposed new garbage and refuse system. Costing new types of pickup and disposal methods will require an understanding of the major physical characteristics of the equipment and operational plan of the proposed system. In addition, if the frequency of pickups and the geographical locations to be covered are being evaluated, costing formula which are sensitive to these characteristics will be needed.

The cost analysis process, thus, requires not only the talents of program cost analysts but also requires substantial technical assistance and inputs from the operational staff and the program designers.

Five techniques for estimating costs can be identified. These are

(1) Use of unadjusted current data applied to the future.

(2) Preparation of internal "engineering" estimates.

(3) Use of "Vendor" estimates.

(4) Use of statistical estimation.

(5) Use of cost factors and cost models.

For any given problem some or all of these techniques might be used. Each of these is discussed below:

(1) Use of unadjusted current data applied to the future.

For example, the latest salary and employee benefit scales might simply be used as cost factors to estimate future personnel costs. Again, current data on the number of personnel or the man-hours required to perform a specific task would probably be appropriate to use as the estimate of the future requirements for that task.

This costing technique is primarily applicable to costs that are not expected to change significantly. However, for example, if a city's vehicles are expected to become more complex in the future (e.g., more automatic drives and more gadgets might have been added), higher costs per vehicle might be anticipated as it became necessary to have higher skilled maintenance personnel and more expensive parts. If a city's garbage and waste collection vehicles become more mechanically complicated, higher wages and additional training costs for drivers as well as higher unit vehicle maintenance costs might be anticipated. In these cases, it would not be appropriate to utilize the unadjusted current data.

Price level changes may, of course, also affect the future costs of program components even if nothing else changes. This problem is discussed in (6) below.

(2) Preparation of internal "engineering" estimates.

As new programs are proposed which involve components significantly different from current or past program components, other techniques are needed. The major technique currently in use is for cost

estimates to be prepared by internal experts (for example, the engineers or others doing the program design) for the new components.

One difficulty in "engineering" estimates is that if many program alternatives and variations are required, the estimate preparation time may become substantial. And this is likely to be the case in a PPB system with its emphasis upon the identification and evaluation of alternatives.

(3) Use of "vendor" estimates.

Certain programs may involve pieces of equipment or facilities for which price quotations may be obtainable from a seller or builder. If the quotes are for already existing items or minor modifications of such, they should be accurate. However, to the extent that a firm commitment is not implied by the estimate and to the extent that complications might arise in making the item, uncertainties in the cost estimates will exist.

(4) Use of statistical estimation.

This is the first method that is probably considerably different than those currently in use in state and local governments. For PPBS program cost analysis it can be very useful.

Predicting future costs, especially for programs with new and perhaps novel characteristics, is a very difficult task. Expert judgment should be helpful and will be necessary, but the cost analysis can be considerably aided by the use of statistical techniques. Statistics, property utilized, can be useful in extracting the most information from historical data.

The use of statistics can be very simple or very complicated. The basic concept is to take the historical and current data that is available and make inferences from it as to future events.

The simpler techniques of statistics are familiar. For example, to derive a figure for the fuel and maintenance cost of police cars used in a traffic control program, a simple arithmetic average of the previous year's costs for all traffic control police cars (if they can be distinguished) can be made to give an average cost per car. Assuming no price level increases or significant changes in the nature of the police cars being utilized, the average cost per car could then be

used to estimate proposed alternative programs involving any number of police cars of the same type.

The concept of means, medians, modes, frequency distributions, etc., add some complexity but are still basically quite comprehensible to the layman, and often useful.

A more advanced, but often useful, technique is the use of "regression analysis". This concept is easiest to explain through a diagrammatic example (See Exhibit 3). Here the analysts are interested in estimating the future maintenance costs of police patrol cars. The cost analyst, with the help of the technical experts on the item being costed, first makes assumptions as to which program characteristics (i.e., variables) significantly affect the cost being estimated. Here they have assumed that the major explanatory ("independent") variable is the number of miles driven. The diagram shows what is called a "scatter diagram" on which is plotted the most recent year's data on the eight patrol cars. (It is a small police force.) From the appearance of the scatter diagram, the analysts estimate that a straight line would fit the data. Using standard mathematical procedures (and perhaps with some computer assistance), a line of "best fit" can be readily derived. The line is shown on the scatter diagram. The equation for the line is also shown. The specific values of "a" and "b" in the equation are the results derived from the historical data. The resulting equation can then be used to help estimate future maintenance costs of police patrol cars of similar type to those in the sample.

Considerably more complicated assumptions may be appropriate in many instances, requiring more complicated statistical techniques and more complicated equations. Another hypothetical example is shown in Exhibit 4. Here, two alternatives as to the form of the relationship have been hypothesized by the analysts (one a "linear" and one an "exponential" form). Data on actual, past, hospital construction costs, Y, and the X's are collected and used in the statistical analyses to determine values for the constants in each of the two equations. The results of the statistical analysis will also provide information as to the "goodness of fit" of each equation and is used to assist in making a choice between the two forms. With more than one explanatory variable, "multiple" regression analysis rather than "simple" regression analysis is required.

These statistical techniques are being increasingly used for this type of problem. The resulting equations are often called, "Cost Estimating Relationships" ("CER").

