THE PERMANENT FUND AND THE GROWTH OF THE ALASKAN ECONOMY: SELECTED STUDIES

A Report for the
House Special Committee
on the Alaska Permanent Fund

INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH
UNIVERSITY OF ALASKA
Anchorage • Fairbanks • Juneau

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A Report for the
House Special Committee
on the Alaska Permanent Fund

by

Scott Goldsmith

with

Lee Gorsuch
Lee Huskey
Mike Scott
and
Arlon Tussing

December 15, 1977

Institute of Social and Economic Research
University of Alaska

Anchorage - Fairbanks - Juneau

707 A Street, Suite 206
Anchorage, AK 99501

UNIVERSITY OF ALASKA

FAIRBANKS, ALASKA 99701

INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH

Representative Clark Gruening, Chairman
Subcommittee on the Alaska Permanent Fund
Alaska House of Representatives
528 West 5th Avenue, Suite 270
Anchorage, Alaska 99501

Mr. James Edenso, Deputy Commissioner
Alaska Department of Revenue
Pouch SB
Juneau, AK 99811

December 15, 1977

Dear Sirs:

The Institute of Social and Economic Research hereby submits the enclosed report entitled The Permanent Fund and the Growth of the Alaskan Economy: Selected Studies. The report, prepared under contract to the State Department of Commerce on behalf of the House Subcommittee on the Alaska Permanent Fund, analyzes the economic and fiscal effects of a) alternative contribution levels to the Fund; b) alternative uses of the Fund's earnings; c) selected in-state investments of the Fund; and, d) in-state placement of the 1969 Prudhoe Bay bonus money.

The compressed contract period for performing the work precluded the preparation of a preliminary draft and the solicitation of comments. ISER could compensate for this shortcoming by preparing a condensed supplemental report designed to reach a broad audience. This supplemental report would benefit from any legislative or departmental comments the final report elicited.

Because the basic analytic tool designed and used in the conduct of the study is a computer program, additional analytical work can be performed efficiently and at low cost. For example, both the timing and the level of revenues, expenditures and/or contributions to the fund could be easily modified within the structure of the existing program and the corresponding outputs re-analyzed.

ISER would be pleased to have the opportunity to prepare the supplemental report and/or conduct additional analyses. We have enjoyed working with the Committee and its staff and trust our work will be of use to the Committee as it fulfills its charge to recommend how the Permanent Fund should be structured and implemented.

As you read the report, I call to your attention one unavoidable conclusion derived from the study. It dramatically underscores the danger of making incremental investment or expenditure decisions without regard for their long-term economic or fiscal effects and poignantly highlights the need for the legislature to engage in long-term fiscal planning.

If we can provide any further information or elaboration of the study's findings, we will be pleased to do so at your request.

With best regards.

Sincerely,

Lee Gorsuch

Lee Gorsuch
Director

LG/m
encl.

THE PERMANENT FUND AND THE GROWTH OF THE ALASKAN ECONOMY: SELECTED STUDIES

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EXECUTIVE SUMMARY

The contract under which this project was done outlined four general study areas. Each centered upon a distinct question related to permanent fund policy.

I. What are the long run fiscal and economic prospects for Alaska and what are the impacts on these prospects of the Permanent fund?

Figure 1 shows the basic pattern of future state revenues (R99S) to be one in which the growth of total revenues reflects the cyclical nature of petroleum related revenues (RP9S). A significant decline in petroleum revenues leads to a corresponding decline in total revenues and adjustment to a lower long term growth path.

Figure 1 - PROJECTED STATE REVENUES

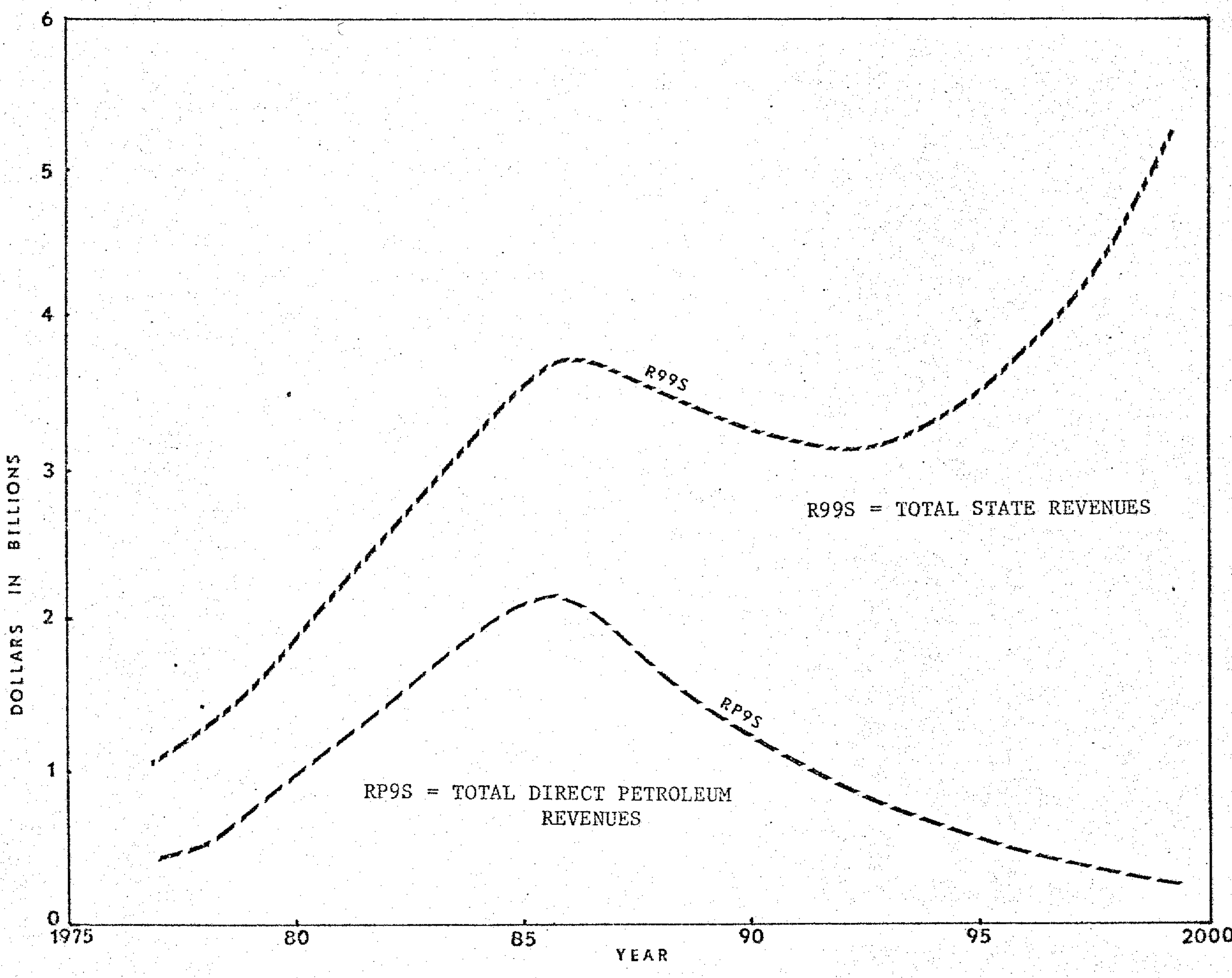
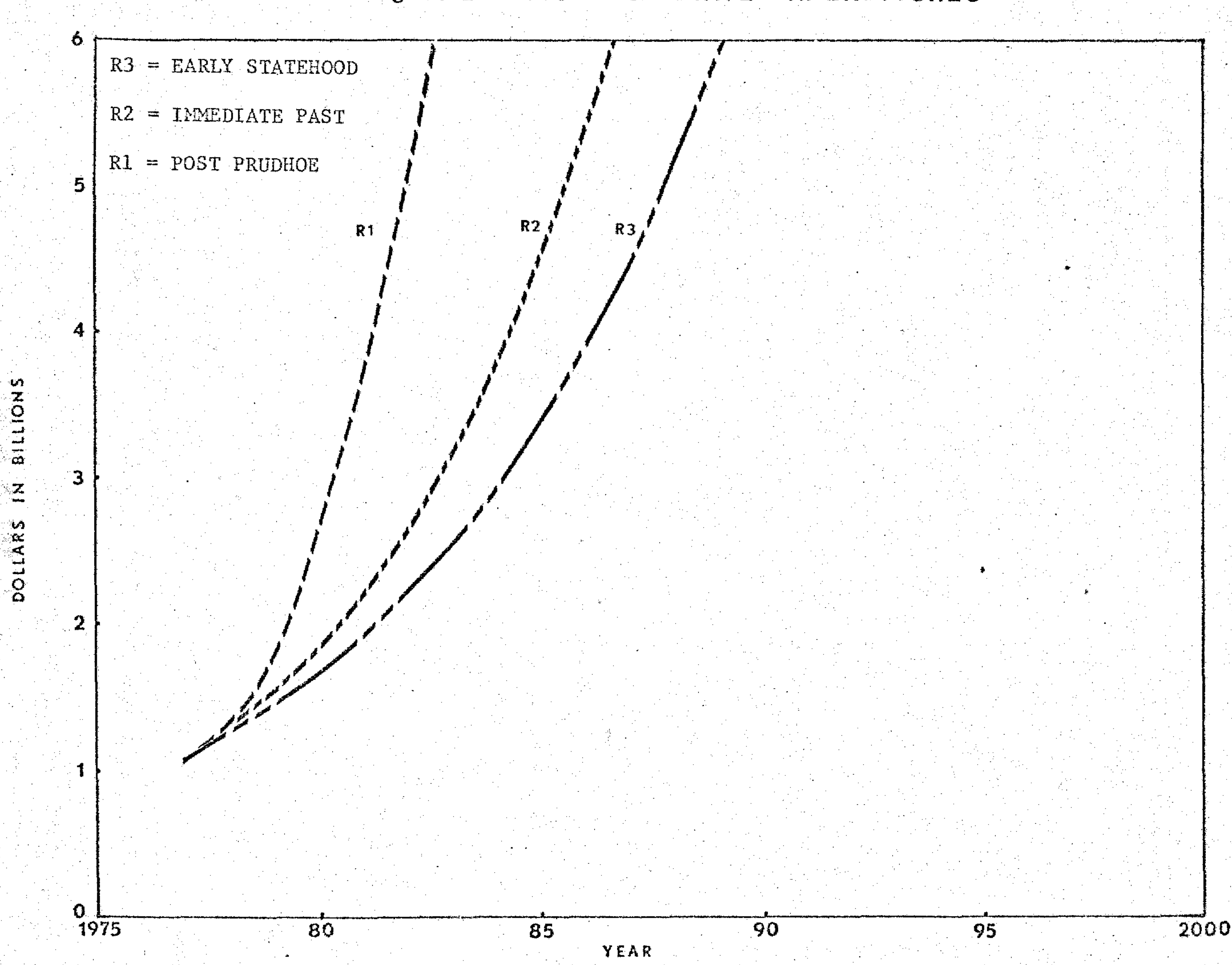


Figure 2 on the same scale presents projected state expenditure growth at rates comparable to three periods of post-statehood growth. Comparison of Figures 1 and 2 shows that even expenditure growth rates such as experienced by the state immediately after statehood cannot be sustained beyond the late 1980s.

Figure 2 PROJECTED STATE EXPENDITURES



A basic simulation of Alaskan economic growth shown in Figure 3 indicates the magnitude of the adjustemnt in state expenditures (E99S) necessary to attempt to maintain state financial solvency. Total expenditure growth has a ten year hiatus. At the same time, the permanent fund (PFBAL) grows to a level of $3 billion.

Figure 3 - SIMULATED STATE FISCAL POSITION including Permanent Fund Part I

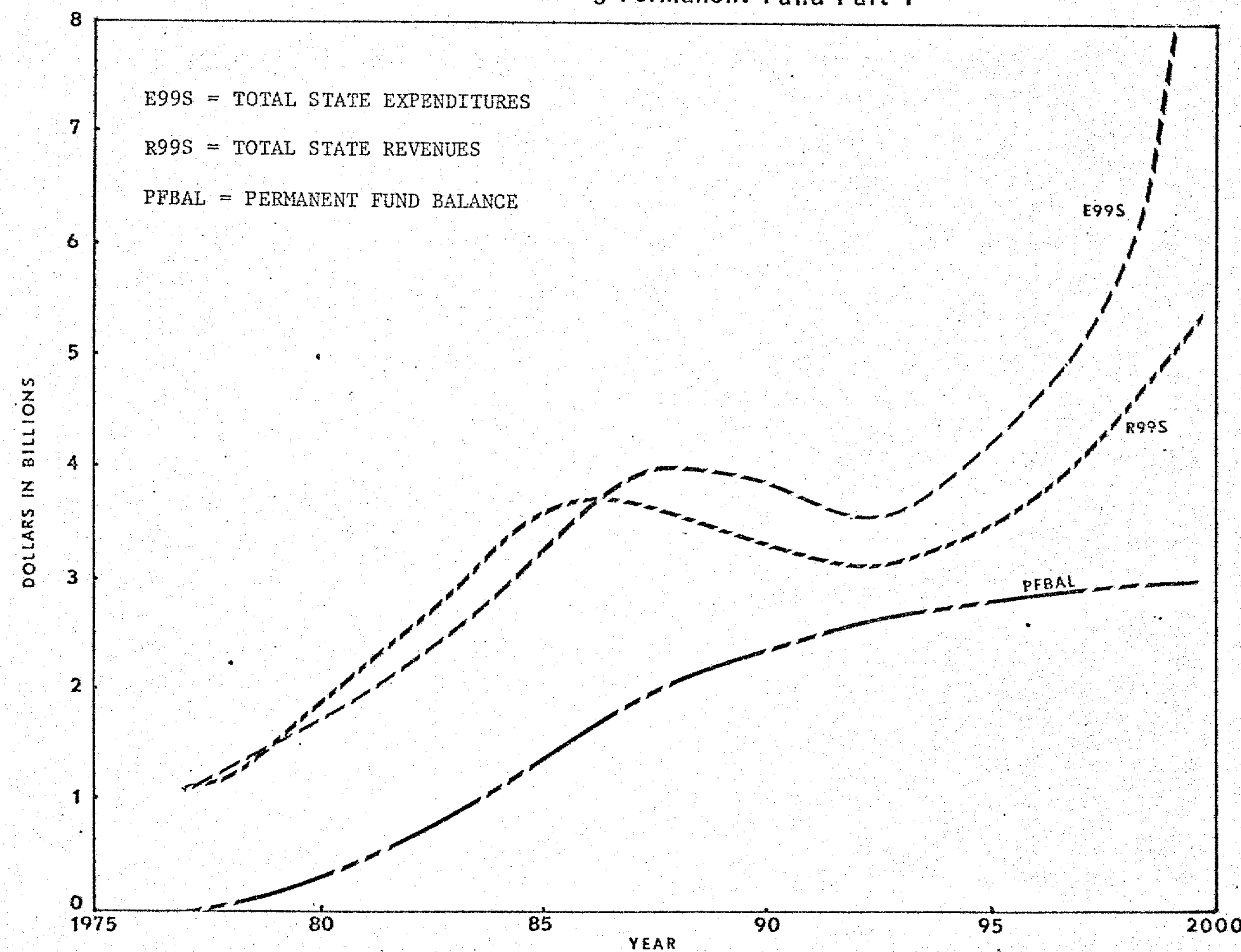
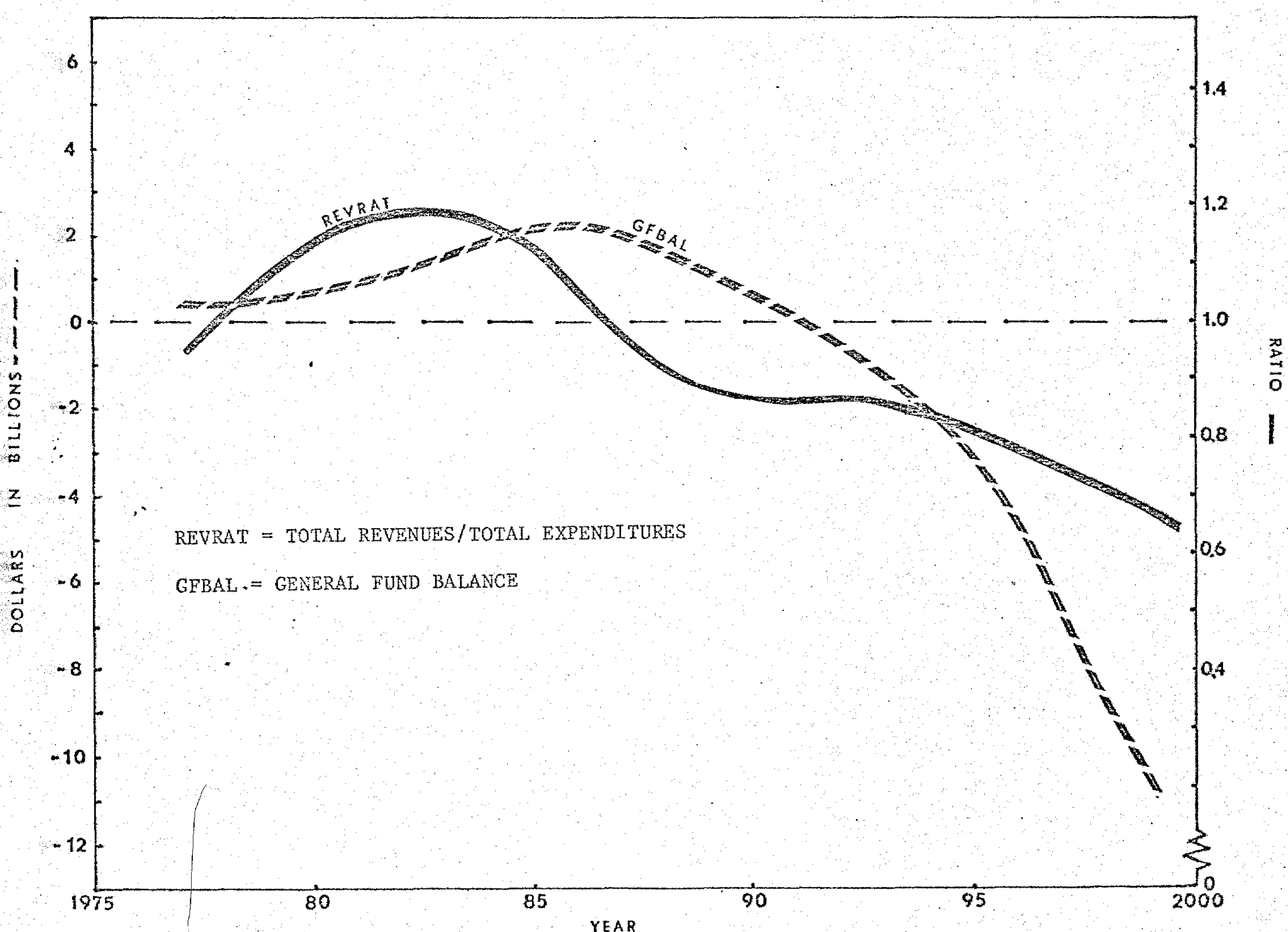


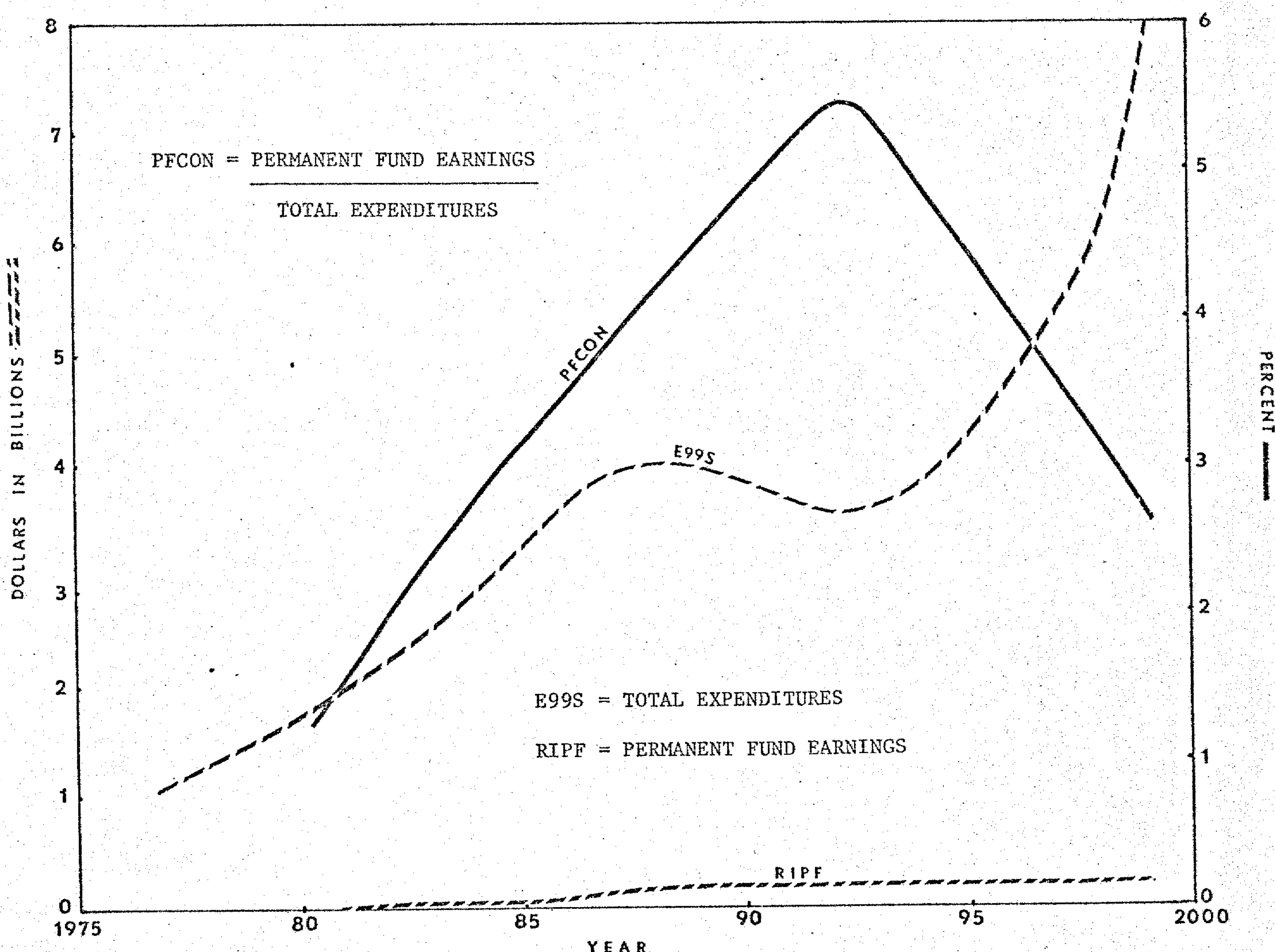
Figure 4 reflects the fact that in spite of this expenditure reduction and the permanent fund the general fund balance (GFBAL) falls below zero in the early 1990s and reaches -$10 billion in less than ten years. This represents the amount of alternative revenues which must be generated within that period to get the state back on a "pay as you go" basis represented by the ratio of total current revenues to current expenditures (REVRAT) not including permanent fund contributions.

Figure 4 - SIMULATED STATE FISCAL POSITION
including Permanent Fund Part II



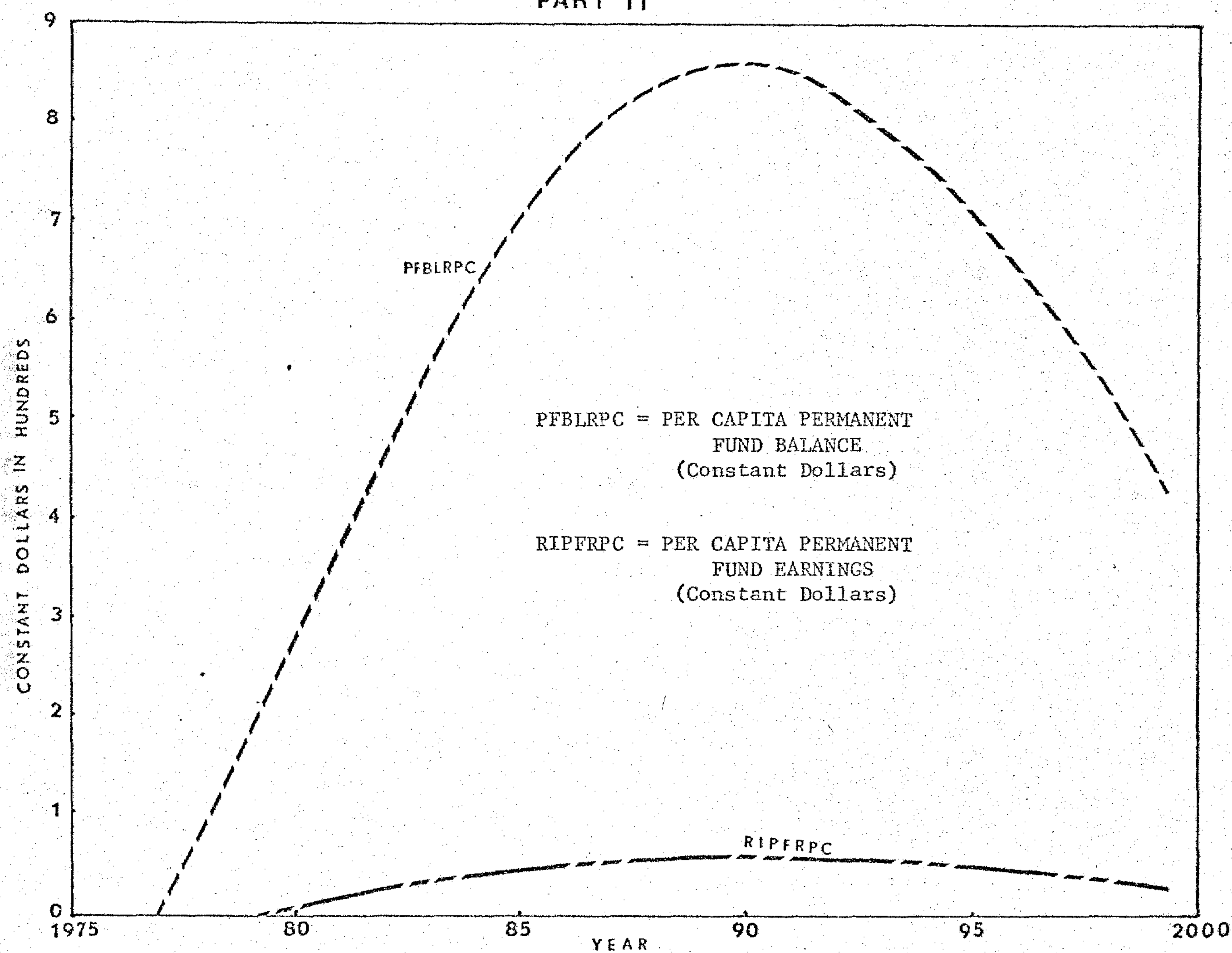
At a 25 percent contribution rate and 7 percent return, the permanent fund generates a substantial amount of annual income (RIPF). As a percentage of total expenditures (PFCON), Figure 5 indicates that its contribution can temporarily exceed 5 percent but will rapidly decline because of a slowdown in the growth of the fund itself.

Figure 5 - SELECTED MEASURES OF THE PERMANENT FUND



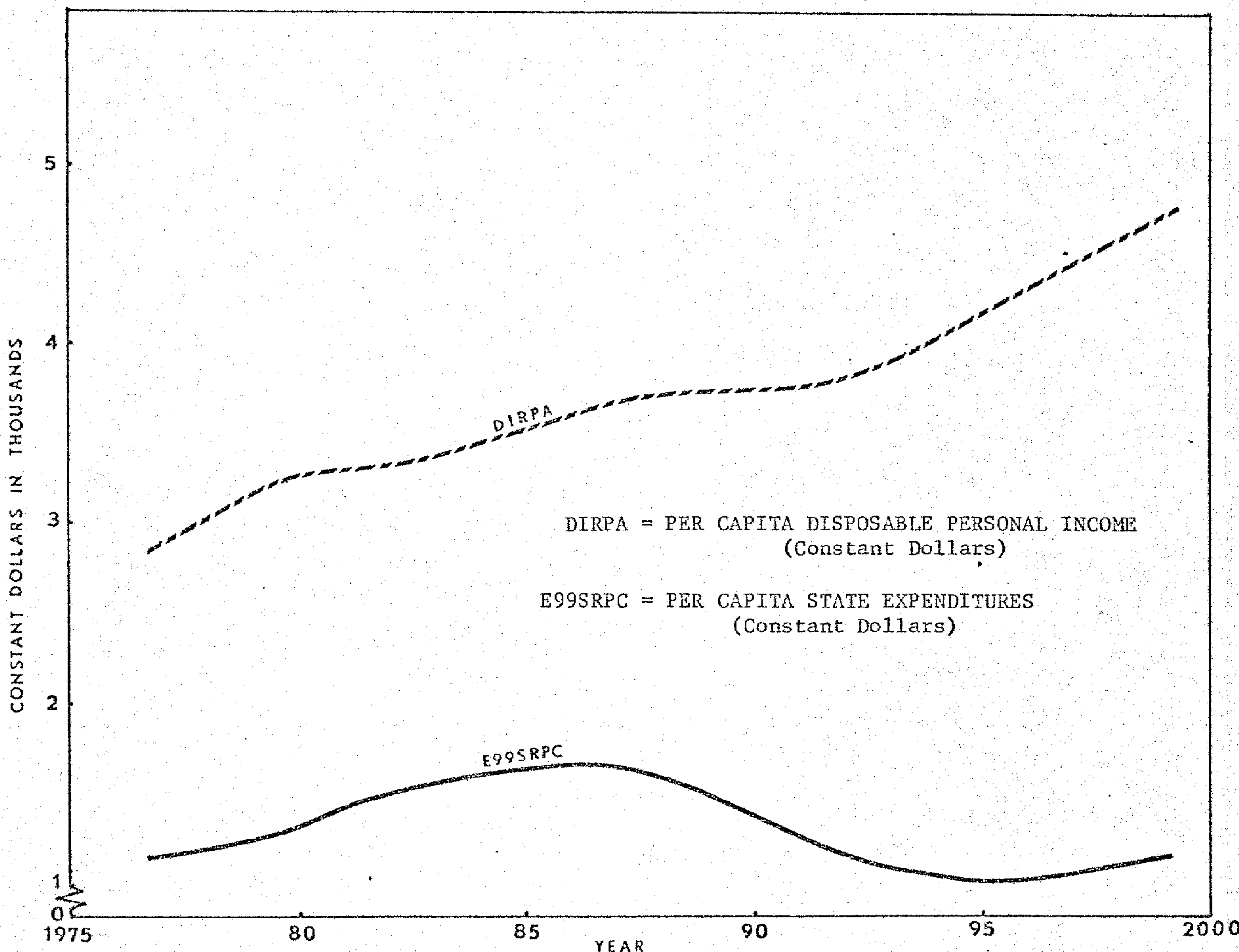
From the perspective of the average citizen of Alaska, the constant dollar (1967 U.S.) value of the permanent fund and the permanent fund earnings (PFBLRPC and RIPFRPC) exhibit long run cyclical behavior. Figure 6 shows they rise rapidly until the early 1990s and then fall off rapidly.

Figure 6 - SELECTED MEASURES OF THE PERMANENT FUND PART II



The total state expenditure pattern which indicates a decline in the late 1980s is reflected in Figure 7 in a significant real decline in per capita state expenditures (E99SRPC) which puts the level of services about 1995 substantially below present levels.

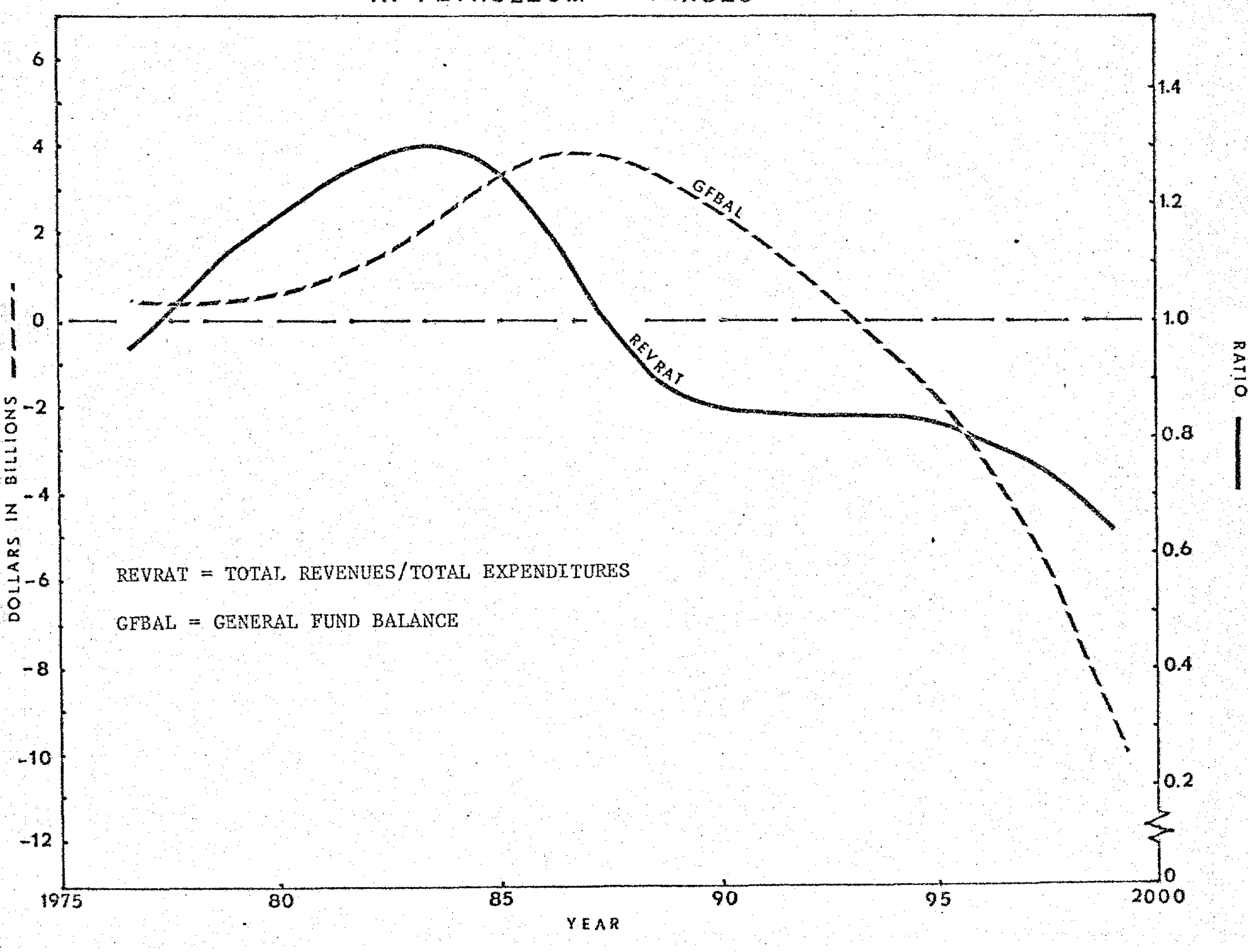
Figure 7 - SELECTED MEASURES OF THE PERMANENT FUND PART III



The assumption of a 25 percent increase in petroleum revenues beginning in 1983 above the level which can presently be reasonably projected changes the timing of future events but not their pattern. In Figure 8, the indicators of state financial viability from Figure 4 are repeated with values taken from a simulation with higher assumed levels of petroleum revenues. The general fund balance remains positive an additional year but there is very small change in the time when there is a deficit on current account.