It is to be noted that to use any of the equations for estimating future program costs, it is first necessary to estimate the

EXHIBIT 3: Example of Regression Analysis

$Y = a + bX = 250 + 0.03X$

where 250 and 0.3 are the values statistically derived from the eight data points

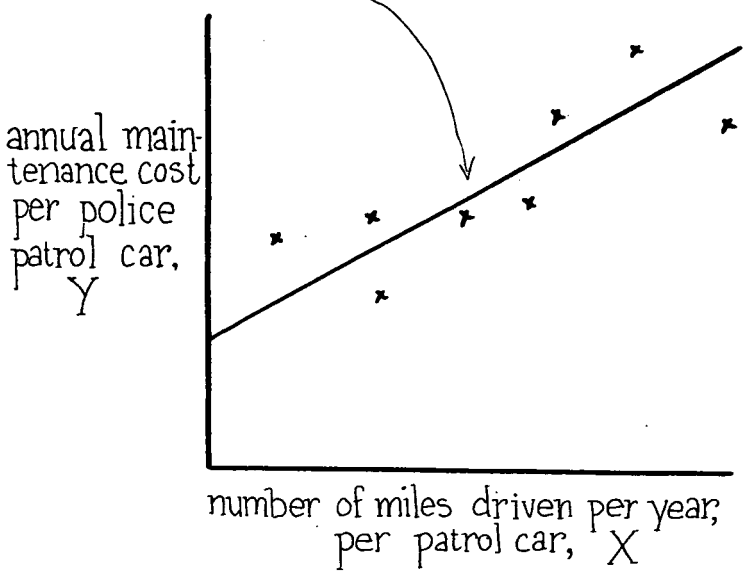

EXHIBIT 4:
Hypothetical Cost Estimating Relationships

$$Y = a + bx_1 + cx_2 + dx_3$$

or

$$Y = px_1^q \; x_2^r \; x_3^s$$

WHERE:

Y = hospital construction cost
x_1 = number of hospital beds
x_2 = size of research staff
x_3 = expected "medical worker per patient" ratio
a,b,c,d & p,q,r,s = values statistically derived from data

values for each of the explanatory variables (that is, the X's in the exhibits). This itself may often be difficult.

A special type of CER, which has found considerable use in the aircraft industry, and is likely to have some applicability even to the "learning curve"). This is based on the concept that where there are repetitive occurrences of an activity (such as the production or the repair of a vehicle) that the unit cost will tend to go down. Quantity discounts from vendors are one expression of this. However, certain internal government on-going activities will also be repetitive and therefore learning curves may also have applicability to internal government operations. The cost-quantity curve would be statistically derived from past data and then used to project future costs for different quantities proposed.

(5) Use of Cost Factors and Cost Models.

There is a need in program analysis for the evaluation of numerous program alternatives, which may run the whole gamut of different scopes and quality of services as well as different types of programs. Thus, there is likely to develop a repetitive need for the preparation of cost factors and cost equations which can be applied to a number and variety of costing problems. Statistical equations such as already illustrated as well as simpler cost factors -- such as the maintenance cost per year per police car, per fire truck, or per ambulance -- might be appropriate for each major program area. These would be up-dated periodically for use as costing problems arose.

Individual cost factors or cost equations might be prepared at any convenient level of aggregation. For example, some might cover a single accounting object class; others might cover a sub-object class; and still others an aggregation of object classes. This will depend upon the particular circumstances such as the nature of the available data and the use to which the factors and equations are likely to be put.

A collection of these cost factors and cost equations which together could provide estimates of the total program cost for different variations of a certain type of program is occasionally called a "cost model". Such cost models might be constructed for welfare programs, for sanitation programs, for recreation programs, etc. If the cost model involves much computation and is used frequently enough, computerization might be appropriate.

Erratum - Page 17

First sentence in first paragraph should read:

"A special type of CER that has found considerable use in the aircraft industry and is likely to have some applicability even to state and local governments, is the cost-quantity curve (also known as the "learning curve")."

(6) Some Special Problems in Cost Analysis.

Before leaving the "how's" of cost analysis, three special problems need to be mentioned.

First, is the question of price level changes. In the federal government, the multi-year financial plans and program analysis costs have usually been expressed in "constant" dollars. That is, no adjustments are made to reflect possible future price changes which are due to general changes in the local or national economy. This is convenient and avoids added problems and computations. The estimation of future general price level changes is no small matter. In addition to the problem of attempting to predict the trend of the general economy, the price index is likely to differ for each element of cost. That is, payroll costs, construction costs, various types of equipment, etc., each potentially requires its own price index projection.

However, for state and local governments, it may well be appropriate, at least in the multi-year financial plan, to provide price level changes estimates in order to be more realistic. Perhaps the best approach would be to make price adjustments for the summary estimates for each year. Individual program decisions are seldom likely to be affected by the price level change estimates and probably the additional effort to make such adjustments would not be worthwhile. Note here, that I am referring only to price changes affected by the general economy, not changes due to unexpected difficulties or unexpected delays and complexities. This latter problem is discussed briefly in the next paragraph.

A second special problem in program cost analyses is the need to provide some indication of the magnitude of the uncertainty in the cost estimates. The magnitudes and likelihoods of the cost uncertainties can affect the final program decisions and should be clearly stated and presented as best as one can to the decision makers. Several techniques can be used ranging from simply providing qualitiative statements such as: "the costs are accurate" or "highly uncertain", to more elaborate techniques which attempt to estimate the likelihoods and sizes of the uncertainty. One, often suggested approach, is to provide "high", "low" and "most likely" estimates (rather than just a single estimate) for each major program alternative.

The third special problem in cost analysis is the form in which the costs (for each program alternative) should be summarized for the decision makers.

The options may be summarized as follows:

(a) Display costs for each year.

(b) Sum all costs for a given number of years, say five years.

(c) Calculate the "Present Worth" (or "present Value") of the cost stream.

Option (c) requires some special explanation. Since funds can be invested and earn a return, postponing expenditures (other things being equal) is advantageous. Thus, if a state or local government defers an expenditure for a year, leaving the money with the citizens or with local businesses, the citizens and businesses would have the opportunity to invest the money and obtain a year's return on the investment. (Of course, if prices rise, as they historically have done, the deferral could mean added costs.)