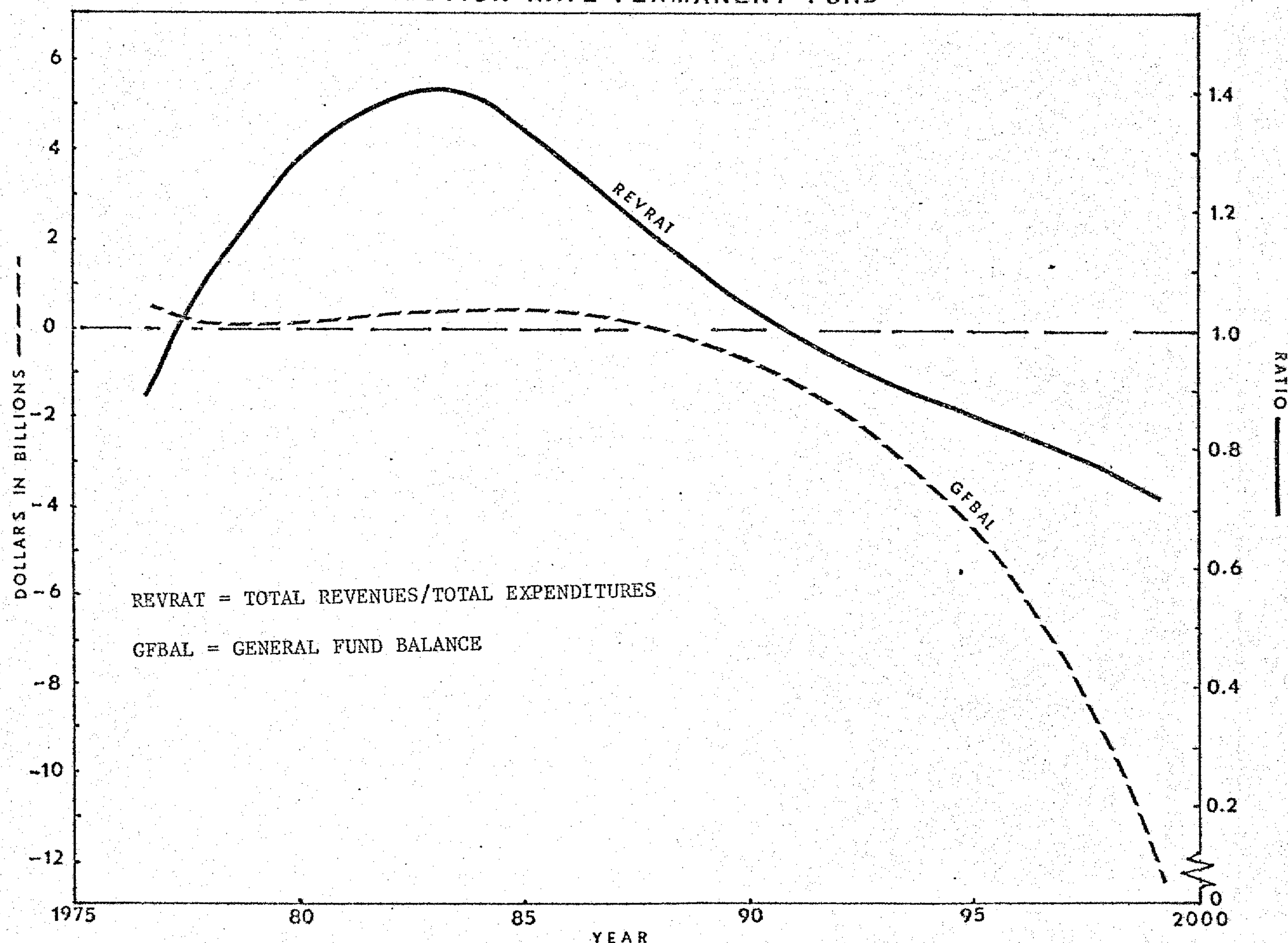
This results because the availability of increased general fund revenues has led to an increase in state spending. This has, in turn, generated economic growth and with it some "feedback" on the demand for state expenditures.

Figure 8 - POSITION OF STATE ASSUMING 25% INCREASE IN PETROLEUM REVENUES



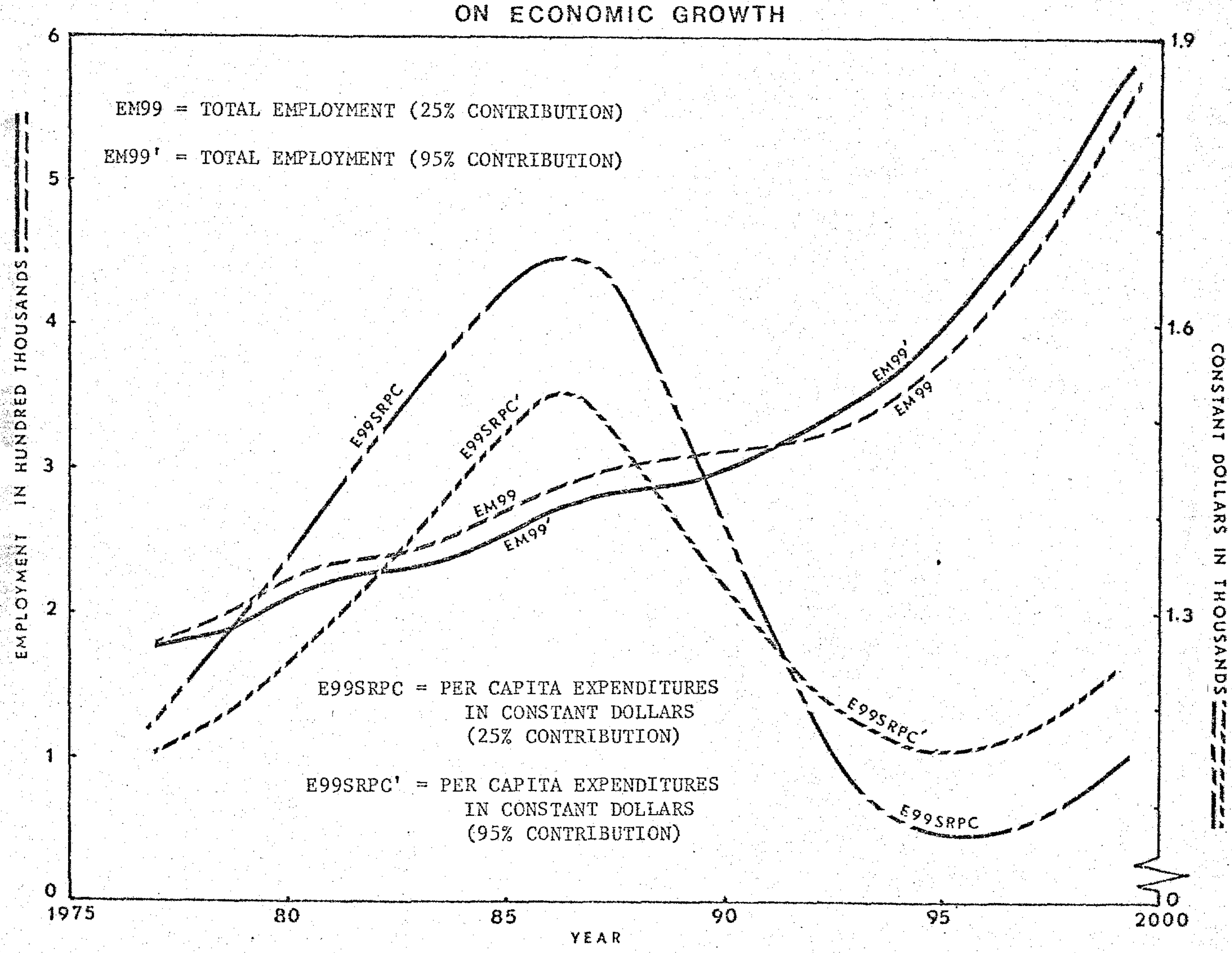
A substantial increase in the contribution rate to the permanent fund has the opposite impact on the financial position of the state. Figure 9 shows that in the case of a 95 percent contribution rate expenditure growth slows such that revenues exceed expenditures for a longer time than otherwise. However, such a large amount of money becomes "locked in" to the permanent fund that the general fund balance becomes negative before 1990.

Figure 9 - FISCAL POSITION OF STATE ASSUMING 100% CONTRIBUTION RATE PERMANENT FUND



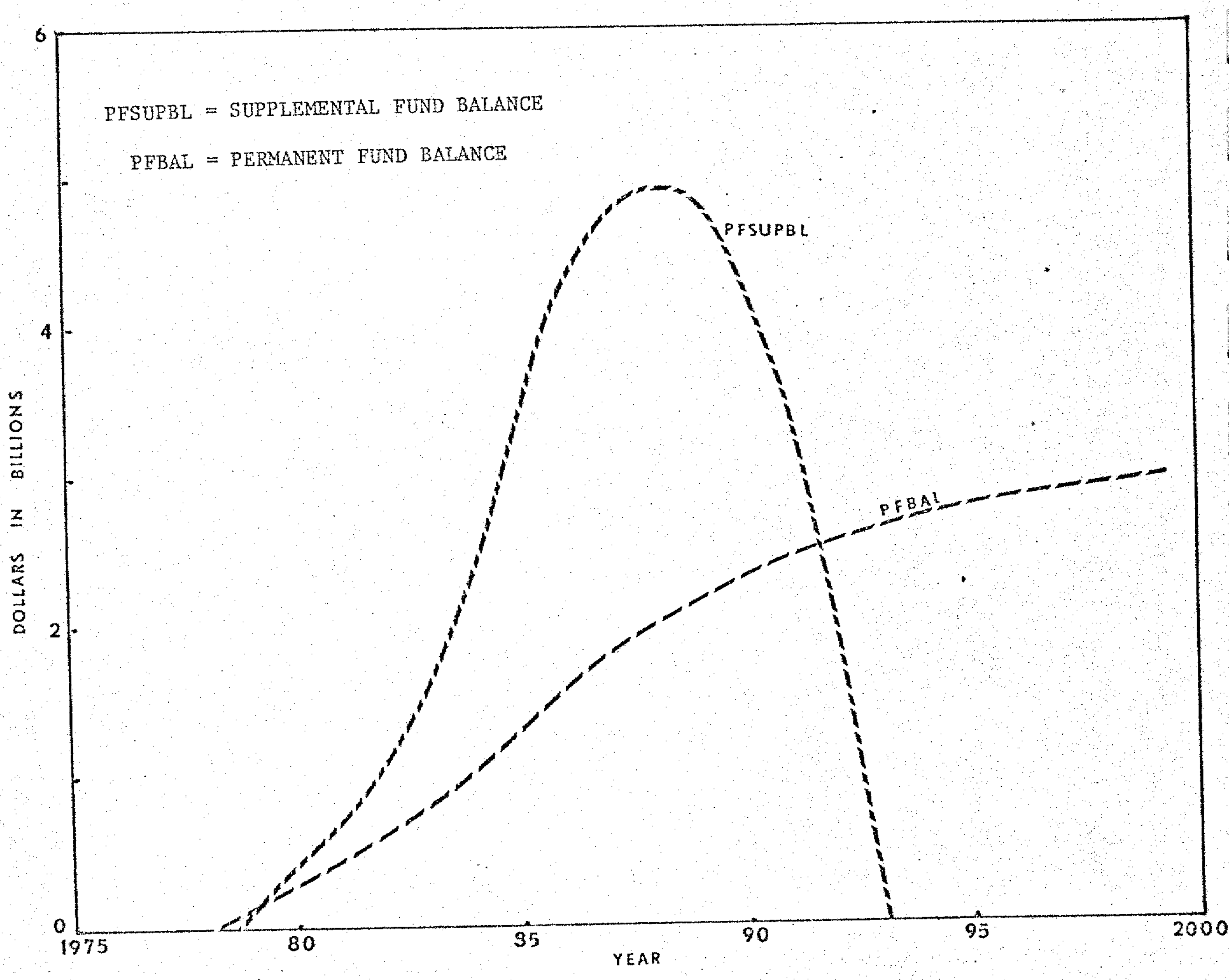
Larger permanent fund contribution rates remove money from the general fund and thus eliminate the possibility of it being spent on current budget appropriations. The resultant slowdown in economic activity is shown in Figure 10 where total employment (EM99) is plotted in the two cases of 25 percent and maximum (95 percent) contribution rates. With higher contributions growth is slower in early years but is later more rapid because the larger balance is able to temporarily provide for about 20 percent of state expenditure needs from earnings.

Figure 10 - IMPACT OF PERMANENT FUND WITHDRAWALS ON ECONOMIC GROWTH



These simulations and others indicate that in the 1980s a very substantial general fund balance will accrue to the state. A relationship between the general fund balance over and above immediate operating needs (PFSUPBL) and the permanent fund (PFBAL) as pictured in Figure 10.A is typical. During the next fifteen years this supplemental fund is likely to be substantially larger than the general fund. To concentrate on the permanent fund as a mechanism for controlling the patterns of Alaskan development overlooks this even larger fund source. This supplemental fund should be managed explicitly to allow state expenditure growth to adjust to the realities of state finances after petroleum revenues begin their decline.

Figure 10.A - RELATIONSHIP OF PERMANENT FUND AND SUPPLEMENTAL FUND



A first step in this direction involves adjusting expenditure growth to hit a target determined by real demand for public services rather than allowing it to fluctuate with the vagaries of short term revenues. Figure 11 illustrates one set of state expenditure patterns based upon growth of state expenditures at the same rate as real per capita personal income. Even in these cases representing conservative (about 12 percent) state expenditure growth, cutbacks are essential in the 1990s. Without foresight, a massive cutback is indicated in 1994 in case A while with the larger petroleum revenues of case B it is not necessary until 1997, but then much larger. Anticipation of the revenue shortfall leads to the smoother case C which allows highest expenditures in the long run. Case D involves more rapid growth of the target and thus earlier and more substantial reduction of expenditures.

Figure 11 - POSSIBLE TARGET EXPENDITURE GROWTH RATE

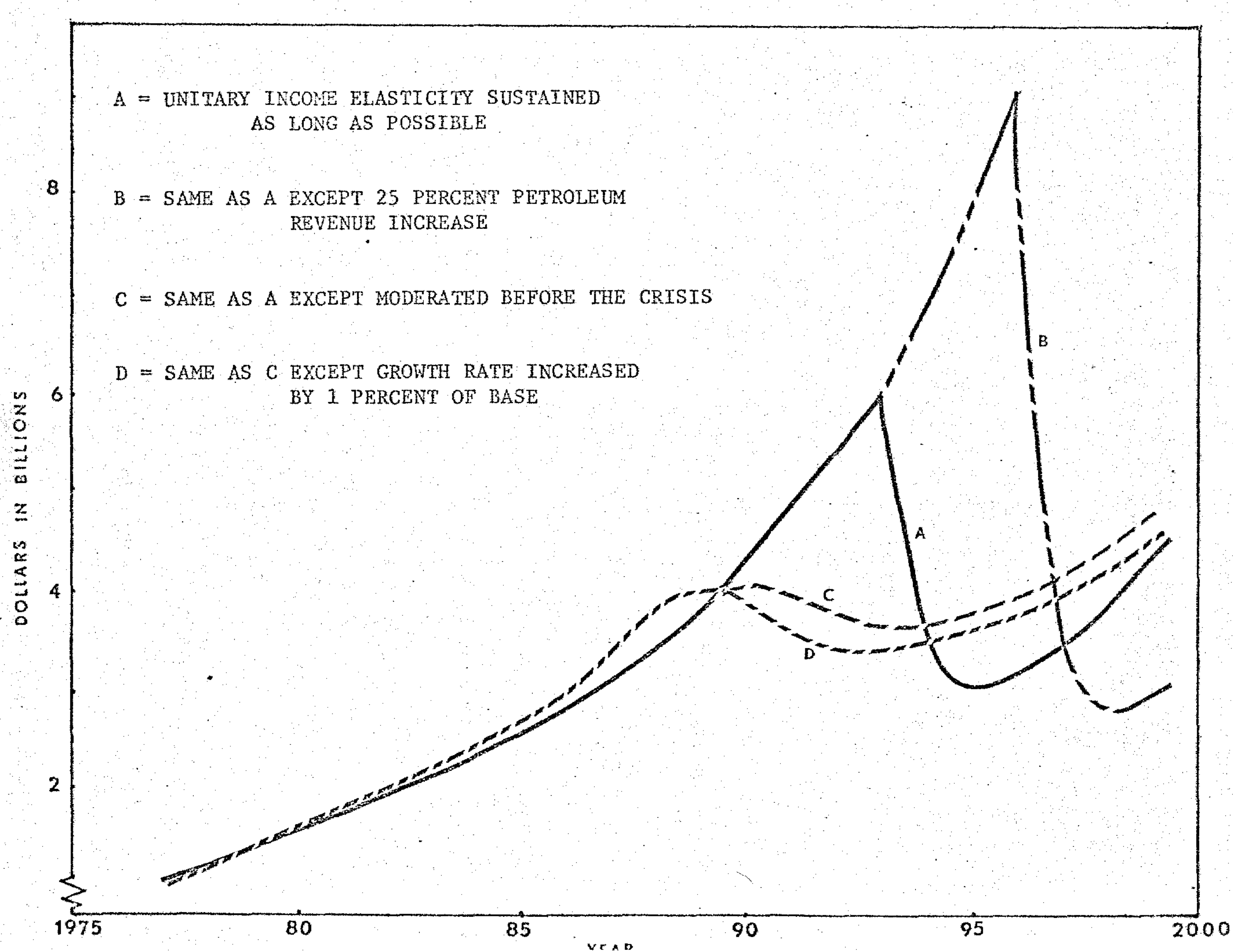
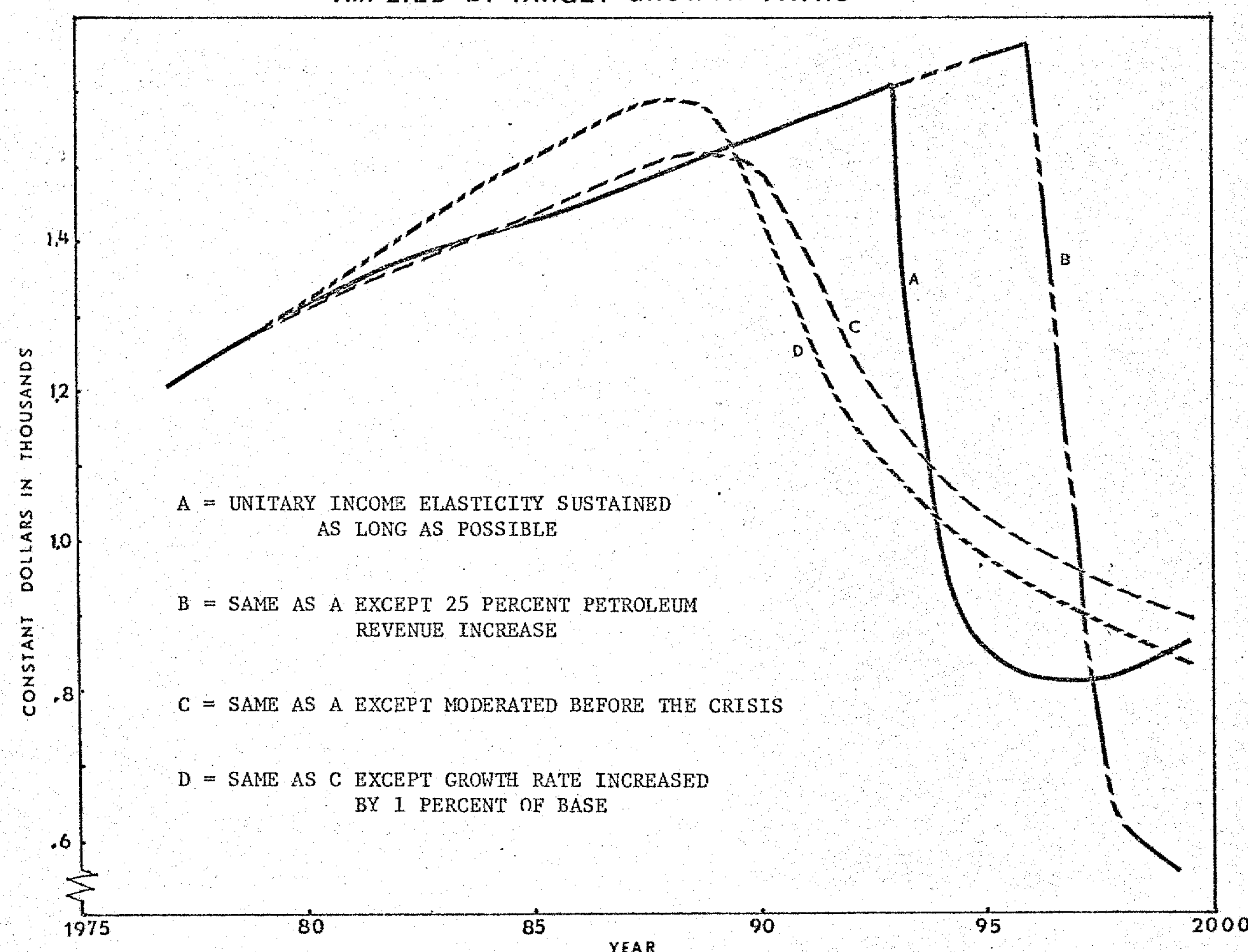


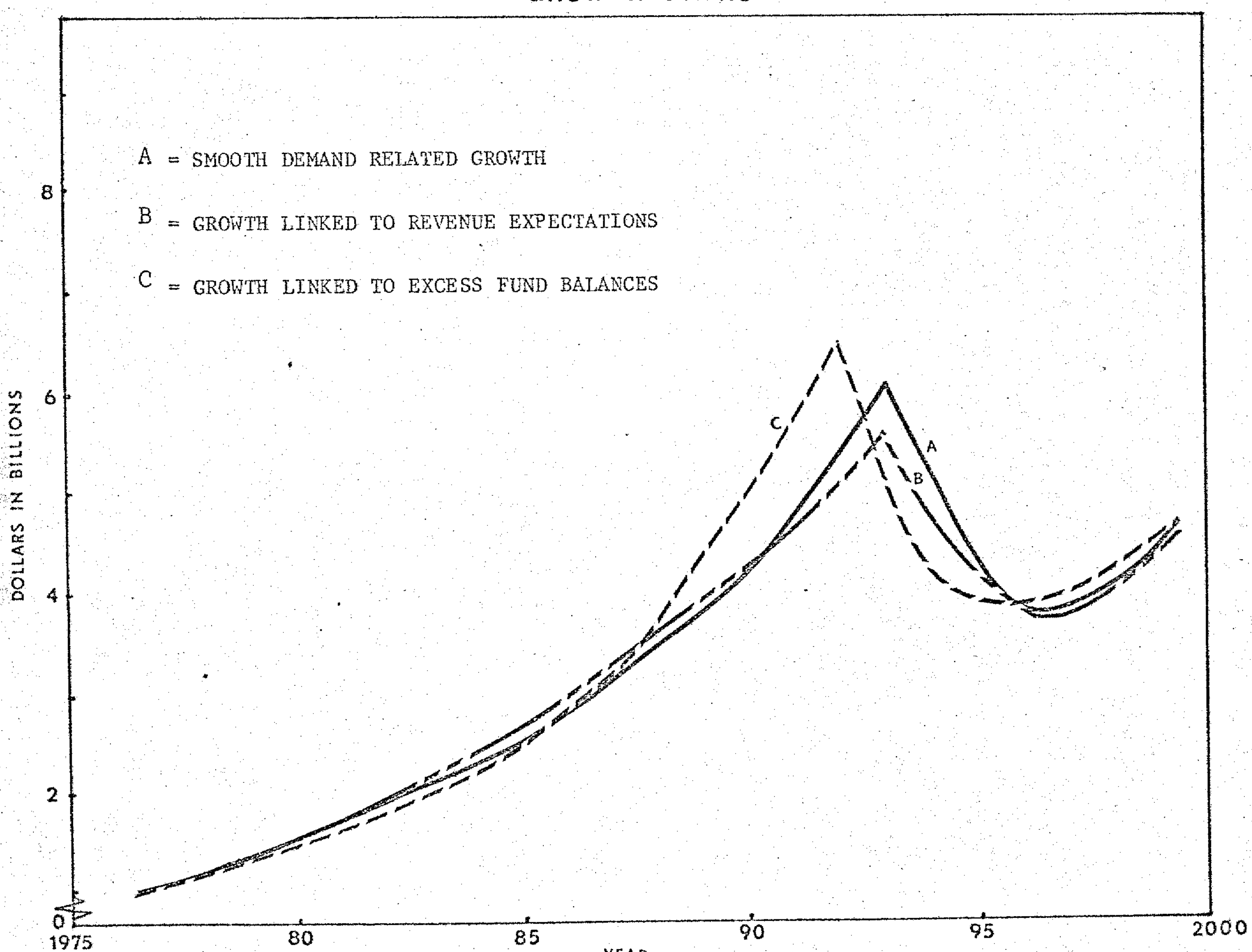
Figure 12 shows for these state expenditure patterns the implications for the level and growth of per capita real state expenditures. Significantly, even in the case where the revenue shortfall is anticipated (C) there is a substantial fall in the level of services provided by the state. In the 1990s it is substantially below present levels.

Figure 12 - LEVELS OF PER CAPITA STATE EXPENDITURES IMPLIED BY TARGET GROWTH PATHS



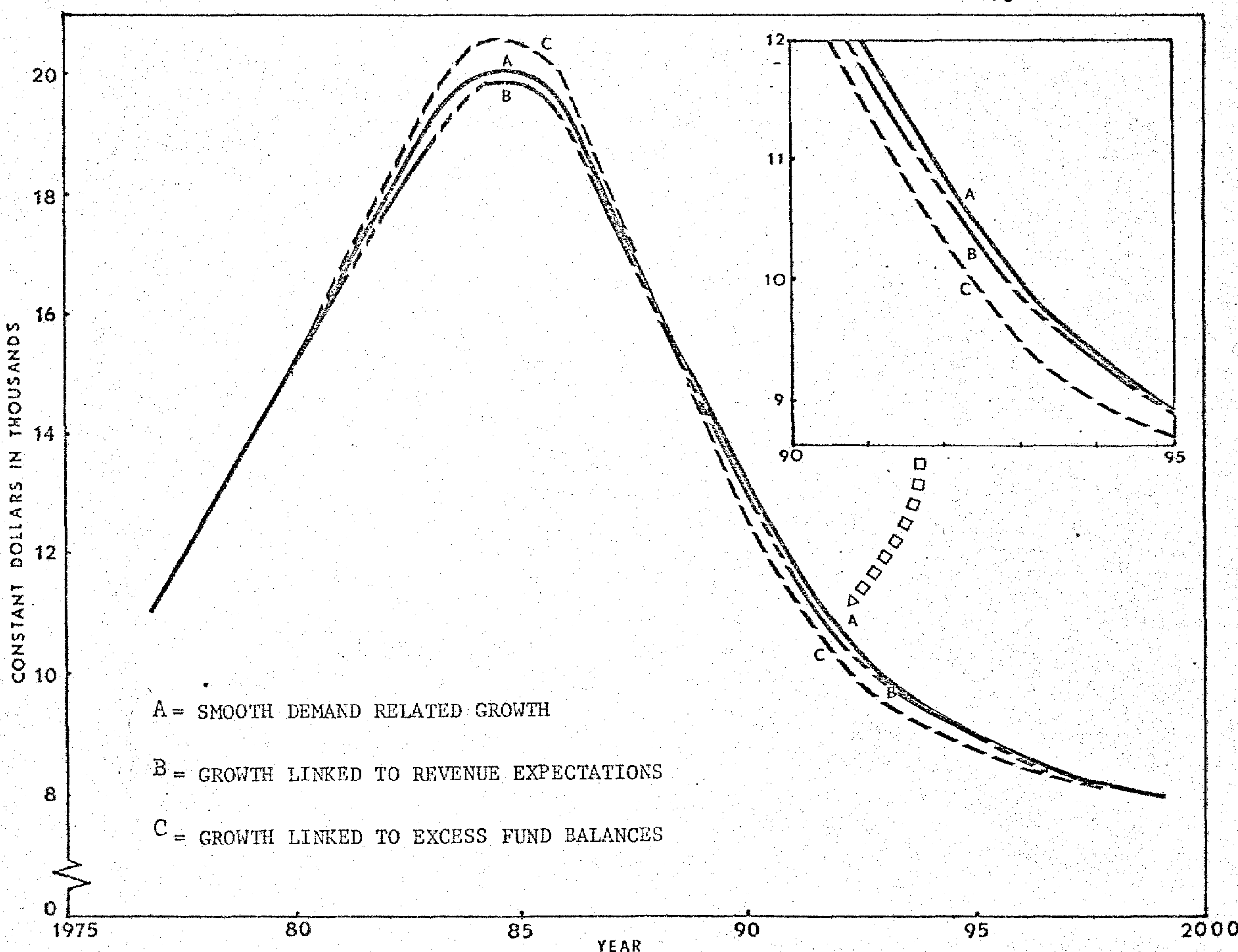
More sophisticated targets can be developed for state expenditure growth which take into account explicitly the unique long term revenue situation in Alaska. Figure 13 shows the state expenditure patterns derived from two such targets in contrast to the previous case A. Linking expenditures to expectations of future petroleum receipts (B) increases expenditures in the present relative to the future. Linking expenditures to the buildup of the balance in the permanent fund (C) delays expenditure growth until a future date. This allows larger expenditures supported by higher fund earnings, but ultimately all cases return to essentially the same growth path. This illustrates that the choice of expenditure patterns in the short run has implications for longer run growth but ultimately the underlying relationship between non-petroleum revenues and state expenditures will re-emerge to constrain state spending.

Figure 13 - POTENTIAL BENEFIT MAXIMIZING EXPENDITURE GROWTH PATHS



Finally, in Figure 14 another dimension of the tradeoff involved in the choice of expenditure growth patterns is shown. The state revenues received in the case C where growth is linked to revenues received results in higher earnings from fund balances but eventually, because state expenditures are stimulated, the per capita real revenues decline below the other cases.

Figure 14 - CONSTANT DOLLAR REVENUES PER CAPITA WITH BENEFIT MAXIMIZING EXPENDITURE GROWTH PATHS



The present state expenditure decisions from this perspective involve three tradeoffs which have implications for

1. the size of the economy,
2. the total amount of state revenues, and
3. the long run timing of state expenditures.

II. What are the economic implications of varying the assumptions regarding use of the earnings from the permenent fund? In particular, what is the effect of Alaska Inc. on the economy and state finances.

The economic impact of changes in the use of the earnings of the permanent fund is significant because of the large size of the fund itself. However, since the fund grows more slowly as time passes the importance of any policy change regarding earnings disposition declines.

The most important impact of any use is upon the level of the fund balance itself. Reinvestment of earnings increases the balance significantly while using the earnings to increase state expenditures leads to rapid depletion of the general fund and any money which can be withdrawn from the permanent fund. Alaska Inc. and a personal income tax rebate occupy essentially middle ground in their impact on the fund since they prevent a faster balance buildup but do not increase demand on the fund as does an increase in state expenditures under the conditions of the "ratchet effect" of state spending assumed in the analysis.

In terms of aggregate economic impact, all alternatives were significant. Reinvestment of earnings shifts the pattern of growth toward more rapid future growth while the opposite is true in the other. They all reflect the fact that an increase in the level of disposable personal income resulting from spending fund earnings results in overall growth of the economy much larger than the original change.

The cases in which growth of the economy is accelerated in early years also illustrate the fact that in these cases the slowdown necessitated by the financial difficulties projected for the state would also be larger.

Finally, the Alaska Inc. program seems to be more effective in getting additional income into the hands of individuals than a tax rebate. Because of the provision of multiple shares after every five year increment in a person's length of residence, the value of an individual share begins to erode in real dollars less than ten years after the program is instituted.

III. What are the economic impacts of the types of projects which might be financially assisted by the permanent fund? In particular, what would be the impact of a large refinery or fisheries enhancement program?

The petrochemical and fisheries enhancement projects cannot be directly compared to one another because of the large differences in size of the proposals and also because no explicit assumptions can be made regarding the method or size of permanent fund financial participation in either project. It is more valid therefore to concentrate on the comparison of each to a base case simulation. The petrochemical facility represents a very capital intensive project while the fisheries enhancement program is labor intensive.

Construction of the petrochemical plant leads to a "mini-boom" which results in an apparent long run increase in the level of aggregate economic activity. The capital intensive nature of the refining process notwithstanding, the employment impact is substantial because the construction phase is relatively labor intensive. Both the "boom" and the long run economic growth are regionally concentrated in the Anchorage and Southcentral areas.

Fisheries enhancement results in growth of the economy which is not accentuated but it is steady and leads to substantial long run increases. Because of the regional dispersion of the hatcheries the impact is not concentrated in any region. Interestingly, however, nearly 50 percent of the growth occurs in Anchorage where there is no primary employment increase.

The refinery provides state tax revenues through the taxation of both business and personal income while the impact of the fisheries enhancement program is primarily in the form of personal tax increases. Revenues generated are significant but less than 1 percent of total state revenues by 1990 in either case. State expenditure growth exceeds revenue growth in each case by a considerable margin because of the target level set for state expenditures on a per capita basis.

In both cases local revenues increase substantially. The refinery pays a substantial property tax but a significant portion of the local revenue increase comes from secondary increases in property values. The increases in the fish hatcheries case come primarily from secondary increases in property values.

IV. What was the economic impact of the placement of $100 million in time certificates of deposit with Alaskan banks by the State of Alaska between 1969 and 1971?

In terms of aggregate economic indicators it is difficult to identify any direct economic impact of this large increase in the amount of capital available to the banking system. Banking statistics for this period indicate a relative shift in portfolio holdings away from loans with a later return to the old ratio. This may be partially explained by four factors operating to limit the capacity of the banks to fully utilize these funds for instate loans:

1. the absorptive capacity of the system to such a large increase,
2. the short average term of these deposits,
3. state regulations requiring substantial collateral backing for state deposits, and
4. state usury laws.

In terms of equity effects the 6.25 percent return earned by the state on these loans was well below the average return on the remainder of their North Slope portfolio between 1969 and 1973 of 7.5 percent. The difference between these rates is an indication of the state's "opportunity cost" for these certificates of deposits from the point of view of a profit maximizing objective.

On the other hand, there may or may not have been excess profits transferred to the banking sector. It is dependent upon whether the negotiated price was the result of arms length negotiations and the banks were bidding competitively. Discussions with individuals involved incicate this was the case. Aggregate profit statistics can neither verify nor refute this.

It is also not possible to determine whether any benefit in terms of lower loan rates reached the consumer because of the increasing interest rates nationally which affected Alaska conditions.

In terms of the efficient use of the resources of state government, it must be asked whether this method was the most efficient in terms of the stated objective of stimulating Alaskan economic growth.

PART I

THE PERMANENT FUND AND THE PATTERN OF STATE EXPENDITURES

A. Introduction

Using not unreasonable assumptions regarding the level of future petroleum related state revenues, the Alaska permanent fund will grow to $1 billion in 1984, $2 billion in 1988, and $3 billion by 2000. If the dedication rate is raised from the present 25 percent level or if income generated by the fund is reinvested, the growth will be more rapid. The disposition of such a large pool of money would have significant impacts upon any economy; but because the economy of Alaska is small, the policies adopted regarding fund contributions and dispersements of earnings will in future years be of central importance to the course of growth of the Alaskan economy.

To illustrate the relative importance of the fund in the future Alaskan economy, it can be noted that in 1988 when the fund balance will exceed $2 billion, total personal income in Alaska will be in the $10 - $12 billion range. The permanent fund might thus represent the equivalent of 20 percent of personal income in a single year.

Lest one assume that this will eliminate all future financial problems for the state of Alaska, it should be kept in mind that in 1969 when the state received a $900 million bonus from the sale of leases around Prudhoe Bay, total state personal income was $1.27 billion. The Prudhoe Bay lease money was equivalent to over 70 percent of personal income in Alaska for that year. Yet over a five-year period, the bonus money had all been spent and many Alaskans were left wondering where the money had gone and what the return had been. In terms of the state budget, which in 1969 fiscal year was $151 million, the lease bonus was six times larger. Assuming very moderate state budget growth in line with historical patterns in other states, in 1988 the state operating budget will be on the order of $3 billion. A permanent fund of a size comparable to the 1969 lease bonus fund would at that time need to be $18 billion, rather than its projected level of $2 billion.

Thus, the fund will be substantial but not monumental if viewed in perspective, and its primary impacts on the economy may not be the result of what the fund can purchase or generate through investment activity but rather the result of both the fund operating to channel state revenues out of the normal state spending stream and also of a savings mentality growing out of the fund's existence.

The petroleum revenues which support to a large extent state government operations will probably not continue to do so in the future. The permanent fund is a device for saving some of the revenues received in the present so that they can be spent in the future, when petroleum revenue growth declines either relatively or absolutely. This act of saving, institutionalized in the permanent fund, serves two functions by removing money from the general fund. First, to the extent that it leads to a reduction in state government spending in the present, the growth of the economy is moderated and this, in turn, leads to a moderation in the rate of increase in the demand for government services in the future.

Second, to the extent that the permanent fund monies are ultimately available for meeting the needs of the state government, the permanent fund serves as a device to focus thinking on the problem of long-run budget balancing over the complete cycle of petroleum revenue expansion and decline. It focuses attention on the question of how much expenditure in the state government sector in the present is feasible given reasonable expectations about long-run petroleum revenues and the necessity to maintain the state treasury in a positive cash position.

It is to these questions that this section of the study is ultimately addressed. It attempts to indicate the link which exists between the size of the permanent fund at any time and the size of the Alaskan economy. It also presents some preliminary analyses of permanent fund contribution and disposition policies which would help the state budget to remain balanced over the long run and at the same time maximize economic well-being for Alaskans.

In attempting to accomplish these tasks, much preliminary information must be presented regarding the likely size of the permanent fund under different assumptions, as well as its relative size and importance in the economy, and the size and growth of the Alaskan economy in general. This information will be of general interest, and thus its presentation becomes another objective of this section of the study.

B. Structure of the Permanent Fund

An amendment to the Alaska Constitution was necessary to establish the Alaska permanent fund. This is because the Constitution specifically forbids the dedication of proceeds from taxes or licenses for any special purpose except in the case of joint federal/ state participation programs. The relevant section of the Constitution is Article IX, Section 15., which reads as follows:

> SECTION 15. ALASKA PERMANENT FUND. At least twenty-five percent of all mineral lease rentals, royalties, royalty sale proceeds, federal mineral revenue sharing payments and bonuses received by the State shall be placed in a permanent fund, the principal of which shall be used only for those income-producing investments specifically designated by law as eligible for permanent fund investments. All income from the permanent fund shall be deposited in the general fund unless otherwise provided by law.

The letter of intent accompanying the proposed amendment from the governor included the following points of clarification:

1) The permanent fund would not include proceeds from petroleum exploration, production, and property taxes as listed under AS43.56.

2) The fund would exclude receipts from petroleum reserves and ad valorem taxes as indicated under AS43.58.

3) The monies dedicated to the fund would be used only for income producing investments.

4) The fund could not be utilized to finance the general operating expenditures or general capital improvements of the state.[1]

Since the approval of the amendment by the electorate in November of 1976, interest has centered upon interpretation of some of the terms used in the amendment and upon the development of legislation to implement the fund. In particular, a workable definition of an investment which is "income-producing" must be developed. In terms of enabling legislation, the immediate question is that of the types of income-producing investments which should be specified by law as eligible for permanent fund investment. Questions of organization, management, and reporting must also be answered. Because these and other questions are only now being discussed, the analysis in this study must adopt a flexible approach to the modeling of fund behavior and administration.

Since the focus of the study is upon not only the relationship between the operation of the fund and the economy, but also upon the long-run adequacy of state government finances, the emphasis in this portion of the study will be upon the permanent fund as a "savings account." Other fund objectives are recognized, such as "community development" and "controlled economic diversification." These objectives are analyzed in detail in other studies and thus not directly addressed here.

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[1] State of Alaska, Department of Revenue, "Permanent Fund," Revenue Journal, Vol. 1, No. 2 (October 1976), pp. 4-5.

The fund proceeds will be placed in investments, some of which are within the state and some of which are outside the state. Clearly, investments made outside the state will have no direct impact on the private economy of Alaska. Investments made in Alaska may have an impact upon the aggregate Alaskan economy, or they may merely displace an investment which would otherwise have been made by the private sector--by either an Alaskan or a non-Alaskan. To the extent that capital markets operate smoothly and efficiently, then capital in Alaska will be fungible. That is, investors will be aware of all investment opportunities and the probable return on those investments. The Alaska permanent fund would be only one of many investors bidding for the right to make a particular investment.

Fungibility of capital may be lacking between Alaska and the rest of the world because of market imperfections in the form of imperfect knowledge of opportunities for investors or imperfect competition. There may be an apparent non-fungibility problem because of a premium required on a particular Alaskan investment because a higher level of risk is involved. Studies indicate that these problems are more likely to arise in small communities and in certain sub-markets of those desiring to obtain loans.

If an investment is a form of subsidy, either through a lower than market rate of return or loose loan repayment requirements, then there would more likely be a positive increase in overall economic activity as a result of the investment.

For simplicity in the analysis that follows, two assumptions are made concerning permanent fund investments. The capital market in Alaska is assumed to be operating satisfactorily so that capital is fungible, and no investments are made with the expectation of a lower than market rate of return. As a result, the level of the permanent fund at any time does not directly affect the private economy through any investment policy. Permanent fund instate investments merely "back out" an investment from another source.

It is recognized that this will not be the case in reality, particularly to the extent that the fund is used to finance investments in rural Alaska. However, these assumptions are made with the intent of highlighting the implications of the fund as a "savings account." To this end, the rate of return on the fund is set at 7 percent in all simulations.

At the same time, however, the notion of petroleum revenue proceeds being used to stimulate Alaskan economic activity has not been completely eliminated from the analysis. In addition to the permanent fund, there have been created by the legislature two renewable resources funds. According to AS 37.11, 5 percent of the proceeds of royalties and bonuses will go into a renewable resources development fund. These funds are to "guarantee the enhancement and development of the state's renewable resources" and appropriations from this fund shall provide "funding for capital and operating expenditures for the rehabilitation, enhancement, and development of renewable resource programs."

Monies paid into the fund, but not expended in that fiscal year, transfer to a renewable resources permanent fund. This fund balance is allowed to grow to $250 million, at which point no additional monies are paid in. The permanent fund principal is inviolate, but the interest on the fund investments must be used for the same purposes as the renewable resources development fund monies.

The simulations in this report assume that half the annual proceeds to the renewable resources development fund are spent and half are channeled into the renewable resources permanent fund. In its peak year of 1986, $50 million flows into the development fund. The permanent fund becomes completely capitalized in 1993, henceforth, earning over $13 million annually at a 7 percent rate. The monies thus generated are assumed to stimulate activity in the agriculture, forestry, and fisheries sector of the economy. The resulting impact on the economy is significant in that sector which grows in employment much more rapidly as a result of this program; but overall, the impact is fairly small simply because agriculture, forestry, and fisheries is one of the smallest sectors of the economy.

In terms of contribution levels and the distribution of earnings, the analysis follows the requirements that are incorporated in the Constitutional amendment. The basic contribution rate is 25 percent, and all earnings of the fund are deposited in the general fund where they are treated like any other source of revenue.

Since these stipulations are subject to change by the legislature, the analysis will sometimes look at other assumptions concerning contributions and earnings than these, but such differences will always be noted.

The permanent fund amendment does not specify whether contributions to the fund over and above the minimum rate of 25 percent are subject to the same restrictions regarding type of investment and withdrawal as the basic permanent fund contributions. A likely interpretation of the amendment would be that any supplementary contributions to the fund would be "captured" and subject to the same restrictions as the basic contribution.

Thus, there would seem to be little incentive for the legislature to lock up permanently additional funds which may be surplus to present needs but required for current expenditures in a few years. On the other hand, leaving them in the general fund leaves them vulnerable for immediate spending. This is not a small problem. Even with very rapid growth of state expenditures, the balance in the general fund may well exceed $2 billion in 1984, which is almost equal to the amount in the permanent fund at that time. Concentration on the permanent fund to the exclusion of the general fund thus overlooks a very important component of the state government financial situation.

In an explicit effort to take the existence of this probably very large general fund balance into account, a special fund account has been created in the model of state government in this analysis. It can be interpreted in either of two ways. First, it can be viewed as a supplementary account in the permanent fund, subject to the same investment restrictions but not to the restrictions on withdrawal to which the compulsory contribution is subject. Since there are no restrictions on either contribution or withdrawal levels and the only factor distinguishing this portion of the permanent fund from the general fund is the rate of earnings growth, this special fund account could be considered a part of the general fund. It would be that portion of the general fund portfolio which was specifically placed in longer term investments which are thus able to earn a somewhat higher return than general fund balances which may be needed in the current year.

A third possibility would be the actual establishment of a special account, either within the general or permanent fund which would specifically be the depository of excess government revenues which are neither needed in the general fund nor should be locked into a permanent fund.

Such an instrument, be it in the general fund, the permanent fund, or in a newly created interim fund, is necessary not only to distinguish investment classes which have different objectives, but also to highlight the long-run cyclical nature of the economic expansion resulting from the Prudhoe Bay oil discovery. This account would contain the funds which the state has in reserve for a "rainy day" in contrast to its two other funds. The general fund is necessary to take care of the normal operations of state government on a regular basis, and the permanent fund is always available in a catastrophy but requires a Constitutional amendment to unlock.

In sum, the permanent fund is formulated as a savings account in this study following the outline of the Constitutional amendment. A separate renewable resources development fund functions as a generator of economic activity in the agriculture, forestry, and fisheries industrial sector, and wage and salary increments there flow through the economy to cause further expansion. A large general fund balance of nearly the same size as the permanent fund is noted, and it is argued that this large balance should be singled out and highlighted in the permanent fund analyses which follow.

C. The Permanent Fund in the Context of the Alaskan Economy

C.1. Introduction

In this section, the Alaskan economy is simulated from the present to the year 1999. The permanent fund, as conceived in the Constitutional amendment, is an integral part of the analysis. State expenditures are assumed to grow rapidly as they have in the recent past, and no conscious attempt is made to balance the long-term expenditures with expected long-term revenues.

The results of this basic simulation are then contrasted with those of two other simulation experiments. In the first, the level of contribution to the permanent fund is dramatically increased from its 25 percent minimum to a maximum 95 percent level. The contribution stops short of 100 percent because of the 5 percent required contribution to the renewable resources fund. The third case examines the implications of a significant change in expectations concerning the level of petroleum revenues received by the state. A significant increase in petroleum revenues is hypothesized.

Before describing the simulation experiments themselves, it is necessary to discuss the assumptions concerning petroleum revenues, state expenditures, state response to deficits on current account, and private economic activity as well as the model used in the simulations. The discussion thus first turns to a review of the assumptions of the analysis.

C.2. Assumptions

C.2.a. Petroleum revenues. In two respects, the assumptions regarding the level of future petroleum revenues are the most important to the whole analysis. First, direct revenues from petroleum-related activities in Alaska comprise the largest single source of revenue to the state. As recently as 1975, the proportion was 15 percent but in 1978, it is estimated that 50 percent of total state revenues will derive directly from petroleum and related activities.[2] Indications are that this percentage will continue to grow at least through the mid-1980s to over 60 percent. In terms of unrestricted state revenues, the ratio of petroleum related to total revenues is much higher since restricted revenues comprise about 25 percent of the total.

The implication of this is that the size of the state treasury, potential state expenditures, and long-run fiscal viability of the state are all dependent upon the level of petroleum revenues. It is unfortunate that this largest component of the state revenues is also the most difficult to accurately estimate.

The second reason that the petroleum revenue assumptions are critical to the analysis is that state government activity in Alaska is one of the most important growth industries in the state. Growth in state government generates growth in the Alaskan economy. The impact of state government growth on the Alaskan economy is particularly strong

[2] State of Alaska, Department of Revenue, Revenue Sources FY 1976-78. Juneau, January 1977.

because of the large amount of state (and local) government activity as a proportion of total economic activity. Since government is large in Alaska, growth in government naturally results in general economic growth.

Because changes in the size of the state government sector imply significant changes in the size of the state economy and the possibilities for state spending are limited by the size of petroleum revenues, the level of petroleum revenues and expectations concerning future levels are a significant factor in the determination of the level of economic activity in the state and future potential levels of activity. The uncertainty surrounding petroleum revenues so translates into uncertainty concerning the possible constraints to growth of the Alaskan economy.

The completion of the Alyeska pipeline earlier this year and the commencement of oil production from the oil fields at Prudhoe Bay has generated a large amount of interest in attempting to accurately predict the level of petroleum revenues accruing to the state in the present fiscal year, or in the next few fiscal years. Each time there is a change in one of the factors affecting price at the wellhead or throughput, the calculations must be redone to determine the immediate fiscal impact.

It is obviously important for the state to be aware of its financial position at all times and be able to effectively plan future expenditures. One of the goals of this study is to attempt to lay out for analysis some of the implications of a long-run analysis of the state's fiscal position. However, much of the concern over the startup problems of the pipeline and of the determination of wellhead oil price seems to center upon the short run only. There is a feeling conveyed that the whole future of the state government hinges upon the ability of a small group of pipeline employees to keep the oil flowing on schedule.

The feeling is correct, but the concern is misplaced. The amount of oil which will flow through the pipeline in this fiscal year will determine whether the state government runs a surplus or deficit in this fiscal year. But if the throughput is low this year, there will be a compensatingly higher throughput in a future year. What is important is not the daily, weekly, or monthly revenue generated, but the long-term total amount. It is this amount which must be estimated as accurately as possible because in the "long run" of the next 20 years, the future of the state is inexorably related to the level of petroleum revenues. It should be remembered that short-term revenue shortfalls can be overcome as was done by the imposition of the reserves tax in 1975. As long as there is a secure future revenue source, short-term fluctuations are a normal occurrence. On the other hand, a revenue shortfall which will continue for a long period with no source of funds to fill in the gap cannot be handled as "business as usual."

For this reason, the specification of the assumptions concerning the level of petroleum production and petroleum pricing, although detailed, do not include a range to take account of either uncertainty regarding short-range production levels or unresolved disputes concerning costs of various phases of petroleum transportation, which can be charged off against the price to obtain the wellhead price. What is developed is a fairly conservative scenario of petroleum activity and pricing, which forms the basis for all simulations.

The scenario is conservative in the sense that it contains no significant petroleum discoveries leading to production beyond what is currently producing.[3] In addition, the most reasonable price assumptions available in the fall of 1977 were used to construct the wellhead values.

It is easier to envision a more optimistic, rather than a more pessimistic scenario. A more pessimistic scenario would require either a reduction in production rates from their already stated levels or a reduced wellhead value. A more optimistic scenario would result from either a price increase or cost reduction, an increased production rate from existing fields, or the discovery of new commercially recoverable deposits in Cook Inlet, Gulf of Alaska, on the North Slope, or elsewhere, or an increase in the severance tax rate.

[3] A more detailed description of the petroleum scenario assumptions is presented in Appendix C. Many of the assumptions are adopted from work done by the staff of the Legislative Affairs Agency who were very helpful in providing assistance to develop the scenario.

Table I.1. shows the simulation values for both total expected petroleum-related revenues and the subset of petroleum revenues from which permanent fund contributions derive. Total petroleum-related revenues consist of state royalties and bonuses on petroleum and natural gas lands, production (severance) taxes, and the property tax on petroleum related activities.[4]

This total petroleum revenue series is net of two major items which the state is obligated to pay. The first is the reserves tax paid to the state in fiscal years 1976 and 1977 by the holders of the Prudhoe Bay leases. These payments are netted out of production taxes for which the companies are liable at the rate of 50 percent of the liability until the $500 million in reserves taxes has been repaid. This takes three fiscal years through 1980, at which time state production tax receipts essentially double.

The second item netted out of petroleum taxes is the state's liability under the Native Claims Settlement Act. Under that Act, the state is obligated to pay the Native corporations $500 million. The funds are to come from state oil and gas royalties at the rate of 2 percent of the total value of production. This has the effect of reducing state royalty revenues by approximately 16 percent until such

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[4] Federal royalties shared with the state and lease and rental income are small components of total petroleum-related revenues netted out for ease of calculation.

Table I.1

Aggregate Petroleum Revenue Assumptions

	RP9S	RP7S
1977	460.75	11.2
1978	462.14	240.
1979	799.32	492.64
1980	1116.65	567.73
1981	1260.02	620.27
1982	1447.84	716.38
1983	1670.62	820.85
1984	1977.71	913.75
1985	2113.23	984.82
1986	2138.19	1007.74
1987	1943.15	911.3
1988	1700.13	788.83
1989	1465.55	670.81
1990	1264.76	570.7
1991	1090.65	485.08
1992	941.39	412.96
1993	813.29	352.43
1994	700.86	300.37
1995	604.4	257.17
1996	509.41	216.52
1997	426.74	182.36
1998	354.45	153.66

RP9S - Total direct petroleum revenues($ million)
RP7S - Bonus and royalty revenue ($ million)

time as the $500 million obligation has been paid. In this study, the obligation is fully paid in 1983. The required Native Claims payments are included in the series on revenues from which permanent fund revenues derive.

Of total direct petroleum-related revenues, petroleum taxes on production and on property are the major categories which are not included in the base for calculating permanent fund contributions. Of these two taxes, the production tax results in the larger revenue, yielding about 4 times the revenues of the property tax in peak production years. The production tax is based upon a complicated formula, taking into consideration actual individual well output and the decline of the productivity of the individual well over time. For simplicity, a 12 percent average tax rate was applied to the value of production to arrive at an estimate of the production tax.

The property tax is levied at the rate of 20 mills on certain categories of oil and gas property in the state. Since the determination of the methodology to use in assessing the value of the Alyeska pipeline over time as the Prudhoe Bay field becomes depleted is an unsettled matter, it is difficult to be precise in estimating property tax revenues. It is assumed that upon completion, facilities decline in value at the rate of 5 percent annually.

Royalty and bonus revenue is the major contributor of money into the permanent fund. At 12.5 percent of the value of production, this revenue source comprises roughly 50 percent of total petroleum-related revenues over the period 1977 to 1999. At a 25 percent contribution rate, the resulting permanent fund contributions, balance, and interest earnings grow rapidly in the 1980s but then begin to taper off in the 1990s (Table I.2).

Corporate taxes paid by corporations engaged in petroleum production may be a significant revenue source during the 1980s when production rates are high, but this is largely dependent upon the outcome of recent proposals before the state legislature to modify the existing methods by which the corporate income tax assigns income of multistate firms among its states of operation. Corporate taxes are assumed to rise to approximately $60 million in a peak year of 1986 and then to decline fairly rapidly. Corporate income tax receipts of the petroleum sector of the economy are not included as a component of direct petroleum-related taxes in Table I.1., because such receipts are not the result of a tax specifically on the petroleum industry.

The fields which are assumed to be producing oil and gas are only those which do so presently--Cook Inlet and Prudhoe Bay. In this respect, the assumptions are conservative but consistent with a necessarily conservative outlook on the part of state government.

Oil production from Prudhoe Bay is based upon an 8 billion barrel field capacity resulting in a maximum pipeline throughput of 1.7 million barrels per day in 1984 and 1985. Gas production from Prudhoe Bay peaks

Table I.2

The Basic Permanent Fund Case

	RPFS1	PFBAL	IPF1
1977	0.	2.4	0.
1978	60.	62.4	0.168
1979	123.16	185.56	4.368
1980	141.932	327.492	12.989
1981	155.068	482.56	22.924
1982	179.095	661.655	33.779
1983	205.213	866.867	46.316
1984	228.437	1095.3	60.681
1985	246.205	1341.51	76.671
1986	251.935	1593.44	93.906
1987	227.825	1821.27	111.541
1988	197.208	2018.48	127.489
1989	167.703	2186.18	141.293
1990	142.675	2328.85	153.033
1991	121.27	2450.12	163.02
1992	103.24	2553.36	171.509
1993	88.107	2641.47	178.735
1994	75.093	2716.56	184.903
1995	64.292	2780.86	190.159
1996	54.13	2834.99	194.66
1997	45.59	2880.58	198.449
1998	38.415	2918.99	201.64

RPFS1 - Permanent fund additions (million $)
PFBAL - Permanent fund balance (million $)
IPF1 - Permanent fund earnings (million $)

in the latter half of the 1980s at about 2.4 billion cubic feet per day. This output is sustained through the early 1990s and then begins to fall off. Prudhoe Bay gas is transported to market through a pipeline along the Alcan route.

The bulk of petroleum revenues derive from existing Prudhoe Bay operations, but Cook Inlet oil and gas production contribute a declining absolute amount of taxes and royalties. Since gas production is not projected to peak until the mid-1980s, but oil production is already declining, the two tend to counterbalance one another in early years, and the decline in overall Cook Inlet contributions from its present level of approximately $40 million is very gradual for about 10 years.

No additional fields are assumed to produce petroleum, although there is significant exploratory activity carried out in the 1980s. Of importance to the state from a revenue standpoint is a bonus lease sale in the Beaufort Sea area in 1979 which yields $100 million in revenues. Exploratory activity contributes to employment in the following areas: Beaufort Sea, Lower Cook Inlet, Gulf of Alaska; but none leads to production which provides revenues to the state.

The most significant variable in the determination of state petroleum revenues is the wellhead price of oil at Prudhoe Bay, because this is the base upon which both royalties and production taxes are calculated. The wellhead price is determined by taking the delivered refinery price and subtracting from it all allowable costs involved in transportation from the wellhead to the refinery. This calculation involves a number of significant issues, some of which have yet to be decided and which necessarily result in estimates which are subject to a large amount of variability in future years.

The refinery price is dependent upon its location as well as future OPEC pricing strategies and federal petroleum pricing policies. Transportation costs are in three categories. The largest is the Alyeska pipeline tariff, which is yet to be agreed upon although it will probably differ by company. The cost of transportation from Valdez to refinery is most dependent upon refinery location with cost rising as the refinery to which the oil is delivered moves eastward. Finally, there are apparently charges involved in the transfer of oil from the field at Prudhoe Bay to the pipeline itself.

The initial values for the wellhead price of Prudhoe Bay oil used in this study were taken from studies done by Legislative Affairs Agency.[5] Independent assumptions regarding each component of the equation determining wellhead price were calculated in that study based upon the best information available at that time. The 1978 wellhead price used is \$7.35 and this rises to \$11.95 in 1985, representing an average rise in price of 7 percent annually. This is predicated upon a 5 percent annual increase in the delivered refinery price of the oil and constant nominal prices for transportation of the oil. After 1985, the wellhead price

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[5] Legislative Affairs Agency, memo on Underlying Data for Revenue and Permanent Fund Forecasts, and Updated Revenue Impacts of Pump Station #8 Explosion, 1977.

continues to rise but at a rate which declines to 6 percent by the final year of the revenue estimate in 1999. The nominal price of Prudhoe Bay oil has risen to $17.30/barrel in 1990 and to $30.91/barrel in 1999.

The explosion at Pump Station 8 in the fall of 1977 caused a temporary reduction in throughput of the Alyeska pipeline, which is reflected in the revenue projections.

In sum, the petroleum revenue projections are generally predicated upon a conservative set of assumptions concerning future events. Prudhoe Bay reserves are estimated at 8 billion barrels, and no new discoveries of petroleum are assumed. The delivered price of crude oil rises at 5 percent annually, which is equivalent to a constant real price after accounting for inflation. The initial wellhead price of Prudhoe Bay oil may be somewhat optimistic based upon the latest information available concerning decisions about transportation cost levels. Since these costs have not been finally decided upon, however, the correct level to assign to this component of the wellhead price equation is somewhat speculative.

C.2.b. State spending. State government spending, as well as that of other levels of government, tends to be highly correlated with increases in population, the level of prices, and personal income of the population. For a variety of reasons, discussed in Appendix A, the growth rate in state spending may well exceed that of these three factors combined. For example, increases in efficiency of delivery of services may lag those in the economy generally such that prices of state services rise more rapidly than private goods. Also, people may desire to purchase public goods with an increasing percentage of increases in their personal incomes.

The pattern of expenditure growth in the state of Alaska has not followed a smooth curve related to these factors because of the great variation over the short period since 1960 of its supply of funds with which to purchase public expenditures. In most states, the pattern of growth of revenues is also fairly smooth and can be correlated to increases in population, prices, and personal income. As a result, the supply of funds for state expenditures grows in close conjunction with growth in demand for state expenditures.

The most significant fiscal event in Alaska since statehood has been the Prudhoe Bay lease sale. Before that time, real state expenditures per capita had increased from 8 percent of personal income per capita to 12 percent over approximately 10 years. That meant that as real personal income per capita rose over that period by approximately $1,000, or 33 percent, real state expenditures per capita rose more rapidly and, in fact, doubled from $235 to $487. This indicates that the "income elasticity" of public expenditures greatly exceeded unity for this period (Table I.3).

Total operating expenditures rose much more rapidly than this, of course, because of increases in both population and prices over this period.

Table I.3

State of Alaska Operating

Expenditures Analysis

Year	Real Expendi. Per Capita (Constant $)	Real Personal Income Per Capita (Constant $)	Ex/Income Real Per Capita (%)	Total Operating Expenditures (Million $)	Population (Thousand)	Expendi. Per Capita ($)	Real Personal Income (Million Constant $)	Anchorage Consumer Price Index 1967=100
1960	-	-	-	36.6	226.2	162	-	-
1961	235	2981	8	51.4	236.7	217	705.6	92.3
1962	281	3024	9	63.2	242.8	260	734.2	92.5
1963	345	3053	11	80.3	249.9	321	762.9	93.1
1964	347	3372	10	82.1	253.2	324	853.8	93.4
1965	354	3459	10	88.4	265.2	333	917.3	94.2
1966	378	3515	11	100.5	271.5	370	954.3	97.9
1967	409	3750	11	113.6	277.9	409	1042.2	100.0
1968	443	3853	11	129.3	284.9	454	1097.8	102.6
1969	487	4058	12	152.1	294.6	516	1195.4	105.9
1970	600	4353	14	199	302.4	658	1316.3	109.6
1971	894	4459	20	315.8	312.9	1009	1395.2	112.9
1972	973	4620	21	366.5	324.8	1128	1500.5	115.9
1973	1063	5051	21	421.8	330.6	1276	1670.0	120.0
1974	1025	5108	20	482.3	351.2	1373	1793.9	133.9
1975	970	5394	18	597.6	404.6	1477	2182.5	152.3
1976	1149	5618	20	778.9	413.3	1885	2321.8	164.1
1977est.	-	-	-	892.6	-	-	-	-
Rate of Increase 1961-76	11.16	4.32	-	19.87	3.79	15.5	8.26	3.91

After 1969, there are tremendous increases in all the entries of Table I.3, except that of real personal income per capita which can be traced to the increased revenues from the Prudhoe Bay lease sale. In a period of only two years, state expenditures as a percentage of real income per capita increased from 12 percent to 20 percent, and it has remained in the 20 percent range throughout the 1970s. Viewed slightly differently, what this means is that during the period 1969 to 1976 when real personal income per capita in Alaska was increasing by 38 percent, real state expenditures per capita increased by 136 percent. The majority of that increase occurred between 1969 and 1972 when real expenditures per capita doubled.

Looking at total operating expenditures over the same period after Prudhoe Bay, an increase of over four times is noted. Most significant, however, is the increase between 1972 and 1975 from $366 million to $598 million--63 percent. Over that period, real expenditures per capita actually fell in spite of the increase in spending because of large increases in the interim in both population and prices.

Because of this abrupt shift in the pattern of growth in state expenditures since statehood, it is difficult to use past average rates of increase to project future levels of spending by developing some rule which might emerge from the past experience. In the early years of statehood, growth in real per capita expenditures was strong and steady; then it took an abrupt jump to a much higher level or plateau in a very short time. Since that time, it has remained within a fairly close range as a percentage of personal income per capita, although it has continued to grow in this time. The income elasticity during these three periods has ranged from one in recent years to three in early years of statehood to approximately ten in the immediate post Prudhoe Bay years. One fact does emerge clearly, of course, and that is that expenditures have been dependent upon available revenues as well as upon demand factors such as population.

Thus, to project state expenditure growth in the future based upon historical experience becomes a difficult task. Clearly, the available supply of revenues should be included as a variable in determining the spending level, as should the demand factors of population and personal income. Expenditures would then rise with population and income but also with increases in available state revenues. The resulting increases in state expenditures would be large because of the large projected increases in revenues. Following the experience of the early 1970s, if funds are available for spending, they will eventually be spent. Money deposited in the permanent fund is, of course, not subject to the temptation to be spent because of the Constitutional restrictions. Balances in the general fund, however, are available to spend.

If increases in state government expenditures continue in the historical pattern, there will come a time when revenues will no longer be sufficient to pay for the desired level of expenditures. Since there is no historical precedent for such a case (the reserves tax being merely a solution to a cash flow problem), it is difficult to say how such a situation would be treated by the state. The three possible avenues of relief would be tax increases, service reductions, and Constitutionally mandated withdrawals from the permanent fund. Some combination of the first two alternatives would be the likely solution to the problem.

It is impossible to know either what types of taxes would be raised in such a situation or what types of services would be curtailed. Also, it is not possible to know how quickly the state would respond with corrective measures to a perceived long-run deficit. For simplicity in this particular analysis, it is assumed that tax increases are not a viable option. In addition, use of the permanent fund remains impossible. Cutbacks in state government services then become necessary, not only in the operating expenditures but also in the capital account and in transfers to local government. Cutbacks in expenditures from the originally desired level occur when the general fund balance is falling or at a very low level relative to the level of expenditures. The actual level of the cutback in spending is dependent upon the current account balance of the state in the previous fiscal year. The larger the deficit on current account in the preceding year, the larger the reduction in expenditures in the current year from the desired level.

In sum, determination of the rate of increase in government expenditures is difficult to do based upon an historical pattern, because there is no well-defined historical pattern for Alaskan expenditures. Both supply and demand factors are obviously important and are included in the determining equations.

Since past patterns of expenditures need not necessarily constrain future expenditure behavior, latter sections of this analysis will look at alternative spending patterns not derived from historical relationships. Such patterns may be designed to achieve certain long-run growth goals or be aimed at balancing the budget in the long run, or some combination of the two.