The present worth technique assumes a specific rate of return (i.e., an "interest" or "discount" rate) and computes the present worth of the annual expenditures required by a particular program alternative. For example, an alternative might require the expenditure of $1 million now and $1 million dollars for each of the next two years. Assuming an annual rate of 10 percent, an amount of approximately $2.7 million invested today would provide just enough with the 10 percent interest to meet the three $1 million payments. Any other expenditure patterns could similarly be translated into a present worth. A competing program requiring expenditures of $0.2 million now and $1.4 million in each of the next two years is equivalent to about $2.6 million today. Therefore, other things being equal, the latter alternative is the less costly. A substantial problem in using the present worth technique is the selection of the appropriate interest rate. This selection is difficult and likely to be quite controversial.

It is probable that in most individual program analyses consideration of the present worth of the cost streams will not alter the choice of programs and therefore may not be worth the effort. It is the tentative recommendation here that the present worth technique be applied primarily when evaluating the full multi-year financial plan and when considering alternative means for raising the needed revenue.

The estimated actual costs for each year of the plan (option (a) above) should be presented for each major alternative. It

would probably also be useful to sum them. In addition, the summation of all costs for an appropriate number of years is likely to be a useful cost criterion in the preliminary stages of individual program analyses for screening out alternatives prior to more detailed consideration of the remaining, major alternatives.

Finally, a special caution in cost analysis. There is a tendency in cost analysis to attempt to be overly precise in situations which do not warrant it. This can be both wasteful of time and effort and misleading. Excessive precision should be avoided.

V. Administrative and Organizational Aspects of Cost Analysis.

Finally, a few comments may be pertinent as to various administrative and organizational aspects of cost analysis.

(1) First, the type of cost analysis discussed here is not the same as traditional industry and government operations-oriented cost analysis. The emphasis in PPB systems is upon estimating future program costs for often advanced and unique types of programs. Unlike fiscal or cost accounting, it is not aimed at determining what has been spent and how efficiently. As such, PPBS cost analysis requires somewhat different skills and abilities.

(2) A PPB system by no means eliminates the needs for the management control aspects of accounting systems. The current cost accounting systems in fact will be a chief source of information for program cost analysis. However, the cost accounting system is not likely to yield sufficiently the types of data required for program evaluation. Program cost analysis data needs are likely to place additional demands on, rather than become a substitute for, information currently obtained by the internal management information systems.

(3) The demands of PPB systems program analysis for cost estimates may well necessitate the formation of a special jurisdiction-wide program cost analysis unit. Such a unit should be part of the program analysis function and be available to assist the program cost analysis needs in any department or agency of the jurisdiction.

VI. Selected Bibliography

There is only a small amount of published material on non-defense "Systems" (i.e., Program) cost analysis. Much of the technique work has come from the RAND Corporation with emphasis upon military applications. However, the following publications are recommended as a start for those interested in exploring in greater depth some of the current techniques of systems cost analysis.

1. Don Vito, P. A., Annotated Bibliography on Systems Cost Analysis, The RAND Corporation, RM-4848-PR, February 1966.

   Contains brief descriptions of numerous publications or various aspects of cost analysis. Both RAND and outside publications are included.

2. Large, J. P. (ed.), Concepts and Procedures of Cost Analysis, the RAND Corporation, RM-3589-PR, June 1963.

   This is a collection of a number of previously published studies on some of the basic concepts of systems cost analysis.

3. McCullough, J. D., Cost Analysis For Planning-Programming-Budgeting Cost-Benefit Studies, The RAND Corporation, P-3479, November 1966.

   Contains a good summary with examples of the cost analysis concepts likely to be applicable to non-defense problems.

NOTE 7.

OUTPUT MEASURES FOR A MULTI-YEAR PROGRAM AND FINANCIAL PLAN

NOTE NO. 7: OUTPUT MEASURES FOR A MULTI-YEAR PROGRAM AND FINANCIAL PLAN

Introduction

Previous Notes in this series have referred to the multi-year program and financial plan as one of the principal products of a Planning-Programming-Budgeting (PPB) system.* It has two parts: a multi-year financial plan which displays the estimated funding required for each program; and a corresponding multi-year program (or output) plan, which indicates the expected products of the programmed expenditures and activities.** This note explores the concept of the "output measure" and some of the difficulties frequently encountered in selecting the particular measures or indicators to be used in the program plan display.

I. Special Problems of Output Indexes in Public Programs

A multi-year financial plan, as one of the summary documents for use at the executive decision-making level, within the context of a PPB system, sets forth (among other things) the information on expenditure levels proposed for the next budget cycle, and the future year expenditures implied by current approved programs. Expenditure decisions that are made in terms of the expected output of public goods and services shift the emphasis away from the cost components of public programs (e.g. number of personnel employed; space and facilities used, and supplies and equipment purchased) to indicators of the results, or output, gained by the costs incurred.

In manufacturing, "output" is a relatively simple thing to determine. The output of car manufacturers is the number of motor vehicles of various types produced--trucks, busses, automobiles; the output of a shoe manufacturer, the number of shoes produced; of clothing items by dozens; of iron and steel in short tons. The development of indicators, or equivalent units of output, for public goods and services has not received much attention prior to recent efforts at evaluation of public programs and services in terms of the product gained for the expenditures made. Further efforts toward the development of such measures are being made as governments turn to implementation of PPB systems.

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* See particularly Program Planning for State, County, City, Harry P. Hatry and John F. Cotton, January 1967, State and Local Finances Project, The George Washington University, pp. 19-23.

** Commonly, the financial plan and output (or program) plan are presented as two separate tables. However, both types of information may be integrated in the same tables. This is primarily a matter of format convenience and readability.