C.2.c. MAP model and private economy. Detailed descriptions of the MAP econometric model and its various components are available in a variety of papers and publications.[6] Thus, only a very brief description of the basic model is presented here.

The model is composed of four submodels. The petroleum scenario model determines petroleum-related employment and state revenues from a set of files containing detailed information on each petroleum province in the state. As the information available and the circumstances surrounding each province change, this file is updated to reflect that fact.

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[6] See David T. Kresge, "Alaska's Growth to 1990," Alaska Review of Business and Economic Conditions, January 1976; Daniel A. Seiver, "Alaskan Economic Growth: A Regional Model with Induced Migration," Anchorage, 1975; Scott Goldsmith, "Fiscal Options and the Growth of the Alaskan Economy," Anchorage, 1977; and David T. Kresge, et al, Issues in Alaska Development, forthcoming 1978.

Petroleum and construction employment figures from the scenario model are input into the economic model. This model employs a set of equations, econometrically derived using historical Alaskan data, to determine employment, wages and salaries, wage rates, and output in all sectors of the economy. Personal income and the Alaskan price level are also determined.

The fiscal model takes as input the revenue projections of the scenario model and develops estimates of all components of state and local revenues and expenditures. Certain revenues reduce disposable personal income in the economic model, and different types of expenditures positively impact the economic model through wage and salary payments and demands placed upon particular sectors, such as the private construction industry.

The demographic model determines an age-sex distribution for the population. It includes not only birth and death rates but also a migratory response to relative economic conditions in Alaska and the rest of the nation.

Economic activity in some sectors of the Alaskan economy is determined largely by forces outside the state. This is reflected in the model in the fact that the activity in federal government; agriculture, forestry, and fisheries; manufacturing; and petroleum is largely determined outside the model. Growth in activity is projected in all of these areas except for the federal government. The strongest growth is projected in the agriculture, forestry, and fisheries sector because of the expenditures of the renewable resources development fund.

Economic activity in other sectors of the economy is determined by demand within the Alaskan economy and the MAP model reflects this in the fact that in these areas, the level of activity is determined simultaneously with demand, which is measured by the level of disposable personal income.

No major projects with the exception of the gas pipeline to transport Prudhoe Bay gas along the Alcan route have been projected in these analyses except as noted.

C.3. A Simulation of the Alaskan Economy

Using the basic assumptions outlined above which include a 25 percent contribution rate to the permanent fund, a conservative estimate of future state petroleum-related revenues, and expansive state expenditure behavior reflecting the historical growth in expenditures, a basic simulation of the Alaskan economy to the year 1999 can be done. The results can best be presented in four sections. Respectively, they deal with indicators of aggregate economic activity, indicators of the state government fiscal position, indicators of individual economic well-being, and indicators of local government fiscal activity.

C.3.a. Aggregate indicators. Three basic indicators of aggregate economic activity--population, employment, and personal income--are presented in Table I.4. Population growth is strong throughout the period, averaging approximately 4 percent annually. The natural increase is augmented by net inmigration to the state such that the total increase between 1978 and 1998 is 581 thousand, which is significantly larger than the present population. In the decade of 1978 to 1988, the state experiences a population increase of about 150 thousand.

Much of the population increase can be attributed to people moving into Alaska to fill new jobs created over the period. Employment does grow by 286 thousand between 1978 and 1998 from less than 200 thousand workers to more than 477 thousand. The growth rate in employment slightly exceeds that of population, indicating that new employees will continue to have relatively small numbers of dependents.

A major cause of the growth in employment will be the increase in personal income which, when spent in the Alaskan economy, will create a demand for products and services. In nominal dollars which are not corrected for inflation, total personal income grows by almost a factor of ten between 1978 and 1998. It increases from its present range of $3.5 billion to approximately $30 billion.

By all of these aggregate indicators, the economy appears to be strong and growing smoothly.

Table I.4

Base Case Aggregate Economic Variables

	POP	EM99	PI
1977	398.119	187.208	3285.73
1978	408.062	191.888	3596.81
1979	424.062	200.283	4026.79
1980	462.78	224.712	4985.68
1981	491.785	238.31	5673.73
1982	503.883	238.916	5955.3
1983	522.713	245.693	6485.98
1984	548.771	258.315	7277.32
1985	578.034	272.908	8217.38
1986	607.547	287.054	9218.44
1987	637.625	301.211	10301.5
1988	655.748	306.01	11032.8
1989	673.067	311.021	11808.2
1990	690.893	317.016	12674.2
1991	709.392	323.982	13646.1
1992	717.546	323.525	14256.
1993	757.177	347.974	16369.4
1994	774.579	353.958	17526.3
1995	831.901	390.574	20691.5
1996	862.406	404.375	22546.5
1997	942.288	455.239	27259.4
1998	989.263	477.972	30198.7

POP - Population (thousand)
EM99 - Employment (thousand)
PI - Personal income (million $)

C.3.b. State fiscal indicators. The more important categories of state revenues are presented in Table I.5. Total petroleum-related revenues rise rapidly during the mid-1980s to a peak of $2.138 billion in 1986 and then begin to decline until they are $354 million in 1998. Non-petroleum tax revenues show a continuously rising trend which reflects a healthy annual average growth rate close to 11 percent. This is, however, slightly less than the growth rate of personal incomes which indicates that in the long run, the existing Alaska tax structure may be income inelastic and may lag increase in incomes.

The personal income tax is the largest revenue generator of the non-petroleum taxes. Presently, the personal income tax contributes more than 50 percent of non-petroleum taxes and that percentage is expected to continue to grow because of the progressiveness which is built into the tax schedule. As individual incomes rise, the marginal tax rate which they face also increases. The increase in personal income tax receipts is projected to be approximately ten times in the next 20 years, a rate of increase in excess of the increase in personal income. In the 1990s, the personal income tax will account for perhaps 75 percent of total non-petroleum tax receipts. And since petroleum tax receipts will be declining absolutely, the personal income tax will also comprise a larger percentage of total tax receipts than in earlier years.

Earnings on the permanent fund are deposited in the general fund where they are treated as ordinary revenues. Since the rate of earnings

Table I.5

Base Case State Revenues

	RP9S	RT98	RTIS	IPF1	RINS	RGF99S1
1977	460.75	242.323	120.229	0.	28.376	1096.04
1978	462.14	237.225	116.828	0.168	34.159	1051.79
1979	799.32	268.763	139.074	4.368	27.596	1349.68
1980	1116.65	313.865	175.067	12.989	33.701	1735.39
1981	1260.02	375.011	216.522	22.924	46.918	2008.02
1982	1447.84	402.359	231.099	33.779	58.514	2253.56
1983	1670.62	419.635	244.343	46.316	71.809	2520.9
1984	1977.71	463.223	279.34	60.681	89.479	2918.2
1985	2113.23	518.478	321.569	76.671	113.237	3179.88
1986	2138.19	559.571	370.413	93.906	132.453	3334.23
1987	1943.15	611.677	422.287	111.541	139.775	3308.47
1988	1700.13	658.846	463.517	127.489	125.559	3211.28
1989	1465.55	692.578	494.706	141.293	101.996	3090.5
1990	1264.76	732.366	528.883	153.033	71.805	2998.4
1991	1090.65	782.228	570.053	163.02	36.267	2936.86
1992	941.39	825.16	603.003	171.509	0.	2884.6
1993	813.29	905.355	678.298	178.735	0.	2940.98
1994	700.86	1030.83	775.642	184.903	0.	3090.39
1995	604.4	1160.04	891.527	190.159	0.	3256.21
1996	509.41	1357.37	1042.13	194.66	0.	3518.94
1997	426.74	1569.17	1228.07	198.449	0.	3827.84
1998	354.45	1879.21	1465.4	201.64	0.	4288.46

RP9S - Total direct petroleum revenues (million $)
RT98 - Total taxes (million $)
RTIS - Personal income tax (million $)
IPF1 - Permanent fund earnings (million $)
RINS - General fund earnings (million $)
RGF99S1 - Total general fund revenues (million $)

is constant, the growth in earnings coincides with the growth in the size of the permanent fund. During the 1980s, the fund increases rapidly and interest revenue increases from almost nothing to more than $100 million. In the next ten years, however, the level of earnings does not double and has barely surpassed $200 million by 1998.

In contrast, earnings on the general fund balance show an interesting rising and falling pattern. For several years, earnings hover near $30 million. In the early 1980s, they rise very rapidly to nearly $140 million, higher than permanent fund earnings at this point, but then fall precipitously and ominously to zero in 1992.

Total general fund revenues reflect the long, significant decline projected for petroleum revenues in late 1980s. In early years, growth is strong and revenues peak in 1986 at $3.334 billion but then a hiatus is experienced during which total revenues actually decline to a nadir in 1992 of less than $2.9 billion. Only in 1996, a full ten years later, is the earlier peak surpassed, but this time in much deflated dollars. At that point, the impact of the decline in petroleum revenues has been absorbed in terms of total revenues.

State expenditures grow rapidly through 1987 at an average rate over the ten-year period in excess of 13 percent(Table I.6). This is considerably less than the average growth rate in state expenditures over the historical period since statehood, which was almost 20 percent, and also less than

Table I.6

Base Case State Expenditure Analysis

	E99S	SAVS	GFBAL	EXCAP	EXCUR
1977	1099.65	0.	569.319	290.	809.647
1978	1271.17	0.	459.936	330.	941.17
1979	1367.89	0.	561.685	359.864	1008.02
1980	1647.18	0.	781.963	396.226	1250.96
1981	1969.55	0.	975.231	464.391	1505.16
1982	2206.67	0.	1196.82	524.122	1682.55
1983	2414.42	0.	1491.32	564.053	1850.37
1984	2728.13	0.	1887.28	617.679	2110.45
1985	3088.81	0.	2207.55	687.635	2401.18
1986	3468.5	0.	2329.59	768.958	2699.54
1987	3831.13	0.	2092.65	857.138	2973.99
1988	3895.14	242.886	1699.94	878.324	3016.81
1989	3862.5	423.55	1196.74	820.153	3042.35
1990	3819.25	564.315	604.453	711.826	3107.43
1991	3758.95	686.081	-45.786	557.542	3201.41
1992	3439.03	769.736	-498.753	369.458	3069.58
1993	3861.41	505.205	-1360.17	272.898	3588.52
1994	3717.23	1085.56	-1987.	88.528	3628.7
1995	4428.69	729.633	-3159.49	0.	4428.69
1996	4569.42	1562.25	-4209.96	0.	4569.42
1997	5628.67	1330.16	-6010.79	0.	5628.67
1998	5925.32	2614.52	-7647.65	0.	5925.32

E99S - Total State expenditures (million $)
SAVS - Reduction from desired expenditure level (million $)
GFBAL - General fund balance (million $)
EXCAP - Capital expenditures (million $)
EXCUR - Current expenditures (million $)

the rate between 1971 and 1977, which was almost 19 percent. However, it is rapid enough so that real state expenditures per capita increase by 42 percent. After 1987, however, this rate of increase cannot be sustained and actual expenditures must be reduced, signaled by a fall in the general fund balance which, until this time, had been steadily increasing.

At this point, total expenditures have reached a plateau from which they do not move for several years. Cutbacks from the desired level of expenditures become larger each year as the general fund balance continues to decline. Because the loss of petroleum revenues has not been anticipated, the fall in the general fund balance is precipitous as it is drawn down in an attempt to maintain the desired expenditure growth path as long as possible. Non-petroleum revenues do not increase rapidly enough to compensate for the loss in petroleum revenues, however, and the general fund balance quickly becomes negative and continues to fall. By 1998 it is negative by over $7.5 billion, and the deficit is increasing at the rate of $1.6 billion annually. This represents the amount of revenues which would need to be raised to maintain the fiscal integrity of the state through that period of time even though expenditures have been significantly curtailed and in 1998 are $2.6 billion less than they would have been if there had been no deficit in the general fund.

This absolute reduction in state government expenditures must somehow be shared by all those functions which receive funding out of the general fund. In this case, the cutback is shared by both the state and the local governments because a large percentage of local revenues are actually state transfers. Because only a portion of local revenues come from the state, local government expenditures will be somewhat insulated from this cutback. Since they do not derive such a large proportion of their revenues directly from petroleum activities, they will need to reduce expenditures to a much lesser degree than the state.

To illustrate the severity of the reduction required at the state level, a large portion of the required cutback has been channeled into capital expenditures. Surprisingly, the capital expenditure program, which in 1988 is nearly $880 million, must be completely eliminated by 1995. In spite of this, current expenditure growth remains sluggish and does not increase significantly for about a five-year period. In real per capita terms, it falls substantially.

Several other statistics can help to put the revenue shortfall problem and permanent fund into perspective in this scenario. CRUNCH is simply the percentage which desired expenditures must be cut back to try to maintain some balance. From the point in time that expenditures must be cut back, the gap rises steadily until in 1998 it is 44 percent (Table I.7).

Table I.7

Base Case Indicators of State Financial Strength

	CRUNCH	REVRAT	PFCON
1977	0.	1.027	0.
1978	0.	0.903	0.
1979	0.	1.124	0.
1980	0.	1.183	0.
1981	0.	1.138	0.015
1982	0.	1.143	0.02
1983	0.	1.17	0.025
1984	0.	1.193	0.029
1985	0.	1.147	0.032
1986	0.	1.07	0.035
1987	0.	0.956	0.038
1988	0.067	0.908	0.042
1989	0.118	0.877	0.046
1990	0.157	0.857	0.049
1991	0.191	0.85	0.051
1992	0.231	0.91	0.056
1993	0.133	0.823	0.05
1994	0.292	0.89	0.051
1995	0.165	0.785	0.043
1996	0.342	0.82	0.043
1997	0.236	0.722	0.035
1998	0.441	0.767	0.034

CRUNCH - Reduction from desired expenditures level (%)
REVRAT - Revenues/expenditures (%)
PFCON - Permanent fund earnings/total expenditures (%)

REVRAT is the ratio of total revenues to total expenditures. It is an indication of when the state is running a surplus or a deficit on current account. Between 1977 and 1987, the state runs a surplus almost each year. In 1987, however, there is a turning point and from that time forward, expenditures exceed revenues in each year.

Finally, PFCON represents the percentage of current state operating expenditures which is financed out of earnings on the permanent fund. This percentage increases during the years when the permanent fund is increasing rapidly. It peaks in 1992 at less than 6 percent of current expenditures. From that point forward, it declines steadily in spite of the fact that there is a significant brake being applied to expenditures. In 1998, it is 3.4 percent. This is a small relative amount but, nevertheless, not insignificant.

From the point of view of the average Alaskan individual, several variables are important. Table I.8 indicates that real disposable personal income per capita increases quite steadily over the next 20-year period. This is essentially that component of personal income which is left after federal and state personal income taxes have been netted out. Real state expenditures per capita do not follow the same smooth, upward path but rather, because of the reduction in state expenditures in the late 1980s, fall off substantially after 1988 from a peak value of $1,681 (1967US = 100 is the deflator for these real units). In 1977 the level is $1,187 and after the rise to 1988, it falls to a low of $1,044 in

Table I.8

Base Case Per Capita Variables

	DIRPA	E99SRPC	R99SRPC	PFBLRPC
1977	2894.88	1186.79	1219.32	2.59
1978	2997.71	1280.2	1156.26	62.843
1979	3096.88	1272.4	1429.64	172.606
1980	3325.01	1323.62	1565.94	263.161
1981	3373.41	1423.89	1620.93	348.868
1982	3332.58	1509.34	1724.54	452.564
1983	3379.06	1534.1	1794.43	550.901
1984	3466.34	1582.43	1887.59	635.324
1985	3553.81	1627.79	1867.17	706.968
1986	3625.6	1666.4	1782.84	765.552
1987	3697.29	1681.4	1607.76	799.318
1988	3706.18	1606.29	1458.71	832.385
1989	3735.17	1499.65	1315.55	848.801
1990	3772.94	1394.99	1195.81	850.617
1991	3816.46	1290.18	1096.66	840.956
1992	3817.56	1132.41	1030.77	840.772
1993	3975.64	1148.34	944.826	785.542
1994	3997.76	1043.93	929.422	762.911
1995	4190.94	1100.86	864.018	691.249
1996	4227.1	1058.14	867.849	656.5
1997	4437.07	1128.43	814.775	577.493
1998	4477.77	1089.23	835.719	536.586

DIRPA - Per capita disposable personal income (constant $)
E99SRPC - Per capita State expenditures (constant $)
R99SRPC - Per capita State revenues (constant $)
PFBLRPC - Per capita permanent fund balance (constant $)

1994, a value which is less than 90 percent of the starting value. This occurs while real disposable personal income per capita has increased by about 40 percent.

The constant per capita value of total state revenues also follows the pattern of petroleum revenues over time. However, the peak in real per capita terms occurs in 1984 at $1,888 and is a form of "leading indicator" of the problem which is developing in state finances but which has not yet surfaced. Total nominal revenues will continue to increase for another two years. By the end of the projection period, per capita revenues in constant dollars are far below the level of the late 1970s. The decline corresponds however to a rise in the tax burden on individuals since the personal income tax has a graduated schedule.

The permanent fund balance can be viewed in real or constant dollar terms, also. In constant dollars, the total in the fund, divided by the total population, reaches a maximum in 1990 at $851. After that time, however, increments to the fund cannot keep pace with the combined effects of population growth and inflation, and the constant dollar per capita value of the fund falls gradually. By 1998, its constant dollar per capita value is $537.

This basic simulation, employing fairly conservative state revenue and expenditure assumptions, has resulted in a very unhealthy situation for the state in the late 1980s and 1990s. A massive general fund deficit rapidly develops in spite of quite significant "belt tightening" to reduce state expenditures. It is natural to next investigate how the situation would be altered if there were a significant increase in the state's petroleum revenues. To this question, the next section is addressed.

C.4. Sensitivity of Basic Case to Increase in Petroleum Revenues

Any of a number of factors could result in petroleum revenues being much larger than projected in the base case. Higher production from existing fields, discovery of new fields, higher wellhead value, or higher tax rates would all result in larger state revenues. It is difficult to place a probability on any of these occurrences. Therefore, a second simulation of the economy was done in which the only change made was to increase the level of petroleum revenues received by the state by 25 percent beginning in 1983 (Table I.9). It is further assumed that the increase occurs in such a way that royalty and bonus income is unchanged and thus the level of contributions to the permanent fund is unchanged. Petroleum revenues increase approximately $500 million in each year in the mid-1980s.

In the aggregate, this allows slightly more rapid growth of the economy as reflected by the increase in population over the base simulation. The increase grows to 46 thousand people in 1992 and then begins to taper off. This reflects the fact that higher levels of government spending, made possible by the additional revenue, have generated jobs and incomes in the private sector of the economy.

Table I.9

Impact of An Increase in Petroleum Revenues
(Measured as the Change From The Base Case)

	RP8S	POP	E99S	SAVS	R99S
1977	0.	0.001	0.	0.	0.
1978	0.	0.001	0.	0.	0.
1979	0.	0.001	0.002	0.	0.
1980	0.	0.001	0.002	0.	0.002
1981	0.	0.001	0.005	0.	0.002
1982	0.	0.001	0.005	0.	0.
1983	417.38	4.937	98.344	0.	424.394
1984	494.29	8.081	157.535	0.	534.646
1985	528.77	10.793	205.361	0.	600.495
1986	534.81	13.446	251.791	0.	639.246
1987	485.85	15.905	293.776	0.	622.855
1988	424.87	31.639	645.182	-242.886	616.943
1989	366.45	29.541	607.274	-15.892	594.321
1990	316.24	33.092	661.963	-57.242	537.377
1991	272.35	30.66	583.879	71.411	493.461
1992	235.61	45.977	912.925	27.365	477.103
1993	203.71	27.174	392.491	506.219	398.336
1994	175.14	36.585	533.583	-45.525	267.445
1995	151.6	11.667	-56.297	376.275	220.957
1996	127.59	39.418	524.754	-458.925	177.728
1997	106.26	4.739	-184.879	562.759	190.185
1998	88.55	50.991	726.195	-708.106	151.676

RP8S - Increment to petroleum revenues (million $)
POP - Population change (thousand)
E99S - Expenditure change (million $)
SAVS - Reduction from desired expenditure level change (million $)
R99S - Total State revenues change (million $)

State government expenditures, partially determined by the level of available revenues, are considerably larger in the late 1980s and early 1990s than in the base case. The expenditure increase over the base case reaches a high of $913 million in 1992. After that, it falls rapidly and approaches the base case.[7]

The intended level of expenditures in this case need not be cut back as sharply as in the basic case, although the difference is not nearly as large as the increased tax revenues. The population increase has resulted in an increase in the desired level of state expenditures, and this has eroded a large percent of the gains to the state treasury from the additional petroleum revenues.

This occurs in spite of the fact that total state revenues increase by a multiple of the increase in petroleum revenues. For example in 1989, total revenues have increased by about $234 million over and above the increase in petroleum revenues, about 64 percent more than the revenue increase. The percentage by which the total revenue increment exceeds the petroleum increment continues to increase, but the total increment falls in later years.

In terms of two measures of personal well-being, there are slight improvements over the base case (Table I.10). Real disposable income

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[7] The difference shows large variation in later years because of the method by which expenditures are reduced from the targeted value. This method gives rise to some oscillatory behavior.

Table I.10

Impact of An Increase in Petroleum Revenues on Per Capita Variables

(Measured as the Change From The Base Case)

	DIRPA	E99SRPC
1977	-0.013	-0.002
1978	-0.01	-0.004
1979	-0.007	-0.004
1980	-0.01	-0.005
1981	-0.003	-0.001
1982	-0.016	-0.002
1983	25.78	41.748
1984	28.953	58.452
1985	29.633	65.85
1986	29.465	70.109
1987	27.857	71.66
1988	84.999	151.978
1989	43.272	141.417
1990	45.358	145.715
1991	17.708	122.769
1992	75.345	189.458
1993	-39.564	65.006
1994	11.261	83.472
1995	-98.707	-26.582
1996	26.457	57.524
1997	-109.652	-37.101
1998	54.219	57.474

DIRPA - Per capita disposable personal income change (constant $)
E99SRPC - Per capita State expenditure change (constant $)

per capita rises slightly as the average wage rate inches up in the 1980s because of a slightly higher percentage of higher than average paid employees find work. At the same time, state expenditures per capita in constant dollars show an increase temporarily as increases in expenditures occur faster than population growth. This advantage is eliminated in the late 1990s as expenditure levels must be cut back as in the base case.

Finally, one can compare the long-term fiscal position of state government in the base case with the case in which petroleum expenditures are 25 percent higher than expected. The 25 percent increase has a beneficial impact on balances in the short run; but in the long run, the cases are nearly indistinguishable. This result occurs because of the additional population growth generated by the additional state expenditures. In 1998 the state is in approximately the same position financially, but the population is considerably larger and revenue growth has not kept pace with expenditure growth.

To illustrate, in Table I.11. the ratio of total revenues to total expenditures is in this case observed to remain positive for exactly the same number of years as the base case. In fact, its pattern closely follows that of the base case. The permanent fund is able to contribute slightly less in this instance to total state revenues. In its year of maximum contribution, it provides 4.5 percent of revenues. The general fund balance is in a better position, however. In the base case, it

Table I.11

Impact of An Increase in Petroleum Revenues

on Indicators of State Financial Strength

(Measured as the Change From The Base Case)

	REVRAT	PFCON	GFBAL
1977	0.	0.	-0.001
1978	0.	0.	-0.
1979	-0.	0.	-0.002
1980	0.	0.	-0.002
1981	-0.	-0.	-0.005
1982	-0.	-0.	-0.01
1983	0.123	-0.001	326.038
1984	0.12	-0.002	705.368
1985	0.111	-0.002	1104.24
1986	0.099	-0.003	1496.85
1987	0.083	-0.003	1832.58
1988	0.007	-0.006	1839.22
1989	0.014	-0.006	1874.48
1990	-0.007	-0.007	1806.4
1991	-0.001	-0.006	1770.26
1992	-0.081	-0.011	1389.13
1993	0.018	-0.005	1398.31
1994	-0.049	-0.006	1128.19
1995	0.061	0.001	1399.64
1996	-0.05	-0.004	1050.64
1997	0.059	0.001	1417.73
1998	-0.061	-0.004	842.242

REVAT - Revenues/expenditures (change) (%)
PFCON - Permanent fund earnings/expenditures (change) (%)
GFBAL - General fund balance change (million $)

becomes negative in 1991. In the revised simulation, it remains positive until 1994. By the last year of the simulation, it shows $842 million less of a deficit than the base case, but it also appears to be declining at a more rapid rate.

To summarize this case in which petroleum revenues are unexpectedly 25 percent higher than originally assumed, the state's fiscal position improves. The improvement is surprisingly small, however, and in the long run, the state faces essentially the same deficit problem. It is aggravated, however, because in the interim, population growth has been more rapid. This introduces the possibility that it would be advantageous to increase the contribution rate to the permanent fund. To that case, the analysis now turns.

C.5. Sensitivity of Base Case to Increased Contribution Rate to the Permanent Fund

In the base case run, state expenditures are determined not only by population and income-related demands but also by the supply of funds available through the flow of revenues and the general fund balance. Since money deposited in the permanent fund could not be spent on the normal operation of state government, there was no direct link between the level of state spending and the permanent fund balance.

There is an indirect link, however, which must be investigated. To the extent that money is placed into the permanent fund, it reduces the level of the general fund. This, in turn, reduces the level of state expenditures. It is interesting to speculate about the impact on both the economy and the state's fiscal position of an increase in the permanent fund contribution rate.

A simulation was done to trace those impacts. All assumptions were identical to the base case with the exception that the contribution rate to the permanent fund was set at a maximum rate of 95 percent of bonuses and royalties. This allowed for a continued 5 percent contribution to the renewable resources development fund.

Two effects could be expected from this change. First, the aggregate growth of the economy would be reduced as a result of reduced government expenditures. Secondly, one would expect a change in the state fiscal position as a result. The permanent fund balance will obviously be much larger, but the current account of the state might either improve or deteriorate.

In Table I.12, the new larger permanent fund balance is shown. The balance in this case exceeds $5 billion by 1985 and $10 billion by 1993. Growth trails off in the 1990s as before. State expenditures reflect this siphoning off of general fund monies to the permanent fund. Throughout the 1980s, expenditures are lower in each year in this case. Surprisingly, however, in the 1990s state expenditures are higher in this case. This must be attributed to the much larger level of permanent fund earnings which is being generated and distributed to the general fund. These

Table I.12

Impact of 95% Permanent Fund Contributions

Rate on Selected Variables

(Measured as the Change From The Base Case)

	PFBAL	E99S	POP
1977	0.	0.	0.
1978	168.	0.	0.058
1979	512.848	-118.297	-6.978
1980	910.259	-355.021	-20.859
1981	1344.45	-293.331	-17.286
1982	1845.91	-301.534	-18.205
1983	2420.51	-331.336	-20.242
1984	3060.13	-367.077	-22.411
1985	3749.51	-408.708	-24.675
1986	4454.92	-452.835	-26.895
1987	5092.83	-579.501	-32.725
1988	5645.01	-577.542	-32.476
1989	6114.58	-595.238	-33.783
1990	6514.07	-280.663	-21.968
1991	6853.62	-187.771	-20.162
1992	7142.69	404.897	3.729
1993	7389.39	79.436	-8.924
1994	7599.64	619.993	16.435
1995	7779.66	160.141	-1.851
1996	7931.22	801.758	31.19
1997	8058.87	277.402	7.551
1998	8166.43	1229.54	58.139

PFBAL - Permanent fund balance change (million $)
E99S - State expenditures change (million $)
POP - Population change (thousands)

additional revenues in the 1990s more than offset the increased level of withdrawals into the permanent fund by that time.

Aggregate growth of the economy as measured by the difference in population from the base case has slowed considerably because of the reduction in state expenditures. By 1989 the level is nearly 34 thousand less. Then, however, the situation rapidly reverses itself and population growth becomes more rapid, reflecting the increase in the level of state expenditures occurring in the 1990s.

In personal terms, this forced saving has had two distinct effects (Table I.13). The level of per capita real disposable personal income has declined during the years of the most stringent forced saving during the 1980s. This reflects the fact that the average wage rate of the foregone employment exceeds that of the average employee in the state. After the period of maximum forced savings, the situation reverses itself and disposable personal incomes are actually higher than in the base case.

The level of real state expenditures per capita follows a pattern of divergence from the base case which is similar to that of disposable personal income. During the period of maximum saving, the reduction in expenditures exceeds the reduction in the rate of population increase, so that there is a significant real decline from the growth observed in the base case. As with disposable personal income, however, the trend is reversed in the 1990s. Although expenditures are not at their

Table I.13

Impact of 95% Permanent Fund Contributions

Rate on Per Capita Variables

(Measured as the Change From The Base Case)

	DIRPA	E99SRPC
1977	0.	0.
1978	0.357	-0.251
1979	-43.73	-82.857
1980	-97.84	-217.342
1981	-29.917	-154.047
1982	-31.256	-142.762
1983	-29.052	-141.755
1984	-24.911	-138.27
1985	-21.457	-135.209
1986	-18.719	-132.479
1987	-33.807	-155.451
1988	-15.972	-148.025
1989	-13.072	-146.661
1990	51.689	-53.353
1991	44.554	-23.245
1992	141.345	115.848
1993	40.483	37.861
1994	140.067	134.461
1995	21.82	41.601
1996	135.668	124.494
1997	8.211	43.816
1998	147.812	127.814

DIRPA - Per capita disposable income change (constant $)
E99SRPC - Per capita State expenditures change (constant $)

desired level in this case as they are not in the basic case, the expenditure level per capita is considerably higher.

What has essentially happened is that the decreased rate of spending brought about by increased permanent fund contributions has caused aggregate growth to moderate, but has also allowed a much larger balance to develop in the permanent fund. Some sacrifice in the current level of expenditures has been traded off against a somewhat higher expenditure level in the future and attendant higher aggregate growth rate.

In terms of the fiscal position of the state, the ratio of revenues to expenditures appears considerably more healthy in the long run. Rather than falling less than 1.0 in 1987 as in the base case, it remains greater than one until 1992. It does, as in the base case, continue to fall but the ratio over the period is higher than in the base year. The percentage of revenues contributed by the interest generated by the permanent fund is considerable. From 1989 to 1991, it exceeds 20 percent. However, this high contribution rate is not sustainable in the long run as the percentage falls to 10 percent by 1998, its approximate value in 1982.

Unfortunately, the position of the general fund balance is worse in this case. It never rises much above a bare minimum level in the 1980s, goes negative in 1988 as opposed to 1991 in the base case, and by the end of the simulation period has a negative value exceeding the base case by about $1.6 billion.

Table I.14

Impact of 95% Permanent Fund Contributions

Rate on Indicators of State Financial Strength

(Measured as the Change From the Base Case)

	REVRAT	PFCON	GFBAL
1977	0.	0.	0.
1978	0.	0.	-167.94
1979	0.092	0.	-412.211
1980	0.28	0.	-533.058
1981	0.189	0.052	-718.08
1982	0.187	0.067	-935.013
1983	0.2	0.084	-1179.96
1984	0.206	0.096	-1438.37
1985	0.201	0.106	-1687.13
1986	0.192	0.115	-1887.73
1987	0.207	0.128	-1886.07
1988	0.203	0.141	-1777.97
1989	0.221	0.158	-1510.61
1990	0.148	0.15	-1373.04
1991	0.152	0.153	-1145.85
1992	0.033	0.135	-1315.56
1993	0.124	0.136	-1079.57
1994	0.005	0.117	-1320.32
1995	0.11	0.115	-1031.09
1996	-0.003	0.095	-1340.04
1997	0.09	0.092	-1022.04
1998	-0.025	0.073	-1593.57

REVAT - revenues/expenditures (change) (%)
PFCON - Permanent fund earnings/expenditures (change) (%)
GFBAL - General fund balance change (million $)

C.6. Conclusions

In each of the three simulations, the general fund balance becomes negative in the 1990s. This occurs in spite of a fairly moderate growth rate of state expenditures. Attempts to relieve the situation by a fortunate increase in petroleum expenditures or by an increase in the contribution rate to the permanent fund do not eliminate the basic problem but rather only change its dimensions. In the long run, the state is facing a substantial deficit.

Changing the level of expenditures in the present affects not only how much revenue will be available directly but also indirectly, as expenditures generate increased demand for expenditures through population increase. Recognition of this basic fact naturally leads to the concept of planning the present level of expenditures not only to satisfy present needs, but also in anticipation of future needs and with the idea of attempting to develop a superior spending strategy not only from the point of view of the present fiscal year but also from the point of view of future years.

With this in mind, the next section analyzes the case where a more active approach to the management of state expenditures and the permanent fund is employed in an attempt to maximize benefits of state government in the long run.

D. Target Expenditure Growth Rates

The simulations examined under section C are clearly not feasible because of the large, negative general fund balances which are generated in spite of significant cutbacks from desired levels of expenditures. Allowing expenditures to grow in an unplanned manner leads to an untenable situation. A more reasonable approach to simulating the future of the economy would be to impose the constraint that, in the long term, the budget for state government should balance. This being the case, a more specific expenditure target may be established as a goal.

Since the demand for state expenditures is closely correlated with growth in population, the level of prices, and personal income, a reasonable target for expenditure growth would be to link it to increases in these factors. Thus, if long-run population growth is 3 percent annually, inflation is 5 percent, and the growth in personal income is 1 percent, then the rate of increase in state expenditures would need to be 9 percent. If this were the expenditure growth rate, then real state expenditures per capita would increase 1 percent and the income elasticity of state expenditures would be unity. In general, the income elasticity of state government expenditures in most states has historically been near unity or slightly above.[8] As noted previously, the average income elasticity in Alaska has exceeded unity since statehood.

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[8] The price elasticity might have been greater than -1 also.

A set of simulations was performed under the assumption of unitary income elasticity of state expenditures. Because of population and employment increases, the rate of growth of total expenditures was on the average 10.5 percent for the decade 1979-1989.[9] The two simulations differed in their treatment of tight fiscal situations.