Professor Jesse Burkhead, in his studies on educational expenditures has illustrated in summary form the production process of education in a manner somewhat analogous to that of industry. He shows the interplay of inputs into the educational system and its output, as is shown in Exhibit 1.

This illustration, as Professor Burkhead emphasizes, does not identify the whole range of possible input, process, and output variables. Furthermore, meaningful measures are not always available. But the illustration does make the point that government agency budgets should describe accomplishments--not just objects of expenditure or "things bought". For example, indicators of the volume of output of a school system might include reduction in the number of dropouts, number of graduates, or numbers of children at each grade level, by reading achievement or arithmetic test scores.

The table below also makes clear that an education system has a variety of outputs and serves a variety of purposes. The answer to the question: Who benefits? is also far from simple. Children who attend school benefit from the schooling; their parents also benefit; industry gains a literate work force and literate consumers. A whole spectrum of industrial and commercial practices is dependent on the output of the school systems, such as the credit and banking system and the insurance industry. The people of the nation benefit collectively in a variety of ways from a high literacy level.

One further comment should be made at this point--the table distinguishes between the proximate results of the current expenditure decision (Process Variables) and the contributions of the system or program as a whole (Output Variables).

We distinguish here between "evaluation criteria" for in-depth analysis, and output indicators shown in multi-year program plans. Measures of output variables that are needed to evaluate program accomplishments often will be numerous and complex. Frequently new information will have to be assembled or collected to provide the required measurements of public service products. Output variables shown in Exhibit 1 are in this definition system essentially "evaluation criteria" rather than simple program "output" indicators. In an output or program plan the indicators serve, primarily as a reminder of at least a component of the program decision, and to highlight the programs that are funded in terms of what is expected to be "bought" over the planning period for the dollars shown in the financial plan.

II. The Format and Function of the Output Indicator in the Multi-Year Program

The multi-year program and financial plan is prepared as a part of the planning cycle. It is a summary document for use by the jurisdiction's executives. It shows the full range of programs, with their associated costs and selected characteristics, as implied by the

EXHIBIT 1. INPUT, PROCESS AND OUTPUT VARIABLES IN THE EDUCATIONAL PROCESS

INPUT VARIABLES (Land, labor, capital)	PROCESS VARIABLES (Current expenditure policies)	OUTPUT VARIABLES (Benefits to the individual & society)
Student Time --in the classroom --at home --extracurricular	Class size Size of the school	Increased intellectual curiosity Social adaptation
Personnel Time --administrative --teaching --clerical --maintenance --auxiliary	Teacher-pupil ratio Ratio of administrative and clerical personnel to students	Development of creativity Increase in skills and earning ability
Materials and Supplies Buildings and Equipment	Use of personnel for guidance of remedial instruction	Increased lifetime earnings Growth of informed electorate Increased national growth

Based on materials developed by Prof. Jesse Burkhead of the Maxwell School, Syracuse University.

most recent program decisions. A major purpose of the plan is to put into perspective the decisions already made, and to form the base from which future program proposals are made.

The format of an output plan is presented in Exhibit 2, using as an example a page of an output plan prepared by the Office of Economic Opportunity. As is indicated by the table heading the output plan is designed to use the same set of program categories (that is, the same program structure) as the financial plan. While, in theory, output units can be provided for each program category at any level of the program structure, in practice no appropriate or meaningful measure may be available.

It is assumed throughout this Note that the multi-year plans are internal documents, limited in use to the executive branch. Jurisdictions that intend to present the multi-year plans to their legislative bodies, and possibly to the general public, will have additional considerations to weigh in determining their format.

The number of years included in the multi-year program plan should be related to the number of years included in the multi-year financial plan. It would be most convenient to have both plans cover the same years. However, there is one consideration that suggests that it might be preferable for the output plan to cover more years than the financial plan. Because of the lead times involved with most investment costs (such as facility and road construction and perhaps personnel training) funds for such purposes will be shown in the financial plan in earlier years before their results are reflected in the program plan. The expected governmental goods and services from investment funds included in the last years of the financial plan will therefore not be completely reflected in the output plan for those years. One option is to include one or two additional years in the output plan so that the additional program resources purchased in the last years of the financial plan can be shown. Another way to handle this problem is shown in Exhibit 2. A final column labeled "Build-Up Estimate" has been added. This column would show the values for any program categories that are expected to be obtained by means of the dollars provided for the investments shown in the financial plan which would otherwise not appear in the program categories for the time period shown.

To summarize the problem of selecting output indicators against this backdrop:

> The major program decision-making has occurred in response to program analyses and other relevant considerations.
>
> The task is to indicate, by highlights of the programs funded, what is expected to be "bought" over the planning period for the dollars shown in the financial plan.

EXHIBIT 2. ILLUSTRATIVE FORMAT OF A MULTI-YEAR OUTPUT PLAN

Program Structure*	Output Unit*	FY 1967 Actual	FY 1968 Current Est.	FY 1969 Budget Yr. Est.	FY 1970 Program Est.	FY 1971 Program Est.	FY 1972 Program Est.	FY 1973 Program Est.	Build-Up Estimate*
II. EDUCATIONAL OPPORTUNITY									
A. PRESCHOOL EDUC. ASSIST.									
1. Headstart - Annual	# Enrol.								
2. Headstart - Summer	# Enrol.								
3. Migrant Day Care	# Served								
B. ELEM. & SEC. EDUC. ASSIST.									
1. NYC In-School Program	# Enrollees								
2. NYC Summer Program	# Enrollees								
3. CAP Remedial Tutorial	# Enrollees								
4. Title I Educ. Act.									
5. Migrant Youth	# Enrollees								
C. PRE-COLLEGE EDUC. ASSIST.									
1. Upward Bound	Graduates								
D. ADULT EDUCATION ASSIST.									
1. Adult Headstart	Unique Particip.								
2. CAP Adult Basic	# Enrollees								
3. Adult Basic Educ. (II D)	# Enrollees								
4. Migrant Adult Basic	# Enrollees								
E. RESEARCH, DEMO. & EVALUATION									
1. Headstart									
2. Neighborhood Youth Corps									
3. Community Action Proj.									
4. Adult Basic (II B)									
F. ALL OTHER PROGRAMS									

* See text.