The basic result in both instances was that the state stayed within its long-run fiscal constraint and in the final simulation year was still registering a positive general fund balance. In fact, in each case supplementary contributions were made during the simulation period to the permanent fund, and some of this money in the "interim" fund remains in each case.

However, in order to obtain these results, it is necessary to pull back from the target level of expenditure growth in each case--gradually in the former and precipitously in the latter. The pattern of expenditure growth in the two cases is compared in Table I.15. On the left is a case

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[9] When attempting to target growth in expenditures, it is important to keep in mind that the rate of population increase and perhaps price increase is not, in Alaska, independent of the growth rate in expenditures itself. This is most pronounced regarding population. For example, if one is attempting to target growth to be unitary elastic with respect to personal income per capita, estimates of population growth and inflation are necessary. If one assumes 2 percent, 5 percent, and 1 percent as the growth rates in population, prices, and income, respectively, then an increase of 8 percent in total expenditures would be targeted. However, if actual population growth were 4 percent because of migration to the state induced by growth in state expenditures, then the actual change in real per capita expenditures would be negative and would be equivalent to a 1 percent reduction per capita in real expenditures.

Table I.15

State Expenditures Growth Under Two Forms of

The Unitary Income Elasticity Target

	PRT.1.1	PFD.8.1
1977	1099.65	1099.65
1978	1271.17	1271.17
1979	1385.2	1385.2
1980	1550.86	1550.86
1981	1839.38	1839.37
1982	2067.21	2067.2
1983	2164.9	2164.87
1984	2307.23	2307.17
1985	2508.6	2508.56
1986	2762.11	2762.07
1987	3046.73	3046.78
1988	3377.95	3377.94
1989	3762.7	3762.69
1990	4218.49	4061.85
1991	4739.22	4004.61
1992	5337.26	3795.62
1993	6018.99	3669.65
1994	3576.13	3696.35
1995	3052.87	3842.31
1996	3144.33	4010.37
1997	3456.16	4197.45
1998	3888.96	4451.29
1999	4422.32	4791.29

PRT.1.1 - Target growth - no anticipation of revenue shortfall
PFD.8.1 - Target growth - shortfall in revenue anticipation

where growth at the targeted rate continues as long as possible. In 1994 the state suddenly realizes that the target rate cannot be sustained and a severe downward adjustment in expenditures occurs in that year. Expenditures are $3.250 billion less than targeted in that year and fall from $6.018 to $3.576 billion. From that point forward, expenditures resume their growth but at a much reduced level. In the other case, the collapse is anticipated somewhat by a decline in the current account surplus and the balance in the general fund, so that there is a somewhat smoother transition to the period of lower revenues. Expenditure growth falls off for a few years in a gradual manner and then resumes increasing, but it never regains the target level.

In both of these cases, the more moderate rate of increase in expenditures also has a moderating influence on the increase in aggregate economic activity which operates throughout the simulation period. This makes the target level of expenditures defined in per capita terms easier to reach.

The reduction in the rate of growth of expenditures in these simulations causes a reduction in real state expenditures per capita from the base case previously analyzed (Table I.16). A comparison of the base case with the case in which the downturn is anticipated indicates that the latter peaks at a level about $180 less than the former. From that time forward, the relationship between the two is not predictable because of the way in which the two are responding to necessary cuts in

Table I.16

Real Per Capita State Expenditures in Three Simulations

	PRF.5.1	PFD.8.1	PRT.1.1
1977	1186.79	1185.25	1185.25
1978	1280.2	1279.2	1279.2
1979	1272.4	1282.35	1282.35
1980	1323.62	1265.61	1265.61
1981	1423.89	1358.48	1358.48
1982	1509.34	1447.27	1447.27
1983	1534.1	1427.93	1427.92
1984	1582.43	1418.23	1418.23
1985	1627.79	1425.39	1425.38
1986	1666.4	1448.33	1448.35
1987	1681.4	1468.23	1468.22
1988	1606.29	1490.01	1490.01
1989	1499.65	1510.81	1510.82
1990	1394.99	1497.01	1537.09
1991	1290.18	1389.44	1561.97
1992	1132.41	1254.58	1587.55
1993	1148.34	1146.15	1605.79
1994	1043.93	1077.05	1023.05
1995	1100.86	1038.16	846.97
1996	1058.14	1000.62	811.646
1997	1128.43	961.413	815.383
1998	1089.23	929.007	829.628
1999	1184.03	902.506	844.007

PRF.5.1 - Historical growth patterns (constant $)
PFD.8.1 - Target growth - shortfall in revenues anticipated (constant $)
PRT.1.1 - Target growth - no anticipation of revenue shortfall (constant $)

expenditures. The fall in state expenditures per capita in the case of the precipitous reduction of state expenditures is more severe.

The fiscal position of the case in which the downturn is anticipated is relatively healthy. The level of the permanent fund is the same as in the base case. The general fund is positive in all periods and, in addition, there is a large amount of money which is neither in the general or permanent fund but which is available to pay for future cash shortages which the state may incur (Table I.17). This has been built up rapidly in the early 1980s and is only beginning to be drawn down in 1998. Together with the general fund balance, this account is larger than the permanent fund until almost the end of the projection period. Given a strict target approach to expenditure growth, it becomes incumbent upon policy makers to consider how to treat the large amounts of money which will be accumulating outside of the permanent fund in the 1980s. The sums make those in the permanent fund seem relatively small by comparison.

The case of targeted growth where the downturn in revenues is anticipated and adjusted exhibits different behavior from the case where growth in expenditures continues blindly until a massive cutback is required. The differences between the anticipated downturn and the abrupt downturn are presented for certain variables in Table I.18. The difference in population is a clear reflection of the different expenditure patterns. Population expands more rapidly where the downturn is not anticipated, but then is abruptly lower after the readjustment of

Table I.17

Position of State Funds in Case of Targeted Growth With Anticipation of Downturn

	PFBAL	GFBAL	PFSUPBL
1977	2.4	570.081	0.
1978	62.4	461.377	0.
1979	185.56	547.732	0.
1980	327.492	861.622	0.
1981	482.56	1177.55	0.
1982	661.655	1535.35	0.
1983	1268.8	1669.32	401.932
1984	2096.97	1869.23	1001.66
1985	3003.44	2089.32	1661.93
1986	3869.3	2293.96	2275.85
1987	4097.12	2855.01	2275.85
1988	4294.33	3076.17	2275.85
1989	4462.03	2920.22	2275.85
1990	4604.7	2475.66	2275.85
1991	4725.97	2040.77	2275.85
1992	4829.21	1738.54	2275.85
1993	4917.31	1528.68	2275.85
1994	4992.4	1353.67	2275.85
1995	5056.69	1148.99	2275.85
1996	5110.82	927.995	2275.85
1997	5156.41	722.345	2275.85
1998	5005.91	722.337	2086.94
1999	4869.16	722.328	1917.8

PFBAL - Permanent fund balance (million $)
GFBAL - General fund balance (million $)
PFSUPBL - Supplemental fund balance (million $)

Table I.18

Differences Between Targeted Growth Without

Foresight and With Anticipation of Downturn

(Measured as the Difference From the No Foresight Case)

	POP	GFBAL	PFBAL	E99SRPC
1977	-0.	0.	0.	0.001
1978	-0.	0.167	0.	0.002
1979	-0.	-86.188	90.733	0.001
1980	0.	-400.08	418.789	0.002
1981	0.001	-706.006	730.018	0.004
1982	0.002	-1053.81	1086.55	-0.002
1983	0.007	-1177.78	1223.33	-0.008
1984	0.01	-1367.69	1428.16	0.003
1985	0.009	-1577.78	1656.14	-0.01
1986	0.	-1772.42	1872.01	0.016
1987	-0.002	-2323.47	2447.78	-0.016
1988	-0.001	-2534.63	2690.88	0.003
1989	-0.002	-2378.68	2571.2	0.009
1990	5.617	-1934.13	2036.59	40.081
1991	26.563	-1499.25	1048.45	172.526
1992	57.174	-1197.02	-442.039	332.97
1993	90.118	-1200.35	-2275.86	459.641
1994	12.974	-1095.21	-2275.85	-54.004
1995	-12.229	-880.529	-2132.61	-191.191
1996	-18.398	-649.533	-1958.26	-188.973
1997	-17.966	-433.884	-1841.87	-146.03
1998	-15.155	-423.877	-1629.72	-99.378
1999	-10.924	-423.882	-1528.11	-58.499

POP - Population change (thousands)
GFBAL - General fund balance change (million $)
PFBAL - Permanent fund balance change (million $)
E99SRPC - Per capita expenditure change (constant $)

expenditures. It appears to be gradually approaching the level of population in the anticipation case as the simulation ends. The general fund balance must be combined with the permanent fund balance which now includes some supplementary contributions in order to obtain an idea of which expenditure pattern gives the state a larger balance at the end of the period. The two strategies give almost identical results in early years;[10] but after about 1990, the case with the abrupt drop is clearly second best in terms of funds left in reserve for any kind of financial emergency.

Finally, the pattern regarding real state expenditures per capita shows neither case to be clearly superior. For a few years when state spending is being gradually reduced in the one case, expenditures per capita increase relatively in the other case. When the massive cutback comes, however, the situations are rapidly reversed. In the extremely long run, the differences appear to be mitigating.

These two simulations, with growth targeted so that the increase in state expenditures follows a path of unitary income elasticity, are interesting in identifying the rather severe constraints upon the continued expansion of the public sector existing in the long run. Since at the end of the simulation period, there was some money still available for spending in the state treasury, it is interesting to look at the case

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[10] There are minor differences introduced by the fact that the different fund mix in the two cases results in slightly differing overall earnings rates on government investments.

of a slightly more rapid growth than unitary elasticity. To accommodate this, a simulation was performed in which state expenditures grew at a unitary income elasticity rate plus 1 percent (independently set). This analysis was applied to the base case where the impending revenue shortfall was anticipated and thus somewhat smoothed out.

The most striking implication of the examination of this case in relation to the unitary income elasticity case is that the cumulative effect of a small increment to the growth rate has a very substantial effect after a few years. In the long run, the level of aggregate activity in these two cases is nearly identical with both recording a population in 1998 of approximately 897 thousand (Table I.19). In the interim, the case with the 1 percent increment to state expenditure growth has a slightly higher level of population which at one point exceeds 21 thousand. Comparison of real per capita state expenditures shows clearly the more rapid growth rate in the 1 percent increment case until the time when prudence requires that expenditure levels be cut back in both cases. Then the high growth case is cut back more rapidly than the other and in later years, per capita expenditures lag those of the slower growth case. This indicates less of a need for continuous cutbacks in the latter case. Interestingly, after ten years of growth at a rate of 1 percent higher than the base case, total state expenditures have risen to 12 percent higher in the rapid growth case. The target increase has been compounded by other factors--primarily population growth.

Table I.19

Differences Between Greater Than Unitary Income

Elasticity Growth Case and Unitary Income

Elasticity Growth Case

(Measured as the Difference From The Unitary

Elasticity Case)

	POP	E99SRPC	E99S	PFBAL
1977	-0.	0.001	0.	0.
1978	-0.	0.002	0.	0.
1979	0.556	6.188	9.223	0.
1980	1.463	14.312	24.413	0.
1981	2.725	23.49	46.077	0.
1982	4.321	34.274	73.795	0.
1983	6.139	45.389	104.846	-401.932
1984	8.241	56.082	141.136	-504.135
1985	10.722	66.652	185.304	-640.084
1986	13.739	77.299	239.821	-1254.01
1987	17.323	88.469	307.118	-1254.01
1988	21.58	99.876	390.01	-1254.01
1989	20.454	64.694	317.471	-1254.
1990	7.851	-44.283	-73.328	-1254.
1991	-0.934	-100.6	-309.976	-1254.
1992	-1.537	-91.267	-296.193	-1254.
1993	0.465	-65.755	-214.272	-1254.
1994	1.426	-52.506	-176.092	-1253.99
1995	1.116	-50.772	-184.772	-1495.49
1996	0.322	-52.445	-211.32	-1746.58
1997	-0.407	-53.542	-238.721	-1977.06
1998	-0.799	-53.172	-261.465	-2001.23
1999	-0.676	-49.841	-269.824	-1917.78

POP - Population change (thousands)
E99SRPC - Per capita expenditure change (constant $)
E99S - Expenditure change (million $)
PFBAL - Permanent fund balance change (million $)

The final general fund balances in both cases are nearly identical, but this is not true of other fund balances. The more rapid growth case exhausts any balances that were saved for a financial problem by the end of the simulation period, and the state is left with zero balances except for the nearly $3 billion in the permanent fund. This is in contrast to the $2 billion available for emergencies in the base case, in addition to the $3 billion in the permanent fund in that case.

A small increase in the rate of expenditure growth can thus have a quite substantial impact on the state fiscal balance of the state in the long run. Earlier, it was shown what the impact of a significant increase in petroleum revenues would be on the economy in the case of a state spending program that was not targeted to demand growth. Much of the increase in revenues was devoured by population increase when the state tried to take advantage of the money.

To see what would be the case if the increase in revenues were instead used to extend further into the future the day at which state expenditures would need to be reduced from their target level, a final simulation was done using the unitary elasticity target. The only difference in this case was that as in an earlier simulation, petroleum revenues were increased by 25 percent in 1983 and for every succeeding year.

There are two primary impacts of this change. The first is that the state need not fall back from its target growth rate in 1994. It can continue its program for an additional three years until 1997 (Table I.20). Thus, the "day of reckoning" is indeed extended a considerable distance into the future by a combination of increased revenues and conservative expenditures.

Unfortunately, when the required reduction in expenditures comes, it is more than twice as severe. In the base case, expenditures must be reduced from target by $3.250 billion while in the expanded revenue case, the one time reduction required is $6.666 billion, a mere three years later. This underscores the importance of anticipation of downturn in revenues in order to help smooth out economic fluctuations caused by massive swings in the level of state expenditure. It also raises the possibility of more sophisticated methods for both anticipating revenue "busts" and adjusting to them. The final section of this part of the study investigates that idea.

Table I.20

Targeted State Expenditures in Cases of

Different Levels of Petroleum Revenues

(Million $)

	PRT.1.1	PRT.1.2
1977	1099.65	1099.65
1978	1271.17	1271.17
1979	1385.2	1385.2
1980	1550.86	1550.86
1981	1839.38	1839.38
1982	2067.21	2067.21
1983	2164.9	2164.9
1984	2307.23	2307.23
1985	2508.6	2508.6
1986	2762.11	2762.11
1987	3046.73	3046.73
1988	3377.95	3377.95
1989	3762.7	3762.7
1990	4218.49	4218.49
1991	4739.22	4739.22
1992	5337.26	5337.26
1993	6018.99	6018.99
1994	3576.13	6831.1
1995	3052.87	7824.02
1996	3144.33	9022.16
1997	3456.16	3882.53
1998	3888.96	2881.43
1999	4422.32	2888.72

PRT.1.1 - Targeted growth
PRT.1.2 - Targeted growth with additional revenues

E. Targets Which Take the Supply of Revenues into Account

The simulation experiments which have been reported thus far have included consideration of the long-run availability of revenues only very generally, if at all. The first series was predicated on the assumption that revenues would be spent more or less when they became available. The second series ignored the short-run level of revenues available for the state to spend and assumed that policy makers would attempt to hit a target rate of expenditure growth. When the target was no longer feasible, a fairly arbitrary downward adjustment in expenditure growth and expectations occurred.

Reexamining that series of simulations, it becomes clear that there exist a variety of growth patterns of state expenditures (and through linkages, the total economy) which will result in the state's finances as well as the private economy being in essentially equivalent positions after a number of years. Recognizing this fact, the question arises whether there is one path of growth, for example between the years 1977 and 1999, which among those paths that reach an equivalent point in 1999, which is to be preferred. For example, there are many growth paths which will just eliminate the general fund balance in the year 1999. Some subset of those paths will reach 1999 with essentially the same population, employment, and personal income. The question is--among that set is one to be preferred above all others? One path, for example, would be that of targeting expenditure growth as long as possible and then backing off.[11]

In this section, three simulations are compared which assume different types of response by the state government to the recognized long-term pattern of state revenues. The initial case is similar to the target growth rate case introduced in the previous section. As before, expenditures are targeted to grow according to the rule of unitary elasticity of income. In this case, the growth continues as long as possible and then a sudden downward adjustment is necessary in expenditures. The adjustment results in a negative general fund balance which exceeds $2 billion in 1999 (Table I.21). The negative balance is not increasing very fast by that time though, indicating the finances of the state are beginning to stabilize at this lower level. Over a five-year period, an alternative source of revenues might be found to eliminate this deficit.

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[11] It is not possible to sustain a target growth rate which results in a constant percentage of expenditures being financed by permanent fund earnings. Such a result is possible in the short run but not the long run, if increments to the permanent fund base decline as projected in this paper. To provide a constant percentage of expenditures, the following equality would need to hold between the growth rate of the permanent fund and the growth rate of state expenditures (assuming desired expenditure growth followed the unitary income elasticity rule):

annual increase in permanent fund base = annual rate of population increase + annual rate of price increase + annual rate of personal income per capita.

Table I.21

Targeted Growth With Maximum Use of Supplemental Fund

	GFBAL	PFSUPBL	PFSUP	WPFSUP	EXPFPER
1977	570.081	0.	0.	0.	0.
1978	461.544	0.	0.	0.	0.25
1979	461.543	90.733	90.733	0.	0.434
1980	461.542	418.789	328.056	0.	0.828
1981	471.542	730.018	311.229	0.	0.752
1982	481.541	1086.55	356.532	0.	0.748
1983	491.541	1625.27	538.715	0.	0.906
1984	501.54	2429.83	804.56	0.	1.131
1985	511.54	3318.07	888.24	0.	1.152
1986	521.539	4147.86	829.799	0.	1.073
1987	531.538	4723.64	575.776	0.	0.882
1988	541.538	4966.74	243.103	0.	0.558
1989	541.537	4847.05	0.	119.68	0.25
1990	541.534	4312.44	0.	534.61	0.25
1991	541.525	3324.3	0.	988.141	0.25
1992	541.517	1833.82	0.	1490.48	0.25
1993	328.33	0.	0.	1833.82	0.25
1994	-981.752	0.	0.	0.	0.25
1995	-1591.	0.	0.	0.	0.25
1996	-1880.4	0.	0.	0.	0.25
1997	-2071.08	0.	0.	0.	0.25
1998	-2260.83	0.	0.	0.	0.25
1999	-2466.92	0.	0.	0.	0.25

GFBAL - General fund balance (million $)
PFSUPBL - Supplemental fund balance (million $)
PFSUP - Additions to supplemental fund (million $)
WPFSUP - Withdrawals from supplemental fund (million $)
EXPFPER - Permanent and supplemental fund contribution rate (%)

This unitary elasticity case differs from those done previously in the assumption that the general fund balance is kept to a minimum level necessary to maintain short-term fiscal solvency. Everything over and above that amount, net of what is deposited into the permanent fund, goes into a fund which may be, and indeed is in all simulations, drawn down when revenues in excess of current receipts are required. Assuming that the contributions to this fund are derived from the same base of royalties and bonuses as the permanent fund, the combined contribution rate to the permanent fund and this interim fund can be calculated. It is simply the amount which is left over from revenues in any year after expenditures and after maintenance of the level of the general fund. Since a contribution rate to the permanent fund of 25 percent is assumed, this combined contribution rate cannot fall below 25 percent. For a period of 14 years, this interim fund is in existence. During its first ten years, from 1979 to 1989, contributions are being made into the fund, and its balance is increasing. During the next four years, the increasing needs of the state drive the balance to zero.

During its existence, this fund is much larger than the permanent fund and thus potentially much more important in the short run as an instrument of state policy. In 1988 when it reaches its peak level of $4.967 billion, the permanent fund contains $2.081--approximately 40 percent as much. The fund is, in a sense, like the investment fund established after the receipt of the Prudhoe Bay bonus sale revenues. The funds may not be immediately necessary but will be in the long run.

The pattern by which the fund rises strongly and steadily for ten years and then falls precipitously is indicative of the fact that to maintain a target expenditure level early, those funds will not be needed; but when they become necessary, their existence and availability are critical. When their sustaining power is rapidly depleted, state expenditures fall rapidly.

In contrast to this base case are two simulations which explicitly take into account the cyclical nature of state revenues during all time periods. In each of these cases, there is a lower targeted growth rate. Expenditures in real terms per capita should not decline. Thus, expenditure increases are linked directly to both increases in population and increases in prices.

Expenditure increases are not linked to changes in personal income levels. Rather they are tied into changes in state revenue prospects in terms of petroleum revenues. In one case, expenditures are programed to rise faster when the level in the permanent fund balance is rising faster. This expenditure growth responds to a measure of how rapidly the state is accumulating revenues. In the other simulation, expenditures rise more rapidly when the level of expected future petroleum-related revenues increases. Since non-petroleum-related revenue growth follows the growth of state personal income in a fairly smooth manner, it is not necessary to include that component of revenue. It is the petroleum revenues where the greater future uncertainty lies and, thus, changes in the rate of expenditure growth should respond to changes in expectations regarding this highly variable component of income.

To show why one only need consider the variability in petroleum income, reference is made to Table I.22, where the relationship between state non-petroleum revenues and Alaska personal income is shown. The ratio of taxes to personal income has remained fairly constant since statehood, falling near 13-14 percent in most years. In a crude way, it could be said that this is the underlying long-run constraint on state expenditures. Without direct petroleum revenues, they must remain no greater than 14 percent of personal income. Petroleum revenues let the 14 percent constraint be ignored, but only as long as petroleum revenues remain. When they disappear, the underlying relationship between revenues and personal income resurfaces and reasserts itself. Thus, changes in the rate of expenditure growth can be made in relation to changes in expected or received petroleum revenues because of the underlying consistent growth of other revenues.

It is interesting to note in Table I.22 that the constant ratio between revenues and personal income implies unitary income elasticity of non-petroleum state revenues. Net of petroleum revenues or some other large exogenous revenue source, the state is not approaching a position where state revenues represent the equivalent of 20 percent of personal income. Recall from Table I.3 that state expenditures approach that percentage. The economy is not "taking off" in the

Table I.22

Non Petroleum Related Revenues

And

Alaskan Personal Income

	Alaska Non Petroleum Related Revenues 1 (million $)	Alaska Personal Income (million $)	Ratio (percent)
1961	69.86	651	10.7
1962	93.21	679	13.7
1963	80.77	710	11.4
1964	119.22	797	15.0
1965	137.46	864	15.9
1966	131.45	934	14.1
1967	150.87	1042	14.5
1968	140.51	1126	12.5
1969	162.63	1266	12.8
1970	182.95	1443	12.7
1971	225.33	1575	14.3
1972	248.48	1739	14.3
1973	290.83	2004	14.5
1974	311.95	2402	13.0
1975	444.07	3324	13.4
1976	581.51	3810	15.3
Average			13.6

1 Total revenues minus general fund interest (primarily from Prudhoe Bay lease sale proceeds) production, property, and reserves tax, leases, bonuses, royalties, and federal shared royalties.

sense of automatically channeling a larger percentage of income into state revenues as its size increases.

Linking the growth in real expenditures per capita in the state to a long-run measure of "non-recurrent" revenues, rather than personal income growth, produces somewhat different total expenditure growth patterns from the base case. Table I.23 contrasts state expenditures in the base case of unitary income elasticity of expenditures with the two modified expenditure strategies.

In the case where expenditures are linked to expected future revenues (actually the present value of the expected revenues over a ten-year period), growth in early years exceeds the base case because large future revenues are anticipated. As the revenues are actually received and the production in the field declines, so do expectations of further revenues and thus, expenditure growth. As the growth rate falls, total expenditures lag the base case. Eventually, they recover to end the simulation period at a level almost identical with the base case.

In the other simulation where the option was to increase expenditure growth only when revenues are received, the pattern is just the opposite. In early years, expenditure growth is slow as the level of revenues channeled into the permanent fund is low. Later with a large balance in the permanent fund, it is possible to make larger expenditures over the preceding years. This policy, however, can only be applied until

Table I.23

State Expenditures in Three Modified Target Cases

(Million $)

	PRT.2.1	PRT.2.2	PRT.2.4
1977	1099.65	1099.65	1099.65
1978	1271.17	1271.17	1271.17
1979	1385.2	1406.23	1360.44
1980	1550.86	1579.94	1476.51
1981	1839.38	1837.03	1675.57
1982	2067.21	2067.35	1859.9
1983	2164.9	2230.94	2001.62
1984	2307.23	2433.	2207.55
1985	2508.6	2669.95	2486.27
1986	2762.11	2934.58	2840.75
1987	3046.73	3212.77	3264.29
1988	3377.95	3515.96	3766.46
1989	3762.7	3846.7	4344.32
1990	4218.49	4216.24	4998.36
1991	4739.22	4619.46	5710.03
1992	5337.26	5063.42	6469.13
1993	6018.99	5547.88	5143.04
1994	5121.05	4738.36	4184.22
1995	4200.83	4146.41	3882.68
1996	3833.58	3943.47	3895.25
1997	3879.9	3978.74	4050.57
1998	4160.94	4161.51	4300.56
1999	4570.73	4450.03	4632.91

PRT.2.1 - Smooth growth
PRT.2.2 - Growth linked to expected revenues
PRT.2.4 - Growth linked to present fund balance

the saved revenues are depleted. Expenditures fall rapidly and finally approach the long-run growth of the other two cases.

The relative movements of aggregate economic variables in the three cases have comparable patterns as rapid expenditure growth stimulates rapid economic expansion and more moderate expenditure growth causes lower rates of increase in population, employment, and personal income (Table I.24). By 1999, however, all three cases are essentially back on the same growth track in terms of employment with less than 1 percent difference among them.

Per capita state expenditures measured in constant dollars, because of the parallel movements of total state expenditures and population, also have patterns similar to the patterns of total expenditures (Table I.25). Each of the special cases has one time period when per capita real expenditures exceed the base case comparable year and one period when expenditures per capita lag the base case. When expenditures are tied to expected revenues, the "bulge" occurs early and when tied to received revenues, it occurs later.

One variable displays a somewhat different pattern from those presented thus far. Total state revenues per capita in constant dollars falls relative to the base case when expenditure growth is linked to expected revenues (Table I.26). It returns on track in the 1990s but never exceeds the base case. In the case where growth is linked to revenues received, there is a period through 1987 when per capita

Table I.24

Employment Levels in Three Modified Target Cases

(Thousand)

	PRT.2.1	PRT.2.2	PRT.2.4
1977	187.487	187.487	187.487
1978	192.029	192.029	192.029
1979	201.316	202.068	200.365
1980	220.719	221.682	217.968
1981	232.928	232.68	227.114
1982	233.345	233.12	226.214
1983	236.415	238.298	230.883
1984	243.346	247.014	239.929
1985	253.07	257.657	251.99
1986	263.693	268.463	265.584
1987	276.056	280.478	281.794
1988	290.201	293.616	300.458
1989	306.862	308.64	321.963
1990	325.256	324.583	345.187
1991	345.603	341.723	370.111
1992	367.843	359.869	396.168
1993	393.956	380.739	370.468
1994	380.93	369.801	355.927
1995	369.425	366.75	360.533
1996	373.946	375.445	374.704
1997	391.916	392.88	395.188
1998	418.294	416.357	420.463
1999	451.459	445.813	451.231

PRT.2.1 - Smooth growth
PRT.2.2 - Growth linked to expected revenues
PRT.2.4 - Growth linked to present balance

Table I.25

Real Per Capita State Expenditures in Three Modified Target Cases

	PRT.2.1	PRT.2.2	PRT.2.4
1977	1185.25	1185.25	1185.25
1978	1279.2	1279.2	1279.2
1979	1282.35	1297.56	1264.65
1980	1265.61	1283.9	1219.04
1981	1358.48	1357.14	1267.4
1982	1447.27	1447.97	1342.37
1983	1427.92	1461.03	1354.92
1984	1418.23	1475.03	1382.57
1985	1425.38	1490.83	1427.26
1986	1448.35	1510.61	1489.09
1987	1468.22	1521.2	1551.97
1988	1490.01	1528.46	1615.27
1989	1510.82	1529.78	1671.26
1990	1537.09	1532.48	1721.58
1991	1561.97	1532.28	1758.47
1992	1587.55	1532.1	1782.83
1993	1605.79	1524.69	1426.41
1994	1338.42	1272.88	1147.58
1995	1081.53	1078.27	1015.74
1996	941.403	968.977	952.27
1997	883.755	907.404	913.728
1998	864.578	870.625	887.189
1999	856.098	845.002	865.757

PRT.2.1 - Smooth growth (constant $)
PRT.2.2 - Growth linked to expected revenues (constant $)
PRT.2.4 - Growth linked to present fund balance (constant $)

Table I.26

Real Per Capita State Revenues in Three Modified Target Cases

	PRT.2.1	PRT.2.2	PRT.2.4
1977	1218.35	1218.35	1218.35
1978	1156.23	1156.23	1156.23
1979	1428.6	1424.98	1433.21
1980	1597.67	1592.44	1612.37
1981	1650.26	1649.85	1682.71
1982	1764.94	1763.19	1812.35
1983	1865.03	1852.32	1915.36
1984	2001.19	1977.52	2051.19
1985	2016.69	1985.23	2058.4
1986	1958.25	1922.75	1985.32
1987	1791.35	1756.06	1800.64
1988	1612.97	1580.55	1605.44
1989	1448.29	1419.93	1426.31
1990	1306.72	1283.47	1272.51
1991	1183.72	1166.	1139.29
1992	1077.93	1066.36	1025.48
1993	982.702	977.624	990.797
1994	946.939	940.932	927.215
1995	901.851	895.827	880.14
1996	858.16	858.549	849.586
1997	830.623	834.654	829.295
1998	815.06	819.333	815.738
1999	806.629	809.753	807.082

PRT.2.1 - Smooth growth (constant $)
PRT.2.2 - Growth linked to expected revenues (constant $)
PRT.2.4 - Growth linked to present fund balance (constant $)

revenues exceed the base case. Then for five years, the reverse is true before they return to essentially track the base case. It appears to be the case that overall per capita state revenues are maximized in these particular examples when growth occurs after revenues are received, rather than in anticipation of those revenues. They are minimized when growth follows movements of anticipated revenues. Targeting growth to personal income increases provides the middle ground. The return on a dollar investment by the state in terms strictly of tax revenue is thus maximized by investment in a fund which earns a fixed return, rather than through an investment seeking to provide tax revenues. This is because of the underlying average ratio of revenues to personal income of 13.6 percent which represents an average return to the state from a dollar of personal income created. A dollar invested in a fund such as the permanent fund might, by contrast, earn 7 percent annually in perpetuity.

How is the state to choose among these three types of growth paths? Each is superior to the others in at least one respect. The base case in which growth is targeted to demand variables only provides for steadily rising public expenditures and incorporates a rationale which can be easily understood. It suffers from a need for a severe downward adjustment of expenditures unless new revenue sources appear. This severe discontinuity is this method's largest problem, although all suffer from it to some degree.

It is more difficult to choose among the other two cases. The case with expenditures linked to anticipated revenues offers the dual advantages of more rapid economic growth in earlier years and larger real per capita levels of state expenditures. The other case offers lower growth of the economy in the present, although more rapid in the future, and it is the case which generates the largest amount of revenue per capita.

Viewed from this perspective, the decision regarding the aggregate spending level for the state rests upon a tradeoff between increased revenues in the long run from slower spending rates and the attendant future benefits derivable from these revenues, and increased benefits in the immediate present from increases in state spending and resulting economic growth. Among these present benefits will not, in general, be the generation of larger state revenues. The immediate benefits are in the form of necessary expenditures by the state and the general advantages of a larger, as opposed to a smaller, economy.

There are, of course, a large number of growth paths of which these three are only examples. They do illustrate the basic choice which the state faces and the tradeoff implicit in that choice. The establishment of the permanent fund was the beginning of the recognition that the tradeoff exists. The next step is to explicitly analyze those tradeoffs facing the state so that choices of expenditure levels can be made with full understanding of their long-term implications.

PART II

IMPACT OF ALTERNATIVE USES OF PERMANENT FUND EARNINGS

A. Introduction

An important policy question surrounding the permanent fund concerns the disposition of earnings generated by the fund. The Constitutional amendment creating the fund provides that all earnings be returned to the general fund to finance state expenditures unless the legislature directs otherwise. It is this option which is assumed in the economic simulations done for the other components of this report.

In this section, the analysis concentrates upon the economic impacts of different proposals which have been suggested for alternative uses of permanent fund earnings. These four are the Alaska Inc. proposal to distribute earnings to individuals who have passed some Alaska residency test, the suggestion that income be reinvested in the fund itself, and two less formal suggestions that personal income taxes be reduced or that state expenditures be increased by the amount of the earnings.

A fifth alternative had been suggested for analysis but was not included because of the feeling that the probable sensitivity of the results to necessarily speculative assumptions would not make the analysis particularly valuable. This was the suggestion to use the earnings in either market rate or below market rate loan programs. The impact of this suggestion, if one were to assume market rate loans and competitive capital markets, would be negligible in aggregate economic terms.

As the assumptions regarding the loan rate or the competitiveness of the capital market are altered to allow subsidized loans or the possibility of imperfect information or some other impediment to the free flow of capital, then a positive economic impact could be generated by the economy, and this would be reflected in the model. The impact would be a direct function of the type of activity, rate of subsidization, and strength of response of that particular economic sector to loan incentives. Any assumptions regarding these matters would be highly speculative and, thus, this particular proposal was not analyzed in order to eliminate the possibility of presenting misleading results.

Of the proposals analyzed, the Alaska Inc. idea has received the most attention in the public forum. The particular form of this idea analyzed here is that of the Governor as embodied in HB 525 - SB 384 (Tenth Legislature). The bill would require that at least half of the earnings of the fund which were transferred to the general fund be distributed each year as Alaska Inc. share payments beginning in 1981. Persons who had been residents of the state for a period of five years would be eligible to receive a share payment; and every fifth year thereafter, a person who had continued in residency in Alaska would be eligible to receive an additional share. This analysis assumes all fund earnings are transferred to the general fund and, of that total, 50 percent is distributed as Alaska Inc.

At this time, there is a legal question as to the constitutionality of such an income distribution program which would exclude a large percentage of the population. There are other legal and administrative questions, answers to which must be assumed in order to do the analysis of the impact of Alaska Inc. on the state economy. It can reasonably be assumed that the program would be structured in such a way to avoid the necessity of paying state personal income tax on the proceeds. However, it is less obvious that federal personal income taxes could be avoided. In this analysis, it is assumed that a method is developed which results in the payments not being liable for federal personal income taxes to maximize the potential economic impact on the state through the change in personal income resulting. Administratively, it is assumed that Alaska Inc. payments enter the personal income stream after the payment of federal and state taxes and are not a form of special credit on the state income tax.

The suggestion to reinvest fund earnings back into the permanent fund is motivated by a desire to increase the future earnings potential of the fund. Thus, saving in early years would lead to the generation of additional revenue in a later period. To compare the impact of this suggestion to that of the Alaska Inc. proposal it is assumed that the portion of permanent fund earnings which would have otherwise gone into the Alaska Inc. program is instead reinvested in the fund. Thus, 50 percent of fund earnings are reinvested and 50 percent are transferred to the general fund.

In the case where the personal income tax is reduced by the earnings of the permanent fund the proportion of the fund earnings allocated to this program is the exact amount which was distributed as Alaska Inc. payments in the first instance. The reduction in taxes is on the basis of an average reduction for the average taxpayer.

In the final alternative examined, the amount of state spending is increased by the amount which would have been distributed as Alaska Inc. shares in the first case. This has the primary effect of raising the level of expenditures above the predetermined target expenditure rate in early simulation years or of reducing the amount by which expenditures are curtailed below the target rate in later years.

All the alternatives analyzed in this portion of the study build upon the same base case, which is one selected from the cases generated in Part I of the study. A description of the basic assumptions underlying this base case follows.

B. Base Case

The base case, which is used to analyze alternative uses of permanent fund earnings, is a simulation of the economy which incorporates a formula approach to the growth of state government expenditures. Under this formula, state expenditures grow at a rate which maintains a constant ratio between per capita real state expenditures and per capita real personal income. This does not involve the imposition of a constraint upon growth until 1990. At that time, growth expectations are gradually revised downward in an attempt to adjust to the long-run revenue constraints imposed on the state.

The other basic assumption concerning the base case which is important is the growth of the permanent fund. In this base case, the basic contribution rate to the permanent fund is 25 percent, but now additional monies are placed in the fund as they are found to be excess to the normal requirements of the general fund. In this way, they are able to earn the 7 percent return available on the permanent fund rather than the 6 percent average return on the general fund. The supplemental contributions to the fund are not "locked in" permanently to the fund and may be withdrawn in periods of deficit on current account in the state treasury.

The reason for this assumption is that it allows the permanent fund to build up a large balance in early years which, in turn, generates a substantial amount of revenue. This revenue, in turn, becomes the direct cause of the impacts associated with redirecting the fund earnings into different programs.

Aggregate indicators of economic activity in the base case are depicted in Table II.1 and reflect a pattern of strong growth. Population increases to 683 thousand by 1990 and to 952 thousand by the end of the simulation period in 1999. Employment growth reflects the same basic trend, except that in the early 1990s, the rate of increase slows to almost a standstill for several years. This is an indication of the readjustment occurring during this period in expectation of state revenue reductions. Cutbacks in state employment are necessary to balance the state budget, and this reduces overall employment growth. Personal income growth seems less affected by the government slowdown in the early 1990s. It shows an almost ten-fold increase over the period of simulation.

The required reduction in state spending in the 1990s is shown in Table II.2. State expenditure growth follows the formula until 1990 and then curtailments from the desired growth path occur. Between 1990 and 1997, expenditures dip significantly in total amount. They are, in effect, waiting for revenue growth to catch up. At this time, petroleum revenues are declining, however, and total revenues are actually declining. Only in 1997 are revenues higher than the level attained in 1986. Each year, the target growth rate is reduced and, yet, each year state spending must adjust downward to compensate for insufficient revenues.

Table II.1

Base Case Aggregate Variables

	POP	EM99	PI
1977	398.502	187.487	3292.21
1978	408.317	192.029	3600.29
1979	425.552	201.316	4055.06
1980	457.817	220.719	4869.6
1981	484.214	232.927	5505.91
1982	495.249	233.346	5771.65
1983	508.399	236.416	6163.83
1984	525.55	243.345	6725.12
1985	546.213	253.068	7437.71
1986	568.45	263.693	8241.99
1987	593.34	276.057	9183.67
1988	621.203	290.201	10285.
1989	653.135	306.862	11599.8
1990	682.79	321.033	12890.7
1991	700.811	326.132	13782.5
1992	712.9	327.504	14502.2
1993	729.005	332.932	15491.
1994	752.009	344.049	16903.8
1995	781.344	359.799	18639.8
1996	814.335	377.756	20651.2
1997	852.652	399.07	23041.3
1998	897.797	424.673	25933.
1999	952.154	456.042	29509.6

POP - Population (thousand)
EM99 - Employment (thousand)
PI - Personal income (million $)

Table II.2

Base Case State Revenue & Expenditure Variables

	E99S	R99S	SAVS
1977	1099.65	1130.36	0.
1978	1271.17	1148.8	0.
1979	1385.2	1538.81	0.
1980	1550.86	1943.59	0.
1981	1839.37	2229.13	0.
1982	2067.2	2512.21	0.
1983	2164.87	2814.78	0.
1984	2307.17	3240.62	0.
1985	2508.56	3531.36	0.
1986	2762.07	3713.25	0.
1987	3046.78	3692.58	0.
1988	3377.94	3624.77	0.
1989	3762.69	3570.7	0.
1990	4061.85	3536.82	155.933
1991	4004.61	3488.56	486.024
1992	3795.62	3428.84	474.706
1993	3669.65	3404.99	317.237
1994	3696.35	3450.24	213.927
1995	3842.31	3561.77	176.178
1996	4010.37	3711.14	207.572
1997	4197.45	3914.45	224.611
1998	4451.29	4184.93	207.384
1999	4791.29	4542.83	188.939

E99S - Total State expenditure (million $)
R99S - Total State revenues (million $)
SAVS - Expenditure cuts below target rate of expenditures (million $)

Because the state has anticipated its revenue problems and begun reducing expenditure levels before it completely eliminates its fund balances, at the end of the simulation period there remains a positive balance in the general fund (Table II.3). In the interim, it had grown to be in excess of $3 billion; but by 1999, it has essentially hit "rock bottom" at a level of $722 million.

The permanent fund has actually built up a substantial supplemental account in this case over and above the amount accumulated by the 25 percent contribution of bonus and royalty receipts. The inclusion of the supplemental account brings the balance rapidly to the $3 billion level in 1985 and over $5 billion by 1995. The supplemental balance is all accumulated by 1986, at which time it is approximately $2.276 billion. This fund level remains constant until 1998, when the first drawdowns occur to fund deficits on current account which cannot be paid out of general fund balances. The rule used in this case in specifying what amount of the current account surplus would go to the general fund and what would go to the permanent fund supplement was simply that 75 percent of excess revenues in excess of 120 percent of expenditures would be transferred to the supplemental fund. This allows the general fund balance to build up in the 1980s. When expenditure levels exceed revenues, the general fund balance is drawn down to a low level before the supplemental permanent fund is opened for spending on current programs.

Table II.3

Base Case State Fund Variables

	GFBAL	PFBAL	PFSUPBL
1977	570.081	2.4	0.
1978	461.377	62.4	0.
1979	547.732	185.56	0.
1980	861.622	327.492	0.
1981	1177.55	482.56	0.
1982	1535.35	661.655	0.
1983	1669.32	1268.8	401.932
1984	1869.23	2096.97	1001.66
1985	2089.32	3003.44	1661.93
1986	2293.96	3869.3	2275.85
1987	2855.01	4097.12	2275.85
1988	3076.17	4294.33	2275.85
1989	2920.22	4462.03	2275.85
1990	2475.66	4604.7	2275.85
1991	2040.77	4725.97	2275.85
1992	1738.54	4829.21	2275.85
1993	1528.68	4917.31	2275.85
1994	1353.67	4992.4	2275.85
1995	1148.99	5056.69	2275.85
1996	927.995	5110.82	2275.85
1997	722.345	5156.41	2275.85
1998	722.337	5005.91	2086.94
1999	722.328	4869.16	1917.8

GFBAL - General fund balance (million $)
PFBAL - Permanent fund balance (million $)
PFSUPBL - Permanent fund balance in excess of 25% (million $)

Two components of state revenues are of interest for purposes of comparisons with later cases (Table II.4). The personal income tax remains an important source of state revenues. As petroleum revenues decline over time, this regains its role as the largest tax revenue generator in the Alaskan tax structure. Permanent fund earnings increase rapidly as the permanent fund balance is built up in the early 1980s. After this time of rapid growth, the rate of increase declines and a plateau near $350 million is reached in about 1995. Future fund withdrawals will drive the total earnings down rapidly after 1999.

Three indicators of average per capita well-being are presented in Table II.5. Real per capita disposable income increases over the simulation period at a fairly constant rate. Real state expenditures per capita increase according to the target formula until 1989 and then fall significantly over the next ten years, until they are below the level of the initial simulation year. Real per capita state revenues reach a peak in 1985 of $2,007 and then they also begin a steady decline. By 1991 they are below the 1977 level, and the fall continues until the simulation ends. At that time, real per capita expenditures are about one-third less than at the beginning of the simulation. This reflects the continuing decline in the importance of oil revenues.

Table II.4

Base Case Components of State Revenues

	RTIS	IPF1
1977	120.479	0.
1978	117.077	0.168
1979	139.925	4.368
1980	172.252	12.989
1981	207.617	22.924
1982	221.933	33.779
1983	231.03	46.316
1984	254.682	88.816
1985	284.217	146.788
1986	322.313	210.241
1987	366.23	270.851
1988	418.676	286.798
1989	483.3	300.603
1990	546.04	312.342
1991	590.936	322.329
1992	618.586	330.818
1993	656.3	338.044
1994	722.41	344.212
1995	809.468	349.468
1996	911.348	353.968
1997	1033.65	357.757
1998	1182.1	360.948
1999	1370.62	350.414

RTIS - Personal income tax (million $)
IPF1 - Permanent fund earnings

Table II.5

Base Case Real Per Capita Economic Variables

	DIRPA	E99SRPC	R99SRPC
1977	2897.39	1185.25	1218.35
1978	2997.94	1279.2	1156.06
1979	3104.74	1282.35	1424.55
1980	3293.58	1265.61	1586.11
1981	3345.17	1358.48	1646.34
1982	3307.67	1447.27	1758.83
1983	3332.05	1427.93	1856.61
1984	3393.5	1418.23	1992.03
1985	3470.31	1425.39	2006.55
1986	3542.6	1448.33	1947.1
1987	3626.	1468.23	1779.44
1988	3710.27	1490.01	1598.89
1989	3806.06	1510.81	1433.72
1990	3875.18	1497.01	1303.51
1991	3889.23	1389.44	1210.39
1992	3894.72	1254.58	1133.34
1993	3934.03	1146.15	1063.49
1994	4006.7	1077.05	1005.34
1995	4093.9	1038.16	962.36
1996	4182.51	1000.62	925.958
1997	4279.07	961.413	896.593
1998	4383.1	929.007	873.417
1999	4494.84	902.506	855.706

DIRPA - Real per capita disposable personal income (constant $)
E99SRPC - Real per capita State expenditures (constant $)
R99SRPC - Real per capita State revenues (constant $)

C. The Economic Impact of Alaska Inc. Payments

In order to analyze the impact on the economy of Alaska Inc., a model simulation was done in which the only change from the base case described above was to allow 50 percent of permanent fund earnings to be transferred to Alaskans eligible under the Alaska Inc. program. The specific assumptions and their rationale for their incorporation into the model are described in detail in Appendix D.

The impacts which are traced through the model derive from the effect the program has on the level of disposable personal income. The increase in this component of income generates an increase in the demand for goods and services by Alaskans which, in turn, generates additional income and with it, employment. It is assumed that for the individual, the change in income is marginal and thus does not affect his overall pattern of consumption. It is further assumed that the Alaska Inc. program does not have a direct impact on migration to the state.

Table II.6 shows the basic calculation of the money which would be annually distributed as Alaska Inc. shares, given the economic assumptions of the base case. The total earnings of the permanent fund, assumed to be 7 percent, are placed in two separate accounts. One-half of the proceeds are paid into the general fund, and the other half are paid out as Alaska Inc. payments. In the first year of the program, 1981, the money available for the program is quite small, amounting to just over $11 million. In subsequent years, the total grows rapidly, approaching

Table II.6

Determinants of Total "Alaska Inc." Payments

	PFBAL	IPF1	ALINC
1977	2.4	0.	0.
1978	62.4	0.168	0.
1979	185.56	4.368	0.
1980	327.492	12.989	0.
1981	482.56	22.924	11.462
1982	661.655	33.779	16.89
1983	1242.11	46.316	23.158
1984	2023.19	86.948	43.474
1985	2849.31	141.623	70.812
1986	3592.36	199.452	99.726
1987	3820.19	251.465	125.733
1988	4017.39	267.413	133.706
1989	4185.09	281.218	140.609
1990	4327.77	292.956	146.478
1991	4449.04	302.943	151.472
1992	4552.27	311.432	155.716
1993	4640.38	318.659	159.329
1994	4715.47	324.826	162.413
1995	4585.04	330.083	165.041
1996	4444.16	320.952	160.476
1997	4321.41	311.091	155.545
1998	4212.46	302.498	151.249
1999	4120.27	294.872	147.436

PFBAL - Permanent fund balance (million $)
IPF1 - Permanent fund earnings transferred to general fund (million $)
ALINC - Permanent fund earnings allocated to Alaska Inc. payments (million $)

$100 million in 1986. From that point onward, the rate of increase slows until the peak year of 1995 is reached, at which point available Alaska Inc. funds in that year are $165 million. After that time, the amount available in any year gradually declines.

Determination of the value of a share of Alaska Inc. requires prior calculation of not only the total amount of money available to fund the program but also the number of individuals eligible under the program and the number of individuals eligible for multiple shares. In Table II.7, the calculation of the number of individuals eligible is presented. In 1980 when the first calculation for distribution is made, the number of individuals eligible is approximately 146 thousand. Over time, this eligibility group increases steadily until it has more than doubled by the year 2000.

During the first five years of the program, the number of permanent fund shares is equal to the number of individuals eligible. In 1985 the first group of individuals will become eligible for receipt of one additional share of Alaska Inc., based upon ten years of residence since 1974. Thus, between 1984 and 1985, the number of shares jumps from 163 thousand to 270 thousand, while the increase in the previous year had been 7 thousand. Table II.8 indicates for 1985 and later years the number of persons eligible for multiple shares. In 1990, for example, the first group becomes eligible to receive three shares.

Table II.7

Basic Elements of Alaska Inc. Payment Determination

	ELIGIBLE	SHARES	ALINCSH
1977	121.130	121.13	0
1978	123.077	123.077	0
1979	131.243	131.243	0
1980	145.607	145.607	0
1981	156.340	156.340	73.31
1982	151.845	151.845	111.23
1983	155.830	155.83	148.61
1984	162.827	162.827	266.99
1985	175.927	270.134	402.51
1986	186.950	288.101	346.14
1987	191.759	290.002	433.55
1988	197.455	298.276	448.26
1989	205.170	310.518	452.82
1990	214.741	387.977	445.81
1991	225.234	409.981	369.46
1992	236.932	422.956	368.16
1993	249.485	440.821	361.43
1994	262.714	461.896	351.62
1995	270.605	518.723	342.89
1996	270.875	533.037	301.06
1997	279.754	550.291	282.66
1998	287.120	569.127	265.75
1999	296.864	592.376	248.88
2000	308.688		

ELIGIBL - Number of eligible individuals (thousand)
SHARES - Number of shares payable based upon length of residence of eligible individuals (thousand)
ALINCSH - Size of individual share payment ($)

Table II.8

Estimate of Individuals Eligible for Multiple Shares of Alaska Inc.

	ELIG2	ELIG3	ELIG4	ELIG5
1977	0.	0.	0.	0.
1978	0.	0.	0.	0.
1979	0.	0.	0.	0.
1980	0.	0.	0.	0.
1981	0.	0.	0.	0.
1982	0.	0.	0.	0.
1983	0.	0.	0.	0.
1984	0.	0.	0.	0.
1985	94.207	0.	0.	0.
1986	101.151	0.	0.	0.
1987	98.243	0.	0.	0.
1988	100.821	0.	0.	0.
1989	105.348	0.	0.	0.
1990	113.824	59.412	0.	0.
1991	120.956	63.791	0.	0.
1992	124.067	61.957	0.	0.
1993	127.752	63.583	0.	0.
1994	132.744	66.438	0.	0.
1995	138.936	71.783	37.399	0.
1996	145.725	76.281	40.156	0.
1997	153.294	78.243	39.001	0.
1998	161.416	80.567	40.024	0.
1999	169.975	83.716	41.822	0.

ELIG2 - Individuals eligible for 2 shares (thousand)
ELIG3 - Individuals eligible for 3 shares (thousand)
ELIG4 - Individuals eligible for 4 shares (thousand)
ELIG5 - Individuals eligible for 5 shares (thousand)

The number of shares which must be paid out obviously affects the monetary value of each share. This is reflected in the long-term patterns of individual share monetary value. The share value in the initial year of payment in 1981 is $73. This increases rapidly over the next five years to over $400. Then the value bumps slightly down as individuals become available for two shares. It grows again until 1989, when eligibility increases overtake the growth of the base of the permanent fund itself. Henceforth, the value of a share declines continuously. In the last simulation year, it is less than $250.

The impact on aggregate economic activity of an Alaska Inc. program of the magnitude outlined above is shown in Table II.9. The multiplier effect of the increase in disposable income from the share distribution is immediately obvious. In the first year of the program, total personal income increases by a multiple of the increase in disposable income associated with the original share payment. The increase in personal income is associated with a rise in both employment and population.

This effect can be traced as far as 1989, when the impact from the base case reaches its absolute peak in positive terms. At that time, personal income is 5 percent larger than the base case at $12.2 billion; while employment exceeds the base case by 10.5 thousand, or 3 percent. After that, the positive impact rapidly is transformed into a negative impact because of the state expenditure cutbacks. In the Alaska Inc. case the cutback must be more severe than in the base case because of both a

Table II.9

Aggregate Economic Effect of Alaska Inc. Program

(Measured as Differences From Base Case)

	POP	EM99	PI
1977	-0.	0.	-0.003
1978	-0.	0.	-0.003
1979	-0.	-0.	0.005
1980	0.	0.	0.016
1981	0.753	0.565	27.566
1982	1.563	1.101	50.875
1983	2.444	1.647	76.988
1984	4.296	2.869	142.004
1985	7.205	4.772	244.746
1986	10.814	7.042	373.211
1987	14.737	9.366	514.082
1988	17.793	10.882	616.898
1989	18.444	10.549	636.125
1990	8.226	2.229	233.867
1991	0.87	-2.922	-44.965
1992	0.65	-2.22	-15.75
1993	2.686	-0.001	112.105
1994	3.682	1.151	187.109
1995	3.471	1.255	198.961
1996	2.417	0.726	160.211
1997	1.485	0.324	126.258
1998	0.996	0.181	114.383
1999	0.81	0.276	116.793

POP - Population (thousand)
EM99 - Employment (thousand)
PI - Personal income (million $)

larger population and a lower average level of state revenues resulting from the loss in permanent fund earnings income. After this downward shift, there is a return to a positive impact in all aggregate indicators in the final years of the simulation. The values are not very different from the base case and are moving closer to the base case in all three indicators.

The overall pattern indicates a short-run, positive economic impact of Alaska Inc. but one which is not lasting. In the long run, the impact generated in the short run is eliminated and the economy returns to its original growth path. By 1999 the Alaska Inc. distribution is becoming an insignificant portion of the total economy. It represents less than one-half of one percent of personal income and less than 3 percent of state revenues. Thus, the decision between distributing it as Alaska Inc. payments or using it to increase revenues to the general fund is becoming less and less important.

Table II.10 reflects what is happening to the state current account over the simulation period because of Alaska Inc. payments. Initially, the levels of both revenues and expenditures rise, although expenditure growth is much more rapid than that of revenues. This is because of two factors. First, the Alaska Inc. shares are not directly taxable, and so any additional tax receipts must be generated by secondary income effects associated with population and income growth. Second, the slight increase in revenues reflects the average non-petroleum revenue generating capacity

Table II.10

State Fiscal Impact of Alaska Inc. Program

(Measured as Difference From Base Case)

	E99S	R99S	SAVS
1977	0.	0.	0.
1978	0.	-0.	0.
1979	0.	-0.001	0.
1980	0.006	0.	0.
1981	0.009	0.864	0.
1982	9.395	2.732	0.
1983	17.671	3.785	0.
1984	26.812	5.294	0.
1985	49.282	8.9	0.
1986	84.113	13.194	0.
1987	127.373	16.134	0.
1988	174.354	16.51	0.
1989	153.451	7.256	54.437
1990	-165.614	-31.183	316.923
1991	-373.798	-80.111	50.041
1992	-360.318	-89.263	-115.827
1993	-286.747	-72.324	-84.298
1994	-252.542	-57.833	-24.868
1995	-258.439	-53.41	-3.133
1996	-275.477	-57.018	-9.876
1997	-287.927	-62.11	-27.179
1998	-289.855	-64.219	-38.904
1999	-285.605	-61.371	-42.86

E99S - State expenditures (million $)
R99S - State revenues (million $)
SAVS - Expenditure cuts below target rate of expenditures (million $)

of the state which is much less than the average per capita revenue generated during this time. (Total permanent fund earnings are counted as revenues, so this series does not reflect the revenue loss of the Alaska Inc. payments themselves, which otherwise would have gone into the general fund.)

Expenditure growth is more rapid than revenue growth also because of the formula by which expenditures are targeted to grow. As long as possible, it automatically grows with population and personal income. When the state financial crunch finally occurs in 1990 the impacts of both expenditures and revenues become negative and remain so through the end of the simulation period. State expenditures stabilize at a level which is permanently lower than the base case, contributing to the lack of positive impact in the aggregate variables. As the positive impact of Alaska Inc. on revenues is not pronounced, neither is the negative impact. The reduction of expenditures from the target level is greater in the Alaska Inc. case in the early years of the fiscal crunch, but later any difference from the base case becomes almost negligible.

Looking at Table II.11 provides a picture of the long-run impact of Alaska Inc. on the position of the general and permanent funds. The increase in state expenditures required by the population increase has largely been paid for by drawing down the level of the general fund. At the same time, supplemental balances in the permanent fund do not increase as rapidly as the base case. The drawdown reaches a peak

Table II.11

State Fund Impact of Alaska Inc. Program

(Measured as Difference From Base Case)

	GFBAL	PFBAL	PFSUPBL
1977	0.	0.	0.
1978	-0.	0.	0.
1979	-0.001	0.	0.
1980	-0.006	0.	0.
1981	-10.613	0.	0.
1982	-33.385	0.	0.
1983	-42.281	-26.688	-26.688
1984	-57.976	-73.775	-73.775
1985	-84.761	-154.128	-154.128
1986	-125.696	-276.934	-276.934
1987	-352.259	-276.934	-276.934
1988	-629.635	-276.934	-276.934
1989	-905.65	-276.934	-276.934
1990	-942.199	-276.934	-276.934
1991	-843.413	-276.934	-276.934
1992	-767.192	-276.934	-276.934
1993	-743.351	-276.934	-276.934
1994	-739.742	-276.934	-276.934
1995	-535.062	-471.656	-471.654
1996	-314.066	-666.664	-666.658
1997	-108.419	-835.004	-834.998
1998	-108.416	-793.445	-793.439
1999	-108.428	-748.895	-748.887

GFBAL - General fund balance (million $)
PFBAL - Permanent fund balance (million $)
PFSUPBL - Permanent fund balance in excess of 25% contribution rate (million $)

(beyond the base case) in 1990 of $1.22 billion. After the reduction in the level of state activity in 1990, the relative drawdown is moderated. However, by 1990 the drawdown is still $850 million below the base case.

Details of the impact on state revenues is shown in Table II.12. Personal income tax receipts rise moderately as the level of aggregate economic activity increases. The rise is smaller than would be the case if Alaska Inc. payments were taxable. When the economy returns essentially to its original growth path in the late 1990s, the level of total personal income is approximately the base case level, but the level of personal income taxes is slightly lower because of the Alaska Inc. exception from liability.

In comparison to the moderate rise in the personal income tax in early years, the general fund revenues provided by the permanent fund decline sharply and continuously until nearly the end of the simulation period. The negative impact of this revenue source is most pronounced in 1998 when it is about $210 million. Later, the revenues lost from this source would be of less and less relative importance.

Finally, the impact of Alaska Inc. on three real per capita variables is shown in Table II.13. Real per capita disposable personal income increases because of Alaska Inc. The impact increases until 1987 and then over the long run, declines slowly towards the base case. Real per capita state expenditures, because total expenditures rise according to a formula,

Table II.12

Revenue Impact of Alaska Inc. Program

(Measured as Difference From Base Case)

	RTIS	RIPF
1977	-0.	0.
1978	0.	0.
1979	-0.	0.
1980	0.	0.
1981	0.419	-11.462
1982	1.328	-16.89
1983	2.236	-23.158
1984	3.86	-45.342
1985	7.069	-75.976
1986	11.788	-110.515
1987	17.466	-145.118
1988	22.907	-153.092
1989	24.757	-159.994
1990	8.751	-165.864
1991	-15.735	-170.857
1992	-18.456	-175.101
1993	-8.671	-178.715
1994	-1.896	-181.798
1995	-0.883	-184.427
1996	-2.916	-193.492
1997	-5.207	-202.212
1998	-5.892	-209.699
1999	-5.348	-202.977

RTIS - Personal income tax (million $)
RIPF - General fund income from permanent fund (million $)

Table II.13

Impact on Per Capita Variables of Alaska, Inc. Program

(Measured as Difference From Base Case)

	DIRPA	E99SRPC	R99SRPC
1977	0.002	0.001	0.001
1978	0.006	0.002	0.001
1979	-0.	0.001	0.
1980	-0.001	0.002	-0.001
1981	11.544	-2.923	-2.914
1982	16.148	0.338	-5.644
1983	21.078	2.354	-9.517
1984	36.747	0.779	-18.583
1985	55.387	2.533	-30.193
1986	71.86	6.821	-41.898
1987	82.679	12.152	-49.744
1988	78.94	19.59	-51.472
1989	64.738	5.832	-48.052
1990	10.512	-80.594	-29.087
1991	-9.53	-128.66	-26.825
1992	4.239	-118.384	-28.811
1993	19.884	-93.545	-26.515
1994	25.219	-79.39	-22.568
1995	24.254	-75.026	-19.52
1996	19.727	-72.	-17.423
1997	17.008	-67.733	-15.984
1998	15.215	-61.614	-14.512
1999	14.625	-54.713	-12.47

DIRPA - Per capita real disposable income (constant $)
E99SRPC - Per capita real state expenditures (constant $)
R99SRPC - Per capita real state revenues (constant $)

remain at the same level as in the base case until the state downward fiscal adjustment. From that time forward, real per capita state expenditures are significantly less than in the base case because of higher population and lower income. Real per capita state revenues actually decline in every year after the commencement of the Alaska Inc. program. At the individual level, there has thus been a tradeoff favoring present consumption in the private sector over future state spending in the public sector.

D. The Impact of Alternative Proposals for the Disposition of Permanent Fund Earnings

In contrast to the case in which one-half of permanent fund earnings were distributed as shares of Alaska Inc., a simulation was done in which that money was redirected back into the permanent fund. This simulation will be referred to as the reinvestment case throughout the discussion in this section.

Table II.14 shows the basic variables affecting this case. Because of reinvestment of 50 percent of earnings, the permanent fund grows to a much higher balance in this case. This results in an increase in the long run of both the level of earnings transferred to the general fund and the level of earnings reinvested into the permanent fund. On the other hand, the level of revenues in the short run could be expected to fall relative to the base case.

A second contrast simulation was done in which the level of the personal income tax was reduced by the same amount in aggregate as disposable personal incomes were increased by Alaska Inc. in the aggregate. This policy would affect economic growth in two subtly different ways from the Alaska Inc. case. First, the tax cut would be liable for the federal personal income tax which would tend to reduce somewhat the multiplier effect which this addition to disposable personal income would have. Second, it would have a slightly different impact upon the incentive to migrate between Alaska and other states. Since the increase in

Table II.14

Permanent Fund Totals With 50% Earnings Reinvestment

	PFBAL	IPF	IPFPF
1977	2.4	0.	0.
1978	62.4	0.168	0.
1979	185.56	4.368	0.
1980	327.492	12.989	0.
1981	494.022	11.462	11.462
1982	690.407	17.291	17.291
1983	1303.79	24.164	24.164
1984	2143.61	45.633	45.633
1985	3069.2	75.026	75.026
1986	3962.44	107.422	107.422
1987	4328.95	138.685	138.685
1988	4677.67	151.513	151.513
1989	5009.09	163.718	163.718
1990	5327.08	175.318	175.318
1991	5634.79	186.448	186.448
1992	5935.25	197.218	197.218
1993	6231.09	207.734	207.734
1994	6524.27	218.088	218.088
1995	6816.91	228.349	228.349
1996	6908.14	238.592	238.592
1997	7019.42	241.785	241.785
1998	7146.77	245.68	245.68
1999	7293.72	250.137	250.137

PFBAL - Permanent fund balance (million $)
IPF - Earnings from permanent fund transferred to general fund (million $)
IPFPF - Earnings retained in permanent fund (million $)

disposable personal income associated with the tax reduction would be available to anyone who earned income in Alaska, there would be a slight incentive to migrate to Alaska or not to migrate out of Alaska. This would be the result of the slight increase in the real disposable personal income in Alaska relative to the rest of the United States, which has been shown to have a causal relationship to the migration rate between Alaska and the rest of the United States.

This alternative will be referred to as the tax reduction case in the remainder of this section. The taxes which would actually be collected under such a plan, in both fiscal year and calendar year totals, are shown in Table II.15.

One final case examined in this section is the alternative of taking the money which would have gone towards the Alaska Inc. program and spending it upon an increase in government expenditures. The increase in expenditures is spread among all programs, operating and capital, in accordance with the existing proportion that each program gets of the budget. The impact of this alternative will operate very much like the Alaska Inc. program itself in that the original expenditure will lead to an increase in personal income which is a multiple of the original increase. This can only be obtained at the cost of a substantial reduction in revenues for the general fund.

There are two primary differences between these cases. First, in the expenditure case, the original expenditure level does not, as Alaska Inc.

Table II.15

Personal Income Tax Receipts Under Tax Reduction Plan

	RTIS	RTISC
1977	120.479	107.467
1978	117.077	129.209
1979	139.925	153.454
1980	172.252	195.985
1981	203.029	211.921
1982	209.408	206.236
1983	213.384	222.408
1984	226.079	230.714
1985	235.202	240.867
1986	249.406	260.185
1987	270.517	283.561
1988	309.328	341.858
1989	370.066	405.677
1990	415.459	427.809
1991	432.612	438.675
1992	451.353	467.358
1993	493.272	525.986
1994	562.664	608.969
1995	648.646	698.737
1996	749.996	814.708
1997	875.332	951.867
1998	1028.31	1124.8
1999	1222.8	1346.52

RTIS - Fiscal year receipts (million $)
RTISC - Calendar year receipts (million $)

does, totally find its way into Alaskan incomes. Some of the original expenditure will go for items other than wages and salaries and a proportion of these items will be purchased outside Alaska. All the Alaskan increase will be taxable also. Second, as in the tax reduction case, any increase in disposable personal income per capita relative to the rest of the United States will have some impact on the level of migration to the state.

This case will be referred to as the high spending case in the rest of this section. Table II.16 shows the modified value taken in this simulation by the variable which indicates differences from the target growth rate of state expenditures. Its negative value in early years reflects the increment to spending coming out of permanent fund earnings.

These three alternative uses of a portion of permanent fund earnings will be discussed in the remainder of this section in relation to the alternative of Alaska Inc. Thus, all tables indicate differences from the Alaska Inc. case rather than from the first case discussed in this part of the study which represented returning 100 percent of permanent fund earnings to the general fund.

Beginning with the aggregate economic impacts of the three alternatives, Table II.17 shows the employment differences from the Alaska Inc. case. Employment is down consistently in the reinvestment case as money is, in this instance, being saved rather than distributed to individuals.

Table II.16

Change in Expenditures Under Increased Expenditure Case

(Million $)

	SAVS
1977	0.
1978	0.
1979	0.
1980	0.
1981	-11.462
1982	-16.89
1983	-23.158
1984	-43.486
1985	-70.853
1986	-99.815
1987	-125.887
1988	-133.861
1989	538.362
1990	745.199
1991	452.275
1992	-155.87
1993	602.486
1994	353.376
1995	194.622
1996	189.65
1997	193.089
1998	173.45
1999	162.578

Table II.17

Employment Impact of Various Permanent Fund Earnings Uses (Thousand)

(Measured as Difference From Alaska Inc. Case)

	PFD.7.2_ ER	PFD.7.3_ ER	PFD.7.5_ ER
1977	0.	0.	0.
1978	0.	-0.	0.
1979	0.	0.	0.
1980	0.	-0.	0.
1981	-0.565	-0.169	-0.008
1982	-1.102	0.036	-0.111
1983	-1.649	0.554	-0.197
1984	-2.867	1.192	-0.282
1985	-4.771	2.394	-0.462
1986	-7.041	4.837	-0.722
1987	-9.367	8.956	-0.982
1988	-10.882	15.385	-1.191
1989	-10.548	7.125	0.233
1990	-7.034	-3.045	1.815
1991	-5.29	-5.404	2.101
1992	-5.828	7.129	1.723
1993	-6.728	2.932	1.529
1994	-7.158	-2.363	1.626
1995	-7.232	-4.517	1.883
1996	-6.895	-4.581	2.152
1997	-6.667	-3.99	2.285
1998	-6.501	-3.333	2.487
1999	-6.528	-3.002	2.764

PFD.7.2 - Reinvestment of 50% earnings
PFD.7.3 - Increased government spending
PFD.7.5 - Reduce personal income tax

The negative values continue because the savings continues throughout the simulation period. In the case of increased spending, the impact is initially smaller, but it quickly rises sharply to a peak of over 15 thousand. The explanation for this surprisingly large increase lies in the nature of the state expenditure function assumed.