At the present stage of the art, output indicators are not always readily available.

Some general guidelines for selection of appropriate output indexes can be formulated--at least in general terms.

Purpose--For purposes of the multi-year program plan, the objective is only to have some ready indicator of what is being purchased, by current and projected levels of expenditure for each of the major program categories and their chief components. In-depth analyses will be necessary for evaluation of the programs in terms of governmental objectives and priorities.

Such program indicators will generally be crude measures of volume or program magnitude. For example, the number of students enrolled or graduated would give little or no indication of the quality of education offered, just as the number of cars produced would show nothing about their quality in terms of style, comfort, maintenance costs or safety. While some output measures might be so refined as to give some indication of quality, measures of quality of many public services need far more assessment than is now readily at hand.

Specifically, use of output indexes in a multi-year program and financial plan can be expected--

1. to serve as a quick reminder of the basis of prior year decisions on program size,

2. to provide an indicator of change that can be expected to accompany changes in expenditures,

3. to raise questions about prospective levels of expenditures and to flag issues on projected expenditures that require closer inquiry.

Criteria for selection--Several factors can be identified as having an important bearing on whether a given measure should be chosen as the output indicator for use in a multi-year program display:

1. Relevance--The measure chosen should be directly related to the particular program category or subcategory for which it is used. (See in this connection the discussion of inter-program products on page 7.)

2. Simplicity--The plan needs to be as simple as possible to avoid overburdening and confusing the user; but it should also display as much as possible of the information that will be most informative. The preference probably should be the one or two most informative measures, with the

realization that the executive can always obtain additional detailed information on individual programs if he feels he needs it.

3. Data availability--The information needed for the selected indicator should be obtainable in usable form and collected on a continuing or periodic basis over the period covered by the plan.* As better indicators are developed, data systems can be revised.

A final cautionary word before moving on to discussion of types and examples of output measures--nothing is to be gained by attempts to count the uncountable. There may be a number of programs--or subprogram categories--for which no really relevant output measures are available, or can be devised at this stage. For these, the best solution may be simply to omit an output indicator or to use the traditional budgetary method of tabulating the physical components that are funded by the contemplated program expenditures. These are essentially "inputs", but they provide a measure of program magnitude--although in terms of program content, rather than in terms of program results. Examples of this type of program size indicator are: pupil-teacher ratios, welfare worker caseloads, population-hospital bed ratios, number of fire stations and their staffing levels, number of policemen on active duty, number of patrol cars. All these are measures of the resources purchased for program purposes; they do not attempt to throw any light on what is accomplished by the purchase and utilization of these program resources. Nevertheless, until a reasonably illuminating measure of program accomplishments can be singled out, these customary measures of program levels may provide the most useful indicator for some categories or subcategories in the multi-year program plan. This will be particularly true in program areas in which there are widely accepted professional staffing standards, e.g., ratio of pupils to public health nurses in school health programs, hours of nursing care per patient day in general hospitals, desirable caseloads for social workers, and similar standard-setting goals for excellence in performance of specialized functions.

In individual cases it will frequently be difficult to distinguish an indicator of program size (stated in terms of the major physical components funded by the program and to be used in providing the program services) from indicators of the volume of services produced by those resources. To a large extent this question may be resolved by making sure the indicator selected is directly related to the defined purposes of the category or subcategory under consideration, as is illustrated by the discussion in the section immediately following.

Inter-program Products--As already pointed out in the discussion of Professor Burkhead's illustration of the accomplishments of an educational system, the program product reflects, and changes with, the content of the program or subprogram under consideration. For example, in a first-level program category of "Personal Safety", there might be

* Measures should not be rejected because of data unavailability; additional data collection will be needed.

second-level categories of "General Crime Prevention and Control" and "Police Academy", with a third-level program of "Surveillance" under the crime prevention category. The number of trained policemen would be a measure of the product (or output) of the police academy operation, but a program resource (or input) for the surveillance program. Since the training of policemen is one of the major measures that contribute to the overall goal of crime prevention and control, but does not represent an end purpose* (at least in the program structure used for illustration) the trained policeman is an intermediate product. A parallel situation is presented by a nursing school in a public hospital.

At least one federal department--Health, Education, and Welfare--handles this problem by distinguishing between "operations indicators" and "program impact indicators" for purposes of reporting output data for its multi-year program plan.

The "operations indicators" are expected to relate to the outputs of the activities in the program structure; they are immediate translations into non-financial terms of what is produced for the money or effort expended. The "program impact indicators" reflect data related to the impact of the total program effort, e.g., changes in morbidity and mortality rates for particular health problems, reductions in pollutant levels, changes in illiteracy or dropout rates, etc.

Still a third kind of indicator--the "social indicator" is to be used in the narrative that accompanies the plan to reflect any significant impact on social problems that results from combinations of programs, but cannot be directly attributed to any one of them.

III. Principal Types of Output Indicators

There are a number of types of output measures linked to specific programs that might be used in multi-year program plans. Illustrative lists of output indicators are shown below grouped by types of measure, for a series of somewhat arbitrarily identified programs. The groups of output measures are those indicative of (1) volume of public services (2) quality of public services and (3) comparative quantities.