Year-to-year growth in expenditures is a function of population, price, and income change calculated on the base from the previous year. There is a built-in "ratchet effect" on government spending such that increases in the previous year become part of the base for calculating the increase in the present year.

In later years, the impact is reversed as the higher expenditure growth catches up with the state and cutbacks must be more severe. In the tax reduction case, the initial impact is almost identical to the Alaska Inc. case. The influence of the federal taxation of the income increase is somewhat stronger than the impact on migration, so the net effect is slightly slower growth. This pattern is reversed later as a positive impact appears. It is attributable to a higher population level than in the Alaska Inc. case which leads to high state spending and, thus, private employment.

This is reflected in the pattern of Table II.18 where the differences in population from the Alaska Inc. case are shown. The only instance of a divergence from the pattern of employment is that population growth occurs consistently in the tax reduction case somewhat independently of

Table II.18

Population Impact of Various Permanent Fund Earnings Uses (Thousand)

(Measured as Difference From Alaska Inc. Case)

	PFD.7.2_ ER	PFD.7.3_ ER	PFD.7.5_ ER
1977	0.	0.	0.
1978	0.	0.	0.
1979	0.	0.	0.
1980	0.	-0.	0.
1981	-0.753	-0.225	-0.009
1982	-1.562	0.024	-0.019
1983	-2.437	0.753	0.029
1984	-4.287	1.73	0.111
1985	-7.196	3.588	0.208
1986	-10.814	7.32	0.352
1987	-14.739	13.682	0.606
1988	-17.794	23.752	0.981
1989	-18.446	15.01	3.462
1990	-14.623	2.146	6.32
1991	-12.524	-1.802	7.615
1992	-13.208	13.847	7.984
1993	-14.472	9.234	8.456
1994	-15.19	2.355	9.242
1995	-15.446	-1.104	10.189
1996	-15.119	-1.959	11.085
1997	-14.865	-1.854	11.738
1998	-14.751	-1.615	12.351
1999	-14.823	-1.553	13.058

PFD.7.2 - Reinvestment of 50% earnings
PFD.7.3 - Increased government spending
PFD.7.5 - Reduce personal income tax

the slight decline in employment. The differences are small but the cumulative effect is significant, for by 1999 the impact level is 13 thousand. As mentioned above, this is partially attributable to the fact that migration into the state is a function of not only employment availability but also the real personal income differential between Alaska and the rest of the United States.

In the reinvestment alternative, personal income generated has fallen as expected (Table II.19). The largest difference is, surprisingly, in 1989 after which time the difference declines markedly for a ten-year period. The reason is that some of the initial savings has later become available as expenditures to buoy up the declining level of government expenditures.

A large portion of the increase in government spending in the second case does not find its way initially into Alaska personal income. It leaks out of the Alaskan economy immediately. The effect of growth in state expenditures quickly overcomes this leakage effect however, so that personal income rises significantly. When the state suffers its financial squeeze, it is felt particularly acutely in this case because the earlier expansion more rapidly depleted revenues.

Personal income in the tax reduction case does not rise as much as it did under the Alaska Inc. assumptions. The federal government takes a large part of the initial increase. At the end of the simulation

Table II.19

Personal Income Impact of Various Permanent Fund Earnings Uses (Million $)

(Measured as Difference From Alaska Inc. Case)

	PFD.7.2_ ER	PFD.7.3_ ER	PFD.7.5_ ER
1977	0.	0.003	0.
1978	0.	0.003	0.
1979	0.	-0.005	0.
1980	0.	-0.016	0.
1981	-27.562	-15.039	-11.664
1982	-50.852	-13.23	-20.738
1983	-76.91	-0.266	-30.359
1984	-141.898	8.016	-54.402
1985	-244.656	36.695	-90.043
1986	-373.309	123.07	-131.836
1987	-514.105	301.375	-172.547
1988	-616.895	630.52	-194.543
1989	-636.109	261.223	-135.
1990	-483.723	-258.031	-57.539
1991	-405.746	-402.68	-41.855
1992	-449.75	294.594	-62.664
1993	-521.844	75.766	-74.535
1994	-571.059	-251.645	-66.891
1995	-598.66	-407.52	-47.629
1996	-594.168	-423.066	-19.352
1997	-595.535	-388.949	2.707
1998	-606.582	-349.664	28.281
1999	-629.309	-323.984	65.84

PFD.7.2 - Reinvestment of 50% earnings
PFD.7.3 - Increased government spending
PFD.7.5 - Reduce personal income tax

period, the situation is reversed because the effect of the increased level of employment has finally surpassed the federal income tax leakage effect.

Turning next to an examination of state expenditures and revenues, Table II.20 shows that the reduced population growth in the reinvestment case has obviated the necessity for expenditures to grow as rapidly as before. In addition, in later years when the expenditure level is being cut back, the higher level of earnings generated by the permanent fund allows expenditures to occur at a higher level. In the higher spending case, expenditures are higher in each period because of not only the assumption of the simulation but also because of the higher population level. When personal income taxes are reduced, state expenditures are initially lower and subsequently higher than in the Alaska Inc. case. The initial slower growth is the result of slower growth in personal income. Eventually, the effect of population becomes more important and expenditures rise to accommodate the increase in demand reflected in the larger population.

Total state revenues fall by a very small amount initially as the economy slows down in the reinvestment case (Table II.21). This is recouped later, however, when revenues greatly exceed those generated under the Alaska Inc. alternative. When state expenditures are increased, the impact on state revenues is initially almost identical to the Alaska Inc. case. Beginning in 1989, it becomes apparent that any revenue increases

Table II.20

State Expenditures Impact of Various

Permanent Fund Earnings Uses (Million $)

(Measured as Difference From Alaska Inc. Case)

	PFD.7.2_ ER	PFD.7.3_ ER	PFD.7.5_ ER
1977	0.	0.	0.
1978	0.	0.	0.
1979	0.	0.	0.
1980	0.	-0.006	0.
1981	0.	11.627	0.
1982	-9.386	25.122	-3.925
1983	-17.643	50.827	-7.096
1984	-26.747	103.389	-10.415
1985	-49.24	187.876	-18.587
1986	-84.077	319.999	-30.519
1987	-127.419	514.297	-44.357
1988	-174.35	772.521	-57.62
1989	-153.44	493.087	-9.847
1990	-12.619	119.966	47.449
1991	64.268	47.936	57.251
1992	54.208	531.409	40.758
1993	29.58	388.511	29.801
1994	23.548	194.432	29.807
1995	32.513	118.302	35.162
1996	44.508	111.424	39.982
1997	54.906	132.276	39.867
1998	64.617	156.441	40.164
1999	72.832	172.926	42.469

PFD.7.2 - Reinvestment of 50% earnings
PFD.7.3 - Increased government spending
PFD.7.5 - Reduce personal income tax

Table II.21

State Revenues Impact of Various Permanent Fund Earnings Uses (Million $)

(Measured as Difference From Alaska Inc. Case)

	PFD.7.2_ ER	PFD.7.3_ ER	PFD.7.5_ ER
1977	0.	0.	0.
1978	0.	0.	0.
1979	0.	0.001	0.
1980	0.	-0.	0.
1981	-0.864	-0.181	-5.043
1982	-2.62	-0.357	-13.806
1983	-3.491	0.732	-19.675
1984	-4.912	-1.552	-31.855
1985	-8.378	-0.541	-54.677
1986	-12.461	2.323	-81.987
1987	-15.099	4.885	-108.46
1988	-14.014	17.3	-125.016
1989	-3.096	-11.107	-126.024
1990	23.5	-89.837	-121.057
1991	52.896	-135.527	-120.647
1992	65.753	-106.284	-126.684
1993	70.281	-87.499	-132.837
1994	77.25	-153.475	-135.855
1995	88.526	-196.414	-136.425
1996	104.88	-199.29	-133.024
1997	120.882	-183.606	-126.084
1998	135.859	-167.33	-119.324
1999	149.465	-153.844	-111.961

PFD.7.2 - Reinvestment of 50% earnings
PFD.7.3 - Increased government spending
PFD.7.5 - Reduce personal income tax

generated by a higher level of economic activity resulting from more government spending have been swamped by reductions in earnings from the general and permanent funds. In the tax reduction case, the total revenue loss is less than the initial tax reduction (equivalently, the Alaska Inc. payments) because of the generation of other income which, in turn, produces state revenues. It is also less, in all but the first few years, than the Alaska Inc. revenue loss because the larger population and personal income levels result in more employment in state government with its attendant impact on private spending.

State spending exceeds the target amount by definition in the increased spending case, as indicated by negative values in Table II.22. In the reinvestment case, when the financial crunch comes the forced reduction in the first years is not as severe as in the Alaska Inc. case. The same is true to a lesser degree in the tax reduction case, where lower levels of personal income result in a slightly lower target.

The general fund and permanent fund impacts are shown in Table II.23 and Table II.24. As indicated previously, the permanent fund consists of the sum of the contributions made at the 25 percent rate and supplementary contributions. The basic contributions cannot be withdrawn; but if the general fund balance is reduced to an arbitrary floor level, then the supplementary permanent fund contributions can be withdrawn.

As expected, the general and permanent funds are much larger where the reinvestment case is assumed. The permanent fund contains an

Table II.22

Target Spending Reduction Impact of Various

Permanent Fund Earnings Uses (Million $)

(Measured as Difference From Alaska Inc. Case)

	PFD.7.2_ ER	PFD.7.3_ ER	PFD.7.5_ ER
1977	0.	0.	0.
1978	0.	0.	0.
1979	0.	0.	0.
1980	0.	0.	0.
1981	0.	-11.462	0.
1982	0.	-16.89	0.
1983	0.	-23.158	0.
1984	0.	-43.486	0.
1985	0.	-70.853	0.
1986	0.	-99.815	0.
1987	0.	-125.887	0.
1988	0.	-133.861	0.
1989	-54.437	483.925	-54.437
1990	-139.566	272.342	-30.543
1991	-15.568	-83.79	20.268
1992	40.821	-514.749	24.068
1993	21.949	369.548	8.666
1994	-0.334	164.317	0.603
1995	-6.517	21.577	0.589
1996	-2.541	-8.046	3.779
1997	6.872	-4.342	10.09
1998	8.069	4.97	8.187
1999	9.646	16.499	6.273

PFD.7.2 - Reinvestment of 50% earnings
PFD.7.3 - Increased government spending
PFD.7.5 - Reduce personal income tax

Table II.23

General Fund Balance Impact of Various

Permanent Fund Earnings Uses (Million $)

(Measured as Difference From Alaska Inc. Case)

	PFD.7.2_ ER	PFD.7.3_ ER	PFD.7.5_ ER
1977	0.	0.	0.
1978	0.	0.	0.
1979	0.	0.001	0.
1980	0.	0.006	0.
1981	-0.864	0.92	6.419
1982	4.722	-4.82	13.082
1983	7.644	349.102	15.571
1984	12.013	336.535	20.848
1985	20.161	312.204	29.117
1986	34.413	619.758	40.5
1987	123.368	290.83	98.171
1988	251.725	-249.448	159.31
1989	368.171	-565.765	183.899
1990	380.443	-619.347	167.596
1991	346.113	-283.244	147.055
1992	326.326	-703.852	139.114
1993	326.543	-517.838	138.458
1994	332.58	-486.661	137.828
1995	140.111	-816.448	137.826
1996	140.111	-1146.24	137.825
1997	140.113	-1456.9	137.825
1998	140.11	-1756.3	137.829
1999	140.122	-2038.14	137.845

PFD.7.2 - Reinvestment of 50% earnings
PFD.7.3 - Increased government spending
PFD.7.5 - Reduce personal income tax

Table II.24

Permanent Fund Balance Impact of Various

Permanent Fund Earnings Uses (Million $)

(Measured as Difference From Alaska Inc. Case)

	PFD.7.2_ ER	PFD.7.3_ ER	PFD.7.5_ ER
1977	0.	0.	0.
1978	0.	0.	0.
1979	0.	0.	0.
1980	0.	0.	0.
1981	11.462	0.	0.
1982	28.753	0.	0.
1983	61.682	-375.244	7.465
1984	120.42	-412.945	23.299
1985	219.892	-485.931	48.102
1986	370.078	-977.048	82.258
1987	508.762	-977.048	82.258
1988	660.274	-977.048	82.254
1989	823.992	-977.045	82.254
1990	999.312	-977.042	82.254
1991	1185.76	-1338.14	82.254
1992	1382.98	-1338.14	82.254
1993	1590.71	-1801.97	82.254
1994	1808.8	-1998.9	82.254
1995	2231.87	-1804.18	78.656
1996	2463.98	-1609.17	69.203
1997	2698.01	-1440.83	61.363
1998	2934.3	-1293.47	55.25
1999	3173.46	-1168.89	50.07

PFD.7.2 - Reinvestment of 50% earnings
PFD.7.3 - Increased government spending
PFD.7.5 - Reduce personal income tax

additional \$3.173 billion above the Alaska Inc. case by 1999. The general fund is also larger. The situation is dramatically reversed in the case of increased expenditure levels where, by 1999, the combined totals are \$3.207 billion below the Alaska Inc. base. Comparing the tax reduction case with the Alaska Inc. case indicates a larger combined balance of the two funds from a tax reduction. In early years, this is the result of relatively lower levels of state expenditures in the tax reduction case. The maintenance of the difference essentially throughout the rest of the period must be attributed to slightly higher tax revenues in the tax reduction case and slightly higher shortfalls from the target expenditure rate.

Looking at particular components of state revenues, it can be seen from Table II.25 that total permanent fund earnings are particularly sensitive to the method of earnings disposition. They increase most rapidly in the case where a portion of the earnings are reinvested. Alternatively, they decrease most rapidly when government spending increases are being fueled by permanent fund earnings. Since the tax reduction case is most similar to that of Alaska Inc., it is not surprising that the permanent fund earnings in the two cases are nearly identical.

Regarding personal income taxes, Table II.26 shows that they obviously fall the most in the tax reduction case. What cannot be seen from this comparison is that the difference between the Alaska Inc. and the

Table II.25

Total Permanent Fund Earnings Impact of Various

Permanent Fund Earnings Uses (Million $)

(Measured as Difference From Alaska Inc. Case)

	PFD.7.2_ ER	PFD.7.3_ ER	PFD.7.5_ ER
1977	0.	0.	0.
1978	0.	0.	0.
1979	0.	0.	0.
1980	0.	0.	0.
1981	0.	0.	0.
1982	0.802	0.	0.
1983	2.013	0.	0.
1984	4.318	-26.267	0.523
1985	8.429	-28.906	1.631
1986	15.392	-34.015	3.367
1987	25.905	-68.393	5.758
1988	35.614	-68.393	5.758
1989	46.219	-68.393	5.758
1990	57.679	-68.393	5.758
1991	69.952	-68.393	5.758
1992	83.003	-93.67	5.758
1993	96.808	-93.67	5.758
1994	111.35	-126.138	5.758
1995	126.616	-139.923	5.758
1996	156.231	-126.292	5.506
1997	172.479	-112.642	4.844
1998	188.861	-100.858	4.295
1999	205.401	-90.543	3.868

PFD.7.2 - Reinvestment of 50% earnings
PFD.7.3 - Increased government spending
PFD.7.5 - Reduce personal income tax

Table II.26

Personal Income Tax Impact of Various

Permanent Fund Earnings Uses (Million $)

(Measured as Difference From Alaska Inc. Case)

	PFD.7.2_ ER	PFD.7.3_ ER	PFD.7.5_ ER
1977	0.	0.	0.
1978	0.	-0.	0.
1979	0.	0.	0.
1980	0.	-0.	0.
1981	-0.419	-0.03	-5.007
1982	-1.329	0.201	-13.853
1983	-2.236	1.114	-19.882
1984	-3.858	2.72	-32.462
1985	-7.066	5.556	-56.084
1986	-11.791	11.23	-84.695
1987	-17.469	21.567	-113.179
1988	-22.905	38.706	-132.254
1989	-24.756	34.049	-137.991
1990	-17.726	-1.526	-139.331
1991	-8.838	-18.705	-142.589
1992	-9.553	9.841	-148.777
1993	-14.501	28.081	-154.357
1994	-17.896	-2.347	-157.849
1995	-19.24	-16.318	-159.939
1996	-19.279	-17.289	-158.436
1997	-19.131	-14.257	-153.109
1998	-19.804	-11.201	-147.902
1999	-21.156	-9.346	-142.469

PFD.7.2 - Reinvestment of 50% earnings
PFD.7.3 - Increased government spending
PFD.7.5 - Reduce personal income tax

tax reduction cases is less than the tax reduction itself because of secondary income generated. Personal income taxes are less in the reinvestment case because of the relative decline in economic activity. In the increased government spending case, they rise as government spending grows and fall sometime after government spending is forced to decline.

Finally, real per capita impacts between the Alaska Inc. proposal and the suggested alternative can be compared. Table II.27 shows that, as expected, real per capita disposable income is less when permanent fund earnings are reinvested than when they are distributed as Alaska Inc. They are less in the two other cases also, but by lesser amounts in early years. The tax reduction case operates like Alaska Inc. to raise disposable income but is less successful because of the federal income tax. The negative impact on disposable personal income in the case of government spending is a combination of the direct effect of the Alaska Inc. payments and the sharp decrease in government spending in the early 1990s.

Table II.28 shows the impact on real per capita state expenditures of the three alternatives to Alaska Inc. With reinvestment of earnings, the initial impact is negligible and it then becomes positive as spending is made possible by past savings. When increased state spending is the use of the fund earnings, it is indeed possible to cause an increase in real per capita terms, although by the end of the simulation period, the real increase is not rising. Reducing the personal income tax has an effect which is almost identical to that of the Alaska Inc. case.

Table II.27

Real Per Capita Disposable Income Impact of Various

Permanent Fund Earnings Uses (Constant $)

(Measured as Difference From Alaska Inc. Case)

	PFD.7.2_ ER	PFD.7.3_ ER	PFD.7.5_ ER
1977	0.	-0.002	0.
1978	0.	-0.006	0.
1979	0.	0.	0.
1980	0.	0.001	0.
1981	-11.543	-8.614	-0.158
1982	-16.183	-8.545	-0.795
1983	-21.149	-7.605	-1.97
1984	-36.783	-13.39	-3.38
1985	-55.419	-16.967	-5.356
1986	-71.868	-12.924	-8.242
1987	-82.668	-0.303	-11.563
1988	-78.929	25.696	-14.883
1989	-64.723	-39.803	-9.224
1990	-38.87	-92.443	-5.474
1991	-30.874	-92.084	-9.696
1992	-35.224	-8.929	-16.409
1993	-37.793	-47.203	-20.865
1994	-35.823	-72.639	-23.546
1995	-31.77	-73.917	-25.281
1996	-24.949	-63.988	-26.617
1997	-19.723	-53.172	-28.488
1998	-14.645	-43.23	-29.172
1999	-11.047	-36.641	-29.488

PFD.7.2 - Reinvestment of 50% earnings
PFD.7.3 - Increased government spending
PFD.7.5 - Reduce personal income tax

Table II.28

Real Per Capita State Expenditure Impact of Various

Permanent Fund Earnings Uses (Constant $)

(Measured as Difference From Alaska Inc. Case)

	PFD.7.2_ ER	PFD.7.3_ ER	PFD.7.5_ ER
1977	0.	-0.001	0.
1978	0.	-0.002	0.
1979	0.	-0.001	0.
1980	0.	-0.002	0.
1981	2.927	9.449	0.037
1982	-0.34	17.399	-2.516
1983	-2.362	30.349	-4.448
1984	-0.776	56.332	-6.238
1985	-2.543	91.599	-10.291
1986	-6.804	136.478	-15.542
1987	-12.168	189.236	-20.913
1988	-19.586	240.657	-25.327
1989	-5.823	144.285	-11.869
1990	33.775	41.865	2.313
1991	51.018	24.623	4.13
1992	44.985	143.513	-0.718
1993	36.118	103.298	-4.039
1994	32.743	54.335	-4.678
1995	33.195	35.807	-4.264
1996	33.108	32.401	-3.937
1997	32.387	34.053	-4.391
1998	31.546	35.523	-4.733
1999	30.394	34.932	-4.823

PFD.7.2 - Reinvestment of 50% earnings
PFD.7.3 - Increased government spending
PFD.7.5 - Reduce personal income tax

In Table II.29 the changes in real per capita state revenues are shown. The impacts are distinct. Revenues per capita rise when earnings are reinvested and fall when expenditures are increased, primarily because of the impact of these programs on the general and permanent fund balances. With the reduction in the personal income tax, the real per capita level of state revenues also declines.

Table II.29

Real Per Capita State Revenue Impact of Various

Permanent Fund Earnings Uses (Constant $)

(Measured as Difference From Alaska Inc. Case)

	PFD.7.2_ ER	PFD.7.3_ ER	PFD.7.5_ ER
1977	0.	-0.001	0.
1978	0.	-0.001	0.
1979	0.	0.	0.
1980	0.	0.001	0.
1981	2.91	0.928	-3.673
1982	5.713	-0.385	-9.359
1983	9.676	-3.256	-12.634
1984	18.765	-9.632	-19.236
1985	30.442	-17.427	-30.406
1986	42.28	-30.758	-41.836
1987	50.251	-48.693	-50.844
1988	52.574	-66.784	-53.972
1989	49.726	-42.061	-55.925
1990	43.403	-34.146	-56.828
1991	45.254	-39.964	-55.936
1992	48.151	-61.436	-55.023
1993	48.707	-42.36	-53.814
1994	48.318	-46.235	-51.839
1995	48.116	-49.193	-49.439
1996	47.999	-45.331	-46.019
1997	47.511	-38.507	-41.563
1998	46.526	-32.208	-37.352
1999	45.004	-26.732	-33.377

PFD.7.2 - Reinvestment of 50% earnings
PFD.7.3 - Increased government spending
PFD.7.5 - Reduce personal income tax

E. Conclusion

The economic impact of changes in the use of the earnings of the permanent fund is significant because of the large size of the fund itself. Thus as the fund grows more slowly as time passes, the importance of any policy change regarding earnings disposition declines.

The most important impact in any case is upon the level of the fund balance itself. Reinvestment of earnings increases the balance significantly, while using the earnings to increase state revenues leads to rapid depletion of the general fund and any money which can be withdrawn from the permanent fund. Alaska Inc. and a personal income tax rebate occupy essentially middle ground in their impact on the fund. This is because they prevent a faster balance buildup but do not increase demand on the fund as did the state expenditure increase case under the conditions of the "ratchet effect" of state spending assumed in this analysis.

In terms of aggregate economic impact, all alternatives were significant. Reinvestment of earnings shifted the pattern of growth toward more rapid future growth, while the opposite was true in the other three cases. They all reflected the fact that an increase in the level of disposable personal income would result in overall growth of the economy much larger than the original change.

The cases in which growth of the economy was accelerated in early years also illustrated the fact that in those cases, the slowdown necessitated by the financial difficulties projected for the state would also be larger.

Finally, the Alaska Inc. program seemed to be more effective in getting additional income into the hands of individuals than a tax rebate. Because of the provision of multiple shares after every five-year increment in a person's length of residence, the value of an individual share begins to erode in real dollars less than ten years after the program is instituted.

PART III

ANALYSIS OF ECONOMIC IMPACT OF PETROCHEMICAL FACILITIES AND FISH HATCHERIES ON THE ALASKAN ECONOMY

A. Introduction

Portions of the permanent fund may be invested in new ventures in the Alaskan economy, particularly in natural resource related areas. Such investments may be done for a variety of reasons which all generally fall into the category of broad economic benefits for the Alaskan economy. Objectives most often suggested are diversification of the economy, the creation of jobs, and the generation of additional tax revenues for state and local government.

In this analysis two particular types of facility are examined to determine their impact on the state economy. Emphasis is placed upon the impact on the overall growth of the aggregate economy, the regional components of growth, and the fiscal impact of the construction and operation of the facilities.

The first alternative is a petrochemical complex. The facility incorporated into the simulation is patterned after, but does not correspond exactly to, the final proposals presented to the Royalty Oil and Gas Board for the construction of Alaskan refineries for the refining of Alaska's share of the production from Prudhoe Bay. This refinery would be located on the Kenai peninsula and would utilize 150,000 barrels of oil per day. Construction would begin in 1979 and operations would start in 1985. Employment during the construction phase would peak at an annual average of 2,550, while 460 would be employed during the operations phase. The value of the refinery for tax purposes would be $1.5 billion. (A more detailed description of the assumptions can be found in Appendix E.)

The second alternative is a series of 30 fish hatcheries located in various parts of the state. The Southeast and Southwest of Alaska each receive eight hatcheries, the Southcentral area receives six, and the Interior part of the state receives eight hatcheries, of which two are located in the vicinity of Fairbanks. These private, non-profit hatcheries are built over a four-year period at a cost of from $2 to $4 million each. Two construction seasons and 30 construction workers are required for each. Operating employment is eight full-time equivalent employees for each hatchery. Fish begin to return two years after operations commence. The hatcheries generate increased economic activity in both the fishing and the manufacturing (processing) industries.

Both the petrochemical facility and the fish hatchery program are assumed to be economically viable operations. Thus, there are no implicit or explicit subsidies to either from the state. In particular, the refinery purchases royalty oil from the state at the same price as the best alternative which is available to the state. The fish hatchery program does not receive an operating subsidy from the state.

This assumption carries over to the form of financial participation by the permanent fund in these projects. At this time the legislature has not determined either what types of projects in which the permanent fund might invest or what form that participation might take, such as the purchase of bonds or an actual ownership position. Neither has the phrase "income producing" been defined. For these reasons, it is not possible to specify either the form of investment or the earnings which might accrue to the permanent fund from participation in the financing of either of these types of projects. Therefore, a neutral assumption is made regarding the impact on the fund itself of financial participation in these projects. It is assumed that whatever form the investment may take, it does not change the average rate of earnings of the fund.

This assumption of neutral impact serves two purposes. First, it allows the analysis to isolate those fiscal impacts which occur through changes in the economic activity of the state from the fiscal impact of a change in the permanent fund and its earnings potential. Second, it allows the reader, if so inclined, to easily substitute his own assumptions concerning the impact on the fund of these participation programs. Any different assumption regarding fiscal impact would be additive to that impact presented in the results. Thus, for example, either a rate of earnings greater than or less than the average for the fund could be accommodated.

Use of this assumption also eliminates the necessity of scaling the two projects so that permanent fund participation is equal in each. This would clearly be impossible in the present case because of the huge difference in the capital requirements, and total resources demanded, by the two projects. The refinery costs $1.5 billion and the 30 fish hatcheries, at most, $ .12 billion. To increase the number of hatcheries to make the total capital requirements of the program equivalent to that of the refinery would require more than 360 fish hatcheries, an impossibly large number.

Because of this, it is not possible to directly compare the two projects in the sense of general economic return to the state from investment of a certain dollar amount. In the sense of scale, this is a comparison of "apples and oranges" which is not completely valid. The projects do offer an interesting contrast, however, in the fact that the refinery is an extremely capital intensive facility, while the series of fish hatcheries is much more labor intensive. As a result, the configuration of impact in the two cases should be quite different.

In assessing the results of this impact analysis, it is important to bear in mind that the validity of the results for the projects is only as robust as the validity of the underlying assumptions which went into the model. In some instances, there may be a difference of opinion regarding the level of a variable in the assumptions, and the results might be sensitive to that variability. For example, the capital-labor ratio in petrochemicals manufacture is not the same for each facility. It is dependent upon such factors as the relative cost of inputs, the types of feedstock employed, and the mix of products produced. With this in mind, it follows that the impact analyses of these facilities should be interpreted not as the analysis of specific projects but of types of projects with the mixture of characteristics as outlined in the discussion of assumptions. The comparison then is between a capital intensive project built on one site and a number of labor intensive facilities scattered around the state.

B. Base Case

The impacts are measured from a base simulation described in Part I of this study. In the base case, state expenditures grow at a rate which maintains a constant ratio between per capita real personal income and per capita real state expenditures. There is no constraint on this growth imposed by a lack of revenues until beyond 1990. Since these simulations go no further than that, the impending fiscal crunch is ignored here.

Aggregate economic growth is strong between 1977 and 1990 in this base case (Table III. 1). By 1990, population is 688 thousand and employment has increased nearly 75 percent from its present level to over 325 thousand. Personal income has increased nearly three times to $13.1 billion.

Up to 1990, the fiscal condition of the state appears healthy, as described by the variables in Table III.2. Expenditure growth is strong and steady as increases track growth in real per capita personal income. Through most of the 1980s, revenue growth more than keeps pace and growth of both the permanent fund and the supplemental fund keep pace. The supplemental fund is the depository of all state revenues in excess of current needs which are not "locked up" into the permanent fund. They are set aside during peak revenue years to be used in times of revenue shortfalls on current account.

Table III.1

Base Case Aggregate Economic Indicators

	POP	EM99	PI
1977	398.502	187.487	3292.21
1978	408.317	192.029	3600.29
1979	425.551	201.316	4055.06
1980	457.817	220.719	4869.61
1981	484.215	232.928	5505.92
1982	495.25	233.345	5771.67
1983	508.406	236.415	6163.91
1984	525.56	243.346	6725.23
1985	546.222	253.07	7437.8
1986	568.45	263.693	8241.89
1987	593.337	276.056	9183.64
1988	621.202	290.201	10285.
1989	653.134	306.862	11599.8
1990	688.407	325.256	13111.5

POP - Population (thousand)
EM99 - Employment (thousand)
PI - Personal Income (million $)

Table III.2

Base Case Fiscal Indicators

	E99S	R99S	PFBAL	PFSUPBL
1977	1099.65	1130.36	2.4	0.
1978	1271.17	1148.96	62.4	0.
1979	1385.2	1543.19	276.293	90.733
1980	1550.86	1957.76	746.281	418.789
1981	1839.38	2234.44	1212.58	730.018
1982	2067.21	2520.95	1748.2	1086.55
1983	2164.9	2827.61	2492.13	1625.27
1984	2307.23	3255.6	3525.13	2429.83
1985	2508.6	3549.28	4659.57	3318.07
1986	2762.11	3734.52	5741.3	4147.86
1987	3046.73	3717.27	6544.9	4723.64
1988	3377.95	3656.71	6985.21	4966.74
1989	3762.7	3606.98	7033.23	4847.05
1990	4218.49	3586.25	6641.29	4312.44

E99S - State Expenditures (million $)
R99S - State Revenues (million $)
PFBAL - Permanent Fund and Supplementary Fund Balance (million $)
PFSUPBL - Supplementary Fund Balance (million $)

Warning signs are, nonetheless, beginning to appear. The level of total revenues peaks in 1986 and begins to inch downward from that point in time. Shortly thereafter in 1988, the level of accrued revenues in the supplementary fund reaches a peak at $4.966 billion and subsequently begins a decline.

These trends are mirrored in movements of the indicators of average per capita economic activity shown in Table III.3. Real per capita disposable personal income shows fairly steady growth throughout the period of analysis, reflecting aggregate economic activity. Likewise, real state expenditures per capita increase according to a smooth pattern. Only real per capita state revenues show a period of growth and then after 1985, a sharp decline from the peak of $2,016 to $1,306 in 1990. This is a drop to below the level of a decade earlier when, in 1980, it was $1,597. In addition, in 1989, for the first time since the beginning of production from Prudhoe Bay, revenues fall short of expenditures.

The pattern of local finances is a healthy one because of both the strong level of state expenditures and revenues from local sources (Table III.4). Local revenues and expenditures are closely tied to the level of state expenditures through a variety of programs. Since state expenditures grow throughout the simulation period, so also do local expenditures and revenues. Increases in the local property tax base contribute an important local source of revenues.

Table III.3

Base Case Per Capita Economic Indicators

	DIRPA	E99SRPC	R99SRPC
1977	2897.39	1185.25	1218.35
1978	2997.95	1279.2	1156.23
1979	3104.74	1282.35	1428.6
1980	3293.58	1265.61	1597.67
1981	3345.17	1358.48	1650.26
1982	3307.63	1447.27	1764.94
1983	3331.98	1427.92	1865.03
1984	3393.46	1418.23	2001.19
1985	3470.27	1425.38	2016.69
1986	3542.59	1448.35	1958.25
1987	3626.01	1468.22	1791.35
1988	3710.28	1490.01	1612.97
1989	3806.07	1510.82	1448.29
1990	3899.71	1537.09	1306.72

DIRPA - Per Capita Real Income (constant $)
E99SRPC - Per Capita Real State Expenditures (constant $)
R99SRPC - Per Capita Real State Revenues (constant $)

Table III.4

Base Case Local Government Indicators

	E99L	R99L	E99LRPC	R99LRPC
1977	597.078	543.726	643.559	586.053
1978	585.067	550.219	588.765	553.697
1979	641.161	603.132	593.552	558.347
1980	731.859	693.146	597.247	565.654
1981	852.174	802.897	629.377	592.983
1982	949.687	898.929	664.885	629.348
1983	1015.12	975.536	669.553	643.445
1984	1100.87	1069.73	676.692	657.552
1985	1210.69	1186.5	687.908	674.166
1986	1324.9	1308.12	694.73	685.931
1987	1460.42	1452.86	703.775	700.133
1988	1617.5	1623.34	713.478	716.057
1989	1799.42	1822.27	722.51	731.687
1990	2014.12	2060.59	733.883	750.816

E99L - Local Expenditure (million $)
R99L - Local Revenues (million $)
E99LRPC - Per Capita Real Expenditures (constant $)
R99LRPC - Per Capita Real Revenues (constant $)

This steady growth is reflected also in the per capita measures of revenues and expenditures. As long as state transfers grow from year to year, the level of local services is able to expand.

C. Aggregate Economic Impacts

Upon this basic simulation of the economy the two projects described above are overlain and impacts measured. The pattern of aggregate economic impact differs considerably between the two cases.