(1) Volume Indicators: These indicators display the quantity of services in terms of number of public consumers or beneficiaries such as numbers of persons assisted, or in terms of the volume of public goods provided such as gallons of water, ship berth facilities. The volume indicators shown in Exhibit 3 are examples of a number of possible indicators for each of the selected program elements shown. In some instances the illustrative indicator takes account of the span of time during a yearly period, in others it does not. For example, in

* This would not necessarily be so, if the police academy operation were subsumed under the "Education" category in the program structure.

EXHIBIT 3. ILLUSTRATIVE VOLUME INDICATORS

Selected Program Elements	Volume of Services
Natural resource programs	
Forestry	Acres of forest lands maintained; acres planted
Agricultural extension services	Number of farmers assisted
Conservation	Number of acres with conservation practices
Reclamation	Irrigated acreage
City environmental programs	
Air pollution control	Number of violations corrected
Water supply system	Gallons of water consumed
Solid waste disposal	Tons of trash removed
Rodent control	Reduction in rat population
Mosquito control	Area sprayed and irrigated
Waste treatment works	Gallons of water treated
Public housing	Number of housing units
Urban residential renewal	Number of housing units renovated; acreage renewed
Beautification	Trees planted; flower beds maintained
Recreational programs	
Parks	Number of persons using parks at peak time of day; number of parks; acreage maintained
Museums	Number of persons attending
Libraries	Number of library users; number of volumes on loan
Zoos	Number of persons attending
Recreation centers	Number of persons using or attending
Performing arts centers	Number of persons attending
Transportation programs	
Airports	Number of passengers embarking; number of aircraft take-offs
Harbors and ship terminals	Dock area; number of berths
Highways	Miles of paved highways maintained
Mass transit facilities	Number of passengers per day
Parking facilities	Number of motor vehicles parked
Ship terminal warehouses	Tons of freight stored
Public safety programs	
Parole activities	Number of persons paroled
Police surveillance	Number of surveillance hours
Traffic controls	Number of intersections controlled
Fire station activities	Number of alarms answered
Courts	Number of cases cleared
Jails and other detention institutions	Number of prisoners released; number housed
Street lighting	Number of street lights maintained; kilowatt hours
Child care and education programs	
Child care centers	Number of children in centers
Day care centers	Number of children in centers
Preprimary education	Number of children enrolled
Regular day programs - elementary schools	Number of students enrolled
Regular day programs - secondary schools	Number of students enrolled
Vocational schools	Number of students enrolled
Higher education (student teaching)	Number of students enrolled; number of degrees granted, total, or by field of specialization
Manpower training	Number of persons enrolled; number of persons employed at close of training

EXHIBIT 3. ILLUSTRATIVE VOLUME INDICATORS (Continued)

Selected Program Elements	Volume of Services
Child care and education programs (continued)	
After-school hour programs	Number of persons enrolled
Summer school programs	Number of persons enrolled
Exceptional children programs	Number of children served
School lunch programs	Number of meals served
School health programs	Number of examinations; number of children screened, by types of screening
Job opportunity programs	
Neighborhood youth programs	Number of persons employed
Job counseling	Number of persons assisted
Employment services	Number of persons placed; number of persons interviewed
Sheltered workshops	Number of persons employed
Vocational rehabilitation	Number of persons receiving services; number of persons reemployed
Health programs	
General hospitals (in-patient care)	Average daily in-hospital patients; number of patients treated in out-patient departments
Mental hospitals (in-patient care)	Average daily patient loads
Institutions for the mentally retarded	Average daily patient loads
Mental health clinics	Number of patient-hours of care provided
Alcoholic clinics	Number of patients treated
Family planning clinics	Number of women counseled
Disease screening clinics	Number of persons screened
Immunization programs	Number of persons receiving services
Referral services	Number of families served
Home health services	Number of persons served; number of hours of care provided
Nursing homes	Average daily patient loads; number of institutions inspected; number of institutions participating in staff training sessions
Welfare programs	
Family counseling services	Number of families assisted; average daily caseload
Welfare payments	Number of persons and families receiving assistance, total and by type
Food distributions	Number of families receiving food surpluses
Foster home care	Number of families assisted; number of children or aged receiving care
Halfway houses	Number of persons assisted; number of persons restored to community

EXHIBIT 4. ILLUSTRATIVE QUALITY INDICATORS

Selected Program Elements	Quality of Service
Natural resource programs	
Forestry	Standing timber growth, by type of timber
Agricultural extension services	Farm output per acre, by crop
Conservation	Top soil depth, width and quality; water levels
Reclamation	Farm output per acre in reclamation areas
City environmental programs	
Air pollution control	Current pollutant levels (carbon monoxide, sulfur dioxide, hydrocarbons, etc.)
Water supply system	Water rationing days; water quality indexes (dissolved oxygen, temperature, hardness, chloride, etc.)
Solid waste disposal	Periods elapsing between collections; proportion of wastes used as landfills
Rodent control	Rat bite cases reported
Mosquito control	Area cleared
Waste treatment works	Water quality levels attained (see water supply system)
Public housing	Physical condition of public housing (working condition of plumbing, lighting, heating or air-conditioning and other equipment; noise)
Urban residential removal	Number of families rehoused in satisfactory housing
Beautification	Measures of physical appearance of selected sample areas
Recreational programs	
Parks	Lawn, trees, planted areas in satisfactory condition
Museums	Number of exhibits or paintings; scope of exhibit coverage; special shows
Libraries	Number of volumes requested not available; waiting lists of borrowers
Zoos	Number of species represented
Recreation centers	Range of activities available for different age groups
Performing arts centers	Number of performances of companies with national reputations
Transportation programs	
Airports	Delay time; ground transport time
Harbors and ship terminals	Size of vessels accommodated; tons of freight handled
Highways	Traffic delays; traffic accidents; vehicle capacity per hour
Mass transit facilities	Extent of crowding at peak hours; frequency of service during off-peak hours
Parking facilities	Number of parked vehicle violations; number of parked vehicles towed from city streets
Ship terminal warehouses	Cubic area, by type
Public safety programs	
Parole activities	Number of persons restored to community; number of repeaters among parolees
Police surveillance	Age adjusted crime rates; number of offenders, by number of prior arrests
Traffic controls	Number of motor car accidents; number of traffic fatalities and injuries
Fire station activities	Time elapsing between calls and fire fighting; fire insurance premium rates
Courts	Length of court dockets; number of decisions sustained on appeal
Jails and other detention institutions	Number of repeaters; numbers rehabilitated and employed
Street lighting	Illumination indexes (kilowatts)

EXHIBIT 4. ILLUSTRATIVE QUALITY INDICATORS (Continued)

Selected Program Elements	Quality of Service
Child care and education programs	
Child care centers	Hours of education, health and counseling services provided
Day care centers	Hours of education, health and counseling services provided
Preprimary education	Number of children by reading-readiness scores
Regular day programs - elementary schools	Number of children with achievement scores at or above grade level
Regular day programs - secondary schools	Number of graduates; number of school leavers; number admitted to colleges
Vocational schools	Number of persons receiving training who are employed
Higher education (student teaching)	Number of college graduates admitted to graduate or professional school; attrition rates; number of graduate students receiving fellowships
Manpower training	Number of persons receiving training who are employed
After-school hour programs	Changes in school achievement scores
Summer school programs	Changes in school achievement scores
Exceptional children programs	Number of children, by achievement or adjustment score level
School lunch programs	Number of children purchasing school lunches; nutritional status of children
School health programs	Number of children with correctable deficiences who have received treatment
Job opportunity programs	
Neighborhood youth programs	Number of persons employed by skill levels
Job counseling	Number of persons employed by skill levels; length of unemployment period
Employment services	Length of unemployment period
Sheltered workshops	Number of persons reemployed in community
Vocational rehabilitation	Earning levels of rehabilitated persons
Health programs	
General hospitals (in-patient care	Number of appendectomy, historectomy cases reviewed by medical boards; waiting lists; special care units
Mental hospitals (in-patient care)	Number of therapy hours of care provided; length of stay
Institutions for the mentally retarded	Number of persons functioning in community; discharges
Mental health clinics	Number of persons functioning in community
Alcoholic clinics	Number of patients cured; number of non-repeaters
Family planning clinics	Number of women planning families
Disease screening clinics	Number of positive cases receiving treatment
Immunization programs	Decline in rates of smallpox, tetanus, whooping cough, measles, polio
Referral services	Number of persons receiving appropriate types of care or services
Home health services	Range of services provided; hospitalizations avoided
Nursing homes	Hours of professional nursing time provided; accessibility of physician care
Welfare programs	
Family counseling services	Changes in separation and divorce rates
Welfare payments	Number of families moving across the poverty line; number at defined budget levels
Food distributions	Nutritional levels of assisted families
Foster home care	Number of cases of institutionalization avoided
Halfway houses	Number of persons restored to community

place of, or in addition to, counts of children enrolled in school as of a single date, figures on pupils in average daily attendance might be used. Conversely, hospital admissions or discharges might be shown in place of, or in addition to, average daily number of patients in public hospitals. Volume indicators may be selected to show peak-time use or off-peak hour use. The specialists in specific program areas in jurisdictions will make their selection of indicators for purposes of a multi-year output in terms of the most appropriate measures that display quickly and simply the program's product. No attempt has been made in developing this Note to obtain the views of such program specialists.

(2) Quality indicators: Quality of a public service may be measured in terms of its characteristics, its duration, its content, or the extent or degree to which it serves its purposes. Specialists in program areas frequently have developed quality indexes that may be used in conjunction with the type of volume indicators displayed above. Quality type indicators shown in Exhibit 4 again are illustrative for selected program elements. The exhibit, however, approximate as it is, perhaps, may serve to suggest the quality indicators that might be displayed in an output plan.

(3) Comparative indicators: Indicators of quantity of public services may be designed to show the volume of services in relation to population, area, or some more specific measure of potential scope or of program need. Without attempting an additional Exhibit over a range of public service components some examples may be given to help illustrate this type of output measure that is a variant of (1) and (2) above.

Program	Comparative Quantity
Water supply systems	Gallons of water per housing unit
Museums, libraries, zoos, recreation	Users per 1,000 population
Crime control	Age adjusted crime rates per 1,000 population
Parking facilities	Public parking facilities per 100 motor vehicles
Traffic safety	Traffic accidents per 1,000 vehicle miles
General hospital in-patient care	Number of days of hospital care per capita
Hospital out-patient care	Average number of visits per capita
Public hospital care	Days of care per person on public assistance
Employment service	Job placements per total work force
Manpower training	Number of trainees per 100 persons employed Number of trainees per 100 persons unemployed

Street lighting	Kilowatt hours of electricity per mile
Disease immunization program	Percent of children vaccinated
Aid to families with dependent children	Percent of children receiving assistance
Open spaces	Open areas as a percent of total land area

As already indicated, to the extent that "standards" for such ratios have been developed by specialists in program areas these standards may be used for program evaluation. If so, the "standard" should probably also be displayed in the output plan for comparison. However, if they are used, such standards should reflect some clearly understood level and nature of service and should be reviewed periodically for possible revision. For example, standards could be made obsolete by some new type of program which would provide very satisfactory service, but might result in the ratio falling below the old unrevised standard.

Planned Expenditures and Output Indicators--Indicators of output for the plan may show the changes over the period of the plan that are anticipated to accompany the program expenditures displayed in the multi-year financial plan. Increases in school enrollments, for example, will point to a growth in school expenditures other things remaining unchanged. Increases in total population may enlarge requirement for community recreational and health services.

In those instances where changes in expenditures are marked and can be accounted for fairly simply by a planned change in operation or activity such as a sizeable addition of patrol cars, or the building of a new hospital wing. These indicators whether of output or inputs should be displayed along with other program indicators.

Clearly, without extensive study, the causal relations between program development and outputs are difficult to establish. There is often too much interaction between public and private activities to permit a simple finding of causal connections. Moreover, interaction among public programs are many and complex. Services provided by one agency through its program expenditures will have an impact on the output and effectiveness of other public programs. Airport activities can adversely affect noise abatement programs; traffic control systems may reduce or enlarge the volume of motor vehicle accidents, and affect the volume of emergency ambulance services. Paving of more highway mileage may enlarge rather than reduce traffic congestion and also increase downtown parking facility requirements. Solid waste disposal systems may increase air pollution or lower it, and what is done about solid wastes may impair water-waste treatment. Reduction in air pollution acquired at the cost of added water wastes enlarges water treatment requirements. To give some further examples, reduction in community mental health programs may enlarge patient loads in state mental hospitals, and the quantity and quality of hospital care may influence

expenditures for police protection and for control of fire hazards. Manpower training and expanded job opportunities for the unemployed is closely intermeshed with the content and requirements of housing programs and welfare assistance.

These outputs may buttress each other or work at cross purposes. An illustration of the interaction of public services is shown in Exhibit 5; the chart is not designed to be an exact measurement, rather it is intended to display quickly the complexity of interprogram dependency and to suggest by this complexity that interagency communication and cooperation on planning and programming for public objectives is urgently needed. By a classification of programs in terms of the objectives the way is opened to gain the cooperative action required for effective and efficient provision of public services. Moreover, in the course of program analysis the range of public program interactions will be considered.

IV. Output Indicators and Evaluation Criteria

For program evaluation purposes criteria of program effectiveness will be applied as part of the program measurement. In these program analyses, a complete set of criteria relating as closely as possible to the basic objectives of the government jurisdiction should be identified and evaluated, wherever possible as a basic part of the analyses. (Because of the difficulty in relating program effects directly to these criteria, "proxy" criteria are often likely to be required.)

There is some question whether evaluation criteria can, and should, be included in the output plan. On the surface, it would appear that this type of measure would be the most important to display since such criteria presumably relate closely to the government's program objectives. There are two, related, major problems. First, often the values for such measures may be very difficult to obtain (though much of the effort in program analyses should be directed towards obtaining meaningful estimates). The second problem is that such criteria may be misleading when taken out of the context of the individual and usually complex program analyses. It is highly desirable that the assumptions underlying the evaluation be directly available. This is not often possible in the concise format of the multi-year plan. Management will need to examine the individual analysis statements to obtain a full perspective as to the estimated program accomplishments.

Some evaluation criteria lend themselves to use in an output plan, without being too misleading. For example, the following: a crime rate index, traffic accident rates, unemployment rates, number of families living in sub-standard housing, and the number of families in the poverty class.

It should be noted that there is considerable precedence in PPB systems for <u>not</u> including effectiveness measures in an output plan. The federal agencies have at least thus far, included few of these in

their output plans. The Department of Defense's plan, for example, primarily displays the numbers of aircraft, ships, and combat units of each type.

In summary, it is apparent that one really has a continuous spectrum of measures of output and program evaluation criteria. At the one end of this range, the measures of program magnitude are relatively easily understood and quantified, but carry little indication of program accomplishments. As one moves across the spectrum, the measures become more complicated and pick up greater connotation of program values. Finally, at the other end of the range, the measures are much more closely related to the end values that underlie the program's purpose and as a result become quite difficult to assess.

It should be clearly recognized that for the most part output measures provide little direct information as to how well the jurisdiction is, or is not doing, in helping the populace to meet its needs and wants.

There are some kinds of information which should generally not be included in a PPB system multi-year output plan. It is preferable to avoid the usual kind of detailed work-efficiency indicators such as: number of traffic tickets per officer; and cost per patient-day. Such measures may be quite appropriate for management control purposes and for annual budget preparation (as supporting justification) but are of little use as output measures for a PPB system.

V. Supplemental "Backdrop" Data

It may be highly desirable to include summary types of informational materials about the jurisdiction as a backdrop for multi-year output plan. Major demographic information such as total population, population by major age groups, total employed population, might well be included as a separate section of the output plan (perhaps in a narrative form). Information about the physical area of the jurisdiction, its income levels, and its major industries might be shown. Such information will form a "backdrop" against which the program plan can be better interpreted. In general, this information has the property of being relatively insensitive to the program decisions made, though, of course, there inevitably will be interactions (for examples, a set of program decisions might result in attracting new families into the jurisdictions--or conversely motivate them to leave).

Such a "backdrop" section might also usefully include (for interpretative purposes) selected indicators that, while not directly responsive to any single program category, would provide perspective on the size and importance of the general social problem or governmental goal to which the program element or activity contributed. Inclusion of such indexes would help to point up problem areas in which major expenditure changes should be considered.

Summary indicators of new design are perhaps in prospect for the future, as governments become more accustomed to a PPB planning framework and as more work is done on the problems of measuring needs and public wants. We may begin to try to design composite indexes of social and family well-being that would relate to a series of aspects of living. This may be one of the major thrusts of the work now being done on "social indicators" under the auspices of the Department of Health, Education, and Welfare. This type of indicator would relate to such things as: family living and home conditions; personal freedom and security; community livability; employment satisfaction.

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