Looking first at the impact of the petrochemical facility (Table III.5), a definite "mini-boom" period can be observed in the early 1980s in contrast to the base case, coming essentially at the end of the peak associated with the construction of the Prudhoe Bay gas pipeline. The boom is evidenced by an employment increase which peaks at over 13 thousand in 1983. This is associated with a population impact of over 24 thousand which peaks in the following year.

After the labor intensive construction phase of the facility, the employment and population differences decline until the late 1980s. Then they appear to stabilize back to the growth rates in the base case which in 1990 result in levels 5 thousand and 15 thousand above the base case, respectively. From that point forward, equal growth rates between the two cases would result in an ever widening margin in terms of employment and population between the two cases. This large construction project, coupled with a small permanent labor force, has put the whole economy on a somewhat higher growth path.

Increases in wages and salaries, and with it personal income, follow the same pattern as the increases in employment. In the peak employment

Table III.5

Aggregate Economic Impact of Petrochemical Facility

(Measured as Differences From the Base Case)

	POP	PI	WS99	EM99
1977	0.	0.	0.	0.
1978	0.	0.	0.	0.
1979	0.239	5.867	5.109	0.181
1980	4.742	134.059	117.121	3.546
1981	12.998	376.582	329.758	9.142
1982	18.71	479.625	420.02	12.001
1983	22.797	551.137	483.172	13.432
1984	24.426	530.23	465.457	13.014
1985	18.161	274.121	240.961	7.005
1986	15.73	210.934	185.711	4.955
1987	14.811	195.91	172.789	4.304
1988	14.557	204.266	180.473	4.248
1989	14.665	226.16	200.23	4.484
1990	15.088	260.086	230.703	4.948

POP - Population (thousand)
PI - Personal Income (million $)
WS99 - Wages and Salaries (million $)
EM99 - Employment (thousand)

year of 1983, the level of employment is 5.7 percent above the base case, while the level of wages and salaries is 8.9 percent above the base. Thus, the employment generated by this facility adds significantly more to personal income than the average employment for the state.

The pattern for the fish hatchery program does not contain a "bulge" because there is no massive construction phase (Table III.6). Growth of all indicators in relation to the base case is incremental. Employment increases come gradually and fall behind the refinery case in early years. After both facilities are operating, however, the two cases show long-run growth above the base case which is almost equal. Because of the incremental nature of the growth, the level of population has not increased by as large an amount relative to employment.

Growth in wages and salaries and personal income shows the same smooth pattern of increase over the base case. In early years, this growth turns out to be less than in the refinery case, but by the late 1980s, the impact on both of these variables is substantially larger from fisheries enhancement than from the refinery.

Part of the reason behind this is the fact that the fisheries enhancement program leads directly to increases in economic activity in two other sectors of the economy. First, the increased level of the fishery increases the value of the fish taken by Alaskan fishermen. This is assumed to lead directly to increases in incomes in this sector

Table III.6

Aggregate Economic Impact of Fisheries Enhancement

(Measured as Differences From the Base Case)

	POP	PI	WS99	EM99
1977	0.	0.	0.	0.
1978	0.	0.	0.	0.
1979	0.725	23.539	20.486	0.55
1980	1.912	54.93	47.984	1.302
1981	3.044	80.238	70.238	1.906
1982	4.729	125.672	110.	2.884
1983	5.153	114.348	100.184	2.76
1984	5.226	107.805	94.582	2.505
1985	6.141	142.141	124.922	2.977
1986	7.229	174.137	153.305	3.531
1987	8.229	205.645	181.375	4.002
1988	9.231	239.875	211.941	4.47
1989	10.286	279.133	247.145	4.977
1990	11.417	324.738	288.082	5.539

POP - Population (thousand)
PI - Personal Income (million $)
WS99 - Wages & Salaries (million $)
EM99 - Employment (thousand)

without an associated increase in employment because of the limited entry laws which effectively limit the number of fishermen working in Alaskan waters. The increased catch, in turn, leads to increased fish processing and is reflected in an increase in the levels of employment and value added in the fish processing industry in the state.

The inclusion of these economic "links" in the analysis of the fish hatchery case highlights the complicated nature of the assumption necessary to carry out this analysis. It is assumed that the fish which the hatcheries produce are all caught by Alaskans and that their incomes are spent in Alaska. Thus, there is no leakage of this income outside the state economy at the time of the initial transaction to the fishermen from the buyers of the fish.

In reality, some of this income to fishermen would not go to Alaskan fishermen and to measure the importance of this assumption, a special case simulation was done in which none of the increase in incomes was received by Alaskans. There was, in this special case, no increase in the fishing sector of the economy from the point of view of Alaskans. Comparing total wages and salaries in the fish hatchery case, including increases in fishermen's incomes, with the case of no increase in fishermen's incomes indicated there is a substantial impact on the wage and salary level as a result of including these incomes. The total loss is several times the assumed increase in income to the fishermen directly.

This is because of the employment and resulting wages and salaries generated in other sectors of the economy because of the demand created by these incomes. The increase in wages and salaries to the state as a whole from either project, assuming no increase in fishermen's incomes, is approximately the same by 1990.

There are other assumptions which could be changed and which would also change the results of the aggregate analysis. It is assumed that the refinery construction work is carried out by Alaskans who will spend their incomes in Alaska. The experience of the construction of the Alyeska pipeline has indicated that this might not be valid. Some income would leak out of the state in this case, and the impact on wages and salaries would be reduced accordingly.

D. Regional Economic Impacts

The economic impact of these two projects can be analyzed on a regional basis also. Here the patterns should also differ because of the concentration of the refinery in the Southcentral part of the state, while the fish hatchery program directly affects most regions of the state.

The regional impact on employment, population, and personal income of the refinery case is shown in Tables III.7, III.8, and III.9. The regions are indicated by Figure III.1. Construction and operating employment are concentrated in the Southcentral region on the Kenai peninsula and in Anchorage. The aggregate growth of the economy as a result of this project affects all regions, but the largest impacts are concentrated in those two regions. During construction the Kenai peninsula has the largest relative impact but after that most of the growth is centered upon Anchorage.

This is the result of two causes. First, a portion of the operating employment for the refinery is assumed to reside in Anchorage, as well as the operational headquarters staff. Second, Anchorage is the commercial and service center of the state and, thus, a large percentage of any secondary employment growth would be centered in Anchorage. In fact, in this case, 80 percent of the growth in 1990 has occurred in the Anchorage area.

Table III.7

Regional Employment Impacts of Petrochemical Facility

(Measured as Differences From the Base Case)

(Thousands)

	EM99R1	EM99R2	EM99R3	EM99R4	EM99R5	EM99R6	EM99R7
1977	-0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.
1979	0.	-0.	-0.001	0.	0.178	0.	0.003
1980	0.005	-0.004	-0.017	0.995	2.472	0.009	0.085
1981	0.081	0.024	0.137	4.187	4.374	0.046	0.294
1982	0.249	0.099	0.529	4.385	6.201	0.09	0.448
1983	0.324	0.135	0.695	4.527	7.084	0.115	0.553
1984	0.362	0.154	0.782	2.836	8.156	0.13	0.595
1985	0.319	0.141	0.717	0.733	4.48	0.12	0.496
1986	0.18	0.075	0.376	0.525	3.462	0.065	0.273
1987	0.128	0.05	0.246	0.447	3.199	0.045	0.189
1988	0.112	0.042	0.201	0.421	3.274	0.038	0.16
1989	0.112	0.041	0.188	0.414	3.539	0.037	0.153
1990	0.121	0.044	0.192	0.42	3.974	0.039	0.158

EM99R1 - Northwest
EM99R2 - Southwest
EM99R3 - Southeast
EM99R4 - Southcentral
EM99R5 - Anchorage
EM99R6 - Interior
EM99R7 - Fairbanks

Table III.8

Regional Population Impact of Petrochemical Facility

(Measured as Differences From the Base Case)

(Thousands)

	POPR1	POPR2	POPR3	POPR4	POPR5	POPR6	POPR7
1977	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.
1979	-0.002	-0.005	-0.018	-0.01	0.283	-0.001	-0.006
1980	-0.04	-0.081	-0.279	1.41	3.816	-0.026	-0.059
1981	0.081	-0.094	-0.28	6.354	6.781	0.009	0.146
1982	0.478	0.061	0.387	6.741	10.448	0.102	0.493
1983	0.694	0.188	0.877	7.184	12.84	0.181	0.833
1984	0.831	0.297	1.294	4.803	15.863	0.248	1.091
1985	0.903	0.484	1.928	1.907	11.17	0.335	1.433
1986	0.634	0.411	1.532	1.661	10.078	0.249	1.164
1987	0.526	0.372	1.33	1.532	9.809	0.212	1.03
1988	0.483	0.346	1.209	1.451	9.924	0.193	0.95
1989	0.468	0.325	1.123	1.39	10.288	0.181	0.891
1990	0.467	0.308	1.053	1.338	10.903	0.175	0.844

POPR1 - Northwest
POPR2 - Southwest
POPR3 - Southeast
POPR4 - Southcentral
POPR5 - Anchorage
POPR6 - Interior
POPR7 - Fairbanks

Table III.9

Regional Personal Income Impact of Petrochemical Facility

(Measured as Differences From the Base Case)

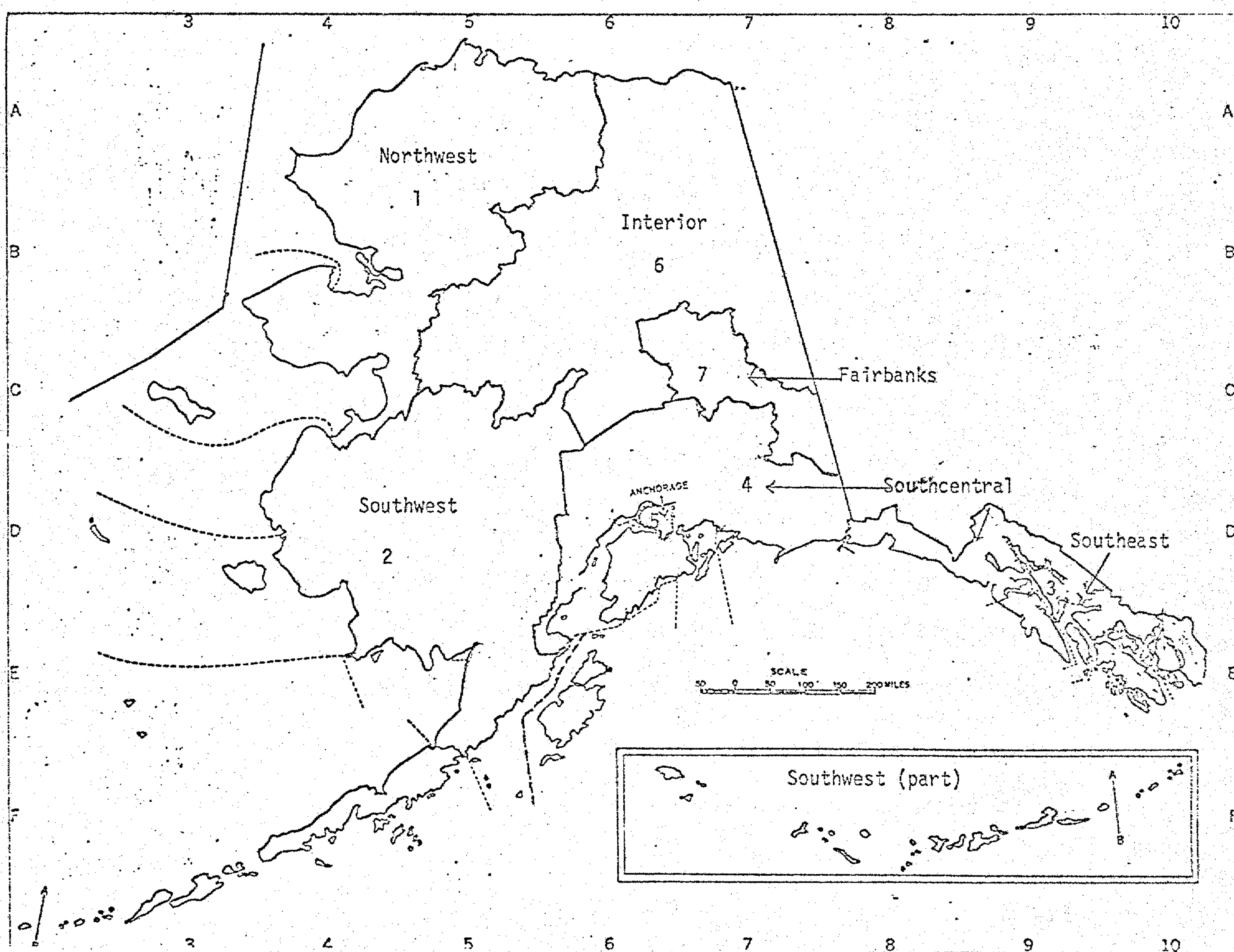
(Million $)

	PIR1	PIR2	PIR3	PIR4	PIR5	PIR6	PIR7
1977	0.	0.	0.	0.	0.	0.	0.
1978	0.	-0.	0.	0.	0.	-0.	0.
1979	0.08	0.062	0.195	0.198	4.844	0.161	0.328
1980	1.447	1.255	3.592	38.043	75.745	5.447	8.528
1981	5.881	4.448	14.769	164.358	149.232	13.43	24.466
1982	12.377	8.103	30.294	176.084	213.451	9.852	29.459
1983	15.728	10.071	37.998	188.811	252.17	10.988	35.37
1984	16.902	10.48	40.35	126.334	289.514	10.484	36.164
1985	12.621	7.316	30.733	33.279	158.698	6.582	24.891
1986	8.345	4.891	19.276	27.469	130.102	4.507	16.341
1987	6.915	4.072	15.096	26.073	126.543	3.865	13.344
1988	6.828	3.989	14.147	26.744	135.918	3.823	12.807
1989	7.426	4.263	14.681	28.49	153.934	4.001	13.371
1990	8.562	4.789	16.145	30.756	180.621	4.489	14.716

PIR1 - Northwest
PIR2 - Southwest
PIR3 - Southeast
PIR4 - Southcentral
PIR5 - Anchorage
PIR6 - Interior
PIR7 - Fairbanks

Figure III.1.

Alaska Regional Definitions for Impact Analysis



The concentration of population growth is also pronounced but not as much as is employment. Over 70 percent of the population increase in 1990 has occurred in the Anchorage region, followed by the Southcentral area and the Southeast. Smaller population increases occur elsewhere with the general growth of the economy and state expenditures. Even during the peak construction years, the population impact is largest in Anchorage.

Personal income grows in all regions as a result of the refinery construction and operation. Increments over the base level are most pronounced during construction phase in the early 1980s when no region feels less than a $10 million impact. These fall off in later years to less than $5 million in the cases of the Southwest and Interior regions of the state. The cycle of increases and decline is most pronounced in the Southcentral region where personal income at the peak has increased by $188 million. Two years later, that has declined to $33 million. Further drops follow. Better insulated from this cyclical phenomenon is Anchorage, which experiences a $290 million increase in the peak year which falls only to $130 million two years later. Not only is the percentage decline less, but the upward part of the cycle comes upon a much larger base of activity.

Regional economic indicators for the fish hatcheries case are presented in Tables III.10, III.11, and III.12. The regional employment impact is much more evenly divided among the regions of the state.

Table III.10

Regional Employment Impacts of Fish Hatcheries

(Measured as Differences From the Base Case)

(Thousands)

	EM99R1	EM99R2	EM99R3	EM99R4	EM99R5	EM99R6	EM99R7
1977	-0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.
1979	0.002	0.095	0.107	0.115	0.15	0.039	0.042
1980	0.014	0.181	0.221	0.231	0.383	0.091	0.181
1981	0.034	0.205	0.28	0.279	0.637	0.145	0.326
1982	0.052	0.419	0.488	0.415	0.997	0.207	0.306
1983	0.08	0.412	0.459	0.402	1.033	0.158	0.217
1984	0.077	0.467	0.392	0.429	0.916	0.079	0.144
1985	0.081	0.648	0.466	0.482	1.074	0.081	0.146
1986	0.112	0.697	0.528	0.526	1.388	0.092	0.188
1987	0.137	0.746	0.572	0.563	1.666	0.101	0.217
1988	0.161	0.797	0.608	0.594	1.958	0.109	0.242
1989	0.186	0.851	0.641	0.623	2.295	0.118	0.265
1990	0.212	0.911	0.671	0.652	2.679	0.126	0.287

EM99R1 - Northwest
EM99R2 - Southwest
EM99R3 - Southeast
EM99R4 - Southcentral
EM99R5 - Anchorage
EM99R6 - Interior
EM99R7 - Fairbanks

Table III.11

Regional Population Impacts of Fish Hatcheries

(Measured as Differences From the Base Case)

(Thousands)

	POPR1	POPR2	POPR3	POPR4	POPR5	POPR6	POPR7
1977	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.
1979	-0.003	0.146	0.109	0.158	0.208	0.046	0.061
1980	0.021	0.307	0.264	0.347	0.568	0.117	0.288
1981	0.067	0.36	0.367	0.438	1.054	0.199	0.559
1982	0.095	0.8	0.666	0.698	1.647	0.295	0.528
1983	0.176	0.926	0.753	0.776	1.859	0.267	0.397
1984	0.179	1.156	0.743	0.912	1.788	0.172	0.278
1985	0.181	1.567	0.878	1.007	2.067	0.171	0.271
1986	0.25	1.649	0.998	1.089	2.693	0.194	0.356
1987	0.307	1.732	1.095	1.165	3.291	0.213	0.426
1988	0.361	1.818	1.179	1.229	3.926	0.23	0.488
1989	0.413	1.906	1.253	1.287	4.638	0.247	0.543
1990	0.468	2.003	1.319	1.342	5.426	0.263	0.595

POPR1 - Northwest
POPR2 - Southwest
POPR3 - Southeast
POPR4 - Southcentral
POPR5 - Anchorage
POPR6 - Interior
POPR7 - Fairbanks

Table III.12

Regional Personal Income Impacts of Fish Hatcheries

(Measured as Differences From the Base Case)

(Million $)

	PIR1	PIR2	PIR3	PIR4	PIR5	PIR6	PIR7
1977	0.	0.	0.	0.	0.	0.	0.
1978	0.	-0.	0.	0.	0.	-0.	0.
1979	0.342	3.968	4.034	4.376	5.837	3.035	1.948
1980	0.858	7.968	8.292	8.801	13.861	7.529	7.622
1981	1.62	9.385	10.835	11.135	22.801	11.29	13.174
1982	2.82	19.991	20.456	17.634	38.132	13.821	12.814
1983	3.325	19.935	18.722	16.003	38.733	8.034	9.593
1984	3.15	24.085	17.647	17.172	36.306	1.716	7.727
1985	3.785	35.139	24.17	20.869	46.754	2.133	9.286
1986	5.366	38.685	28.503	23.934	62.512	2.864	12.267
1987	6.9	42.46	32.452	26.898	78.383	3.595	14.963
1988	8.565	46.625	36.447	29.932	96.281	4.369	17.661
1989	10.466	51.274	40.655	33.225	117.828	5.194	20.492
1990	12.711	56.499	45.24	36.726	143.723	6.19	23.641

PIR1 - Northwest
PIR2 - Southwest
PIR3 - Southeast
PIR4 - Southcentral
PIR5 - Anchorage
PIR6 - Interior
PIR7 - Fairbanks

Rather than 80 percent of the employment increase as in the refinery case, the Anchorage area now accounts for 48 percent of the increase in 1990. In 1985, its percentage is much less--36 percent. This reflects the assumption that there are no primary employment additions allocated to Anchorage in the fish hatchery assumptions. Employment growth in Anchorage results from increased demands for goods and services and increased state government on a statewide basis.

Outside Anchorage, the majority of the growth occurs in the Southwest, Southeast, and Southcentral regions of the state. Their relative positions are just reversed from the refinery case as now the Southwest growth is second only to Anchorage.

As before, population growth patterns follow those of employment. Anchorage again leads the growth in spite of the absence of direct employment assumed to occur there. The Southwest is second, followed by the Southeast and Southcentral. Smaller increases occur in the Fairbanks, Northwest, and Interior regions.

Personal income increases occur in each region, although here some amount of cyclical activity is observed to occur, particularly in the Interior and Fairbanks regions. The reason for this is that fish hatchery construction and operation takes place in these regions, but the fish are caught and processed in the coastal areas of the state. After construction of these interior hatcheries, construction income declines and is not immediately replaced by fishery and manufacturing income increases. In this sense, the hatcheries in those regions result in patterns of income change similar to the refinery. Fairbanks eventually recovers its income level because of its position as a service and commercial center for the Interior. The Interior region, however, does not within the period examined return to a position where the impact on income exceeds the base case by as much as it did in 1982.

E. State Fiscal Impacts

Under both projects state expenditures must increase to accommodate the increases in population. Since changes in the level of state expenditures are related to changes in the level of population rather than the level itself, the pattern of Table III.13 is the result. Expenditure increases occur rapidly in the refinery case since population growth occurs rapidly in the 1980s. Later it slows considerably and expenditure growth slows in a reflection of this. In the case of the fish hatcheries, the growth follows a steady pattern, since the growth in population is occurring steadily over the period. As a result, even though population is higher at the end of the period in the refinery case, the expenditure impact is larger in the fish hatchery case. In later years, they would tend to converge.

The impact on state revenues is shown in Table III.14. Total impact is more pronounced in the case of the refinery project, particularly during the construction phase. The peak impact occurs in 1984 at $46 million. This is the combined effect of the primary generation of personal and corporate income taxes and the business tax, as well as the secondary generation of revenues resulting from aggregate economic growth.

The increase in the fish hatchery example is much less cyclical as revenues grow slowly but steadily throughout the period. By 1990 the

Table III.13

Impact on State Expenditures of Hypothetical Projects

(Measured as Differences From the Base Case)

(Million $)

	PRT.RG2_ ER	PRT.RG4_ ER
1977	0.	0.
1978	0.	0.
1979	0.	0.
1980	1.317	5.521
1981	30.017	13.441
1982	90.24	20.187
1983	121.975	35.439
1984	142.913	38.635
1985	137.458	43.602
1986	76.673	59.609
1987	55.332	73.62
1988	48.444	87.255
1989	48.622	101.469
1990	52.559	117.156

PTR.RG2 - Petrochemicals
PRT.RG4 - Fisheries Enhancement

Table III.14

Impact on State Revenues

	PRT.RG2 ER	PRT.RG4 ER
1977	0.	0.
1978	0.	0.
1979	0.	0.844
1980	4.141	3.35
1981	18.892	5.953
1982	37.547	9,229
1983	45.509	12.335
1984	45.82	12.297
1985	30.556	14.676
1986	27.838	18.884
1987	25.49	21.47
1988	27.63	23.598
1989	30.739	25.518
1990	33.856	27.341

PRT.RG2 - Petrochemicals
PRT.RG4 - Fisheries Enhancement

impact levels are nearly equivalent, although the total impact over the whole period has been much larger for the refinery case.

Table III.15 confirms that the composition of the state revenue impact has differed considerably in the two examples. Personal income tax increases represent more than two-thirds of the total revenue increase for the fish hatchery case while less than 25 percent in the petrochemical example. Two factors account for this difference. First, a large component of the increase in the refinery case takes the form of corporate income taxes. Second, there has been a substantial increase in incomes to fishermen in the hatchery case, and these increases are taxed at higher marginal tax rates. This explains the large difference in personal income tax returns in the two cases in spite of a small difference in employment impact between them. Referring back to Table III.2, one gets an impression of the relative size of the impact on state revenues of the additions. Since in 1990 in the base case, revenues are projected at $3.586 billion; the impact in that year of either would be less than one percent of total revenues. On the other hand, revenues are falling in the base case and this addition would help to slow the rate of decline. It would not reverse the direction, however.

The net fiscal impact on state government is represented by the difference between the change in revenues and the change in expenditures in either case presented in Table III.16.

Table III.15

Impact on State Personal Income Taxes of Hypothetical Projects

	PRT.RG2_ ER	PRT.RG4_ ER
1977	0.	0.
1978	0.	0.
1979.	0.114	0.48
1980	2.951	1.678
1981	11.154	2.814
1982	18.135	4.457
1983	20.356	5.771
1984	20.478	5.972
1985	13.152	7.841
1986	5.661	10.477
1987	5.37	12.476
1988	5.638	14.667
1989	6.51	17.162
1990	7.658	19.933

PRT.RG2 - Petrochemical
PRT.RG4 - Fisheries Enhancement

Table III.16

Net Fiscal Impact on State Finance

of Hypothetical Projects

(Million $)

	Petrochemicals	Fisheries Enhancement
1977	0.	0.
1978	0.	0.
1979	0.	.844
1980	2.783	-2.171
1981	-11.125	-7.488
1982	-52.693	-10.958
1983	-76.466	-23.104
1984	-97.093	-26.338
1985	-106.902	-28.926
1986	-48.835	-40.725
1987	-29.842	-52.15
1988	-20.814	-63.657
1989	-17.883	-75.951
1990	-18.703	-89.815

In either case, the net fiscal impact is negative in all but the initial year. Given the structure of state revenues, this is the expected result. The petrochemical facility does poorly in the early years as expenditures must rapidly rise to accommodate the population increase. Later, however, its net impact improves as the income from the facility begins providing larger amounts of tax revenues. In the case of the fish hatchery, the impact on the current account of the state is negative and cumulative. Here, there is no capital intensive facility in place in later years to mitigate the size of the deficit in earlier years.

F. Local Fiscal Impact

Expenditures at the local level respond primarily to changes in population and personal income, as well as to changes in the amount of revenues transferred from the state. Table III.17 reflects this pattern. Local expenditures rise rapidly and then fall in the refinery example and grow slowly but steadily in the fish hatchery case.

Local revenues in both examples increase strongly, primarily through the local property tax (Table III.18). There is a cycle in local revenues generated by the refinery and a smooth increase in the case of the fish hatcheries.

Direct taxes on the refinery property contribute to the level of the local revenue impact in that case, exceeding revenues in the fish hatchery example. It is interesting that the direct property tax accounts for about half of the increment to local revenues in the refinery case. Also interesting is the rapid increase in local revenues in later years in the fish hatchery case, as personal incomes rise.

Table III.17

Impact on Local Expenditures of Hypothetical Projects

	PRT.RG2_ ER	PRT.RG4_ ER
1977	0.	0.
1978	0.	0.
1979	0.144	0.606
1980	3.701	3.129
1981	18.809	6.203
1982	39.944	9.631
1983	51.008	14.323
1984	56.474	15.725
1985	49.082	18.944
1986	45.512	26.45
1987	23.681	32.615
1988	20.606	38.611
1989	20.829	44.868
1990	22.82	51.82

PRT.RG2 - Petrochemicals
PRT.RG4 - Fisheries Enhancement

Table III.18

Impact on Local Revenues of Hypothetical Projects

	PRT.RG2 ER	PRT.RG'	PRT.RG4 ER
1977	0.	0.	0.
1978	0.	0.	0.
1979	0.167	0.	0.702
1980	4.133	6.133	2.877
1981	18.025	21.525	5.607
1982	36.204	42.204	9.185
1983	47.197	57.197	13.223
1984	53.275	70.275	15.178
1985	47.39	77.39	19.095
1986	48.761	78.761	26.784
1987	28.78	58.78	33.744
1988	26.683	56.683	40.896
1989	27.592	57.592	48.672
1990	30.272	60.272	57.566

PRT.RG2 - Petrochemicals (without property tax)
PRT.RG' - Petrochemicals (with local property tax)
PRT.RG4 - Fisheries enhancement

G. Per Capita Impacts

Real per capita variable changes occur in the directions expected by the analysis of the foregoing changes. Per capita disposable personal income rises rapidly in the refinery example with the increase in high paying construction jobs (Table III.19). Later the trend is reversed, primarily by a slowdown in the rate of increase in government employment. Disposable personal income gains in the fish hatchery case are not as pronounced but are not eliminated by 1990.

The patterns of state expenditures per capita in constant terms reveals an interesting fact about attempting to use a target expenditure growth formula based upon historical growth rates (in this case, the previous two years). From time to time, there will be fluctuations in those growth rates which will cause the target to miss on either the high or low side. In theory, all values in Table III.20 should be zero but, particularly in the case of cyclical variation in growth experienced in the refinery case, the target is only approached rather than hit squarely.

In both cases, revenues per capita in real terms declined. This was more pronounced in early years for the refinery, but in later years for the fish hatchery.

Table III. 19

Impact on Disposable Personal Income

Per Capita of Hypothetical Projects

(Measured as Differences From the Base Case)

(Constant $)

	PRT.RG2_ ER	PRT.RG4_ ER
1977	0.	0.
1978	0.	0.
1979	1.392	5.852
1980	26.671	9.599
1981	60.584	10.542
1982	61.451	19.498
1983	56.854	14.968
1984	34.917	14.484
1985	-12.143	19.365
1986	-18.78	18.194
1987	-20.532	16.514
1988	-19.666	14.373
1989	-17.894	12.102
1990	-15.783	10.137

PRT.RG2 - Petrochemical
PRT.RG4 - Fisheries Enhancement

Table III.20

Impact on State Expenditures

Per Capita of Hypothetical Projects

	PRT.RG2_ ER	PRT.RG4_ ER
1977	0.	0.
1978	0.	0.
1979	-0.685	-2.867
1980	-12.976	-2.192
1981	-19.646	-0.37
1982	1.912	-3.212
1983	9.918	4.472
1984	19.4	3.591
1985	31.366	-0.272
1986	3.281	1.459
1987	-5.855	1.836
1988	-9.032	1.566
1989	-9.712	0.954
1990	-9.527	0.112

PRT.RG2 - Petrochemical
PRT.RG4 - Fisheries Enhancement

H. Conclusion

The petrochemical and fisheries enhancement projects cannot be directly compared to one another because of the large differences in size of the proposals and also because no explicit assumptions were made regarding the method or size of permanent fund financial participation in either project. It is more valid therefore to concentrate on the comparison of each to a base case simulation. The petrochemical facility represents a very capital intensive project while the fisheries enhancement program is labor intensive.

Construction of the petrochemical plant leads to a "mini-boom" which results in an apparent long run increase in the level of aggregate economic activity. The capital intensive nature of the refining process notwithstanding, the employment impact is substantial because the construction phase is relatively labor intensive. Both the "boom" and the long run economic growth are regionally concentrated in the Anchorage and Southcentral areas.

Fisheries enhancement results in growth of the economy which is not accentuated but it is steady and leads to substantial long run increases. Because of the regional dispersion of the hatcheries the impact is not concentrated in any region. Interestingly, however, nearly 50 percent of the growth occurs in Anchorage where there is no primary employment increase.

The refinery provides state tax revenues through the taxation of both business and personal income while the impact of the fisheries enhancement program is primarily in the form of personal tax increases. Revenues generated are significant but less than 1 percent of total state revenues by 1990 in either case. State expenditure growth exceeds revenue growth in each case by a considerable margin because of the target level set for state expenditures on a per capita basis.

In both cases local revenues increase substantially. The refinery pays a substantial property tax but a significant portion of the local revenue increase comes from secondary increases in property values. The increases in the fish hatcheries case come primarily from secondary increases in property values.

PART IV

ALASKA CAPITAL MARKETS AND STATE FUNDS

A. Introduction

The institutional arrangements for investing the permanent fund are as important as the amount and timing of the investment. The effect of the many possible institutional arrangements are not as easy to assess as the timing or amount, since they do not easily lend themselves to modeling. One way to project the impact of the institutional arrangements is to examine similar historical events and derive applicable generalities. During the period following the Prudhoe Bay Lease Sale, the state of Alaska had excess funds which it invested in three ways--investment in Federal and Corporate Securities by the Bank of America, investment directly in loan programs by the state, and placement of funds in time certificates of deposit in banks in Alaska. Although the goals of these programs were different than those of the permanent fund, examining these programs may provide insights into the effects of these institutional arrangements. This chapter will review one of those programs, the placement of approximately $100 million of the North Slope Lease Bonus in Alaska banks between 1969 and 1971; it is hoped that the insights gained from this exercise will be helpful in determining the best arrangements for investing the permanent fund.

The review of this strategy will identify the intentions and goals of the policy makers, the strategies pursued, and the impact of those strategies. This program can only be examined in relation to the events of that period, including the other investment programs operated from surpluses of the state general fund. The strategies followed and the resulting impact will be examined for the period 1969 through 1973, the period from the first placement until just prior to the construction of the trans-Alaska pipeline. There are three important problems which limit the analysis of the effects of these strategies. First, this period was one of change for Alaska associated with the discovery of oil at Prudhoe Bay, the anticipation of its development, and the construction of a pipeline to carry it south. This makes it difficult to isolate the portion of the growth in the state's economy which resulted from the placement of $100 million in the state's banking system. Secondly, the early 1970's was a period of extreme fluctuation in the national money markets; this affects our ability to consider past relationships normal and analyze impacts as changes from them. Thirdly, only tentative conclusions can be drawn, because data concerning the banking system during this period is limited.

To the extent they can be defined, the analysis of the impacts of this policy will be done in terms of its equity, efficiency, and growth effects. The program can be considered efficient if, given the goals established by the policy makers, the placement of these funds was the best way to achieve them. The income redistribution resulting from this policy describes the equity effect. Windfall profits for banks and changes in the cost of borrowing money are possible income redistribution effects which will be analyzed. Questions about the effect of this policy on growth revolve around the question of whether this money got from the banks into the state economy.

B. The Setting: The Alaskan Financial Sector

The discovery of oil at Prudhoe Bay and the expectation of its production and the construction of a pipeline to carry the oil south were responsible for the healthy growth of the Alaska economy during the period after 1970. Table IV.1 shows the growth of population and employment during the period 1968-1973. In most developing economies, particularly those experiencing rapid growth, the demand for capital quickly outpaces the supply produced by the local economy. Alaska, during this period, was no exception; the growth during the late sixties accentuated a capital shortage which had always been a factor in the Alaskan financial sector. In theory, regional capital shortages should not exist, since capital is a mobile resource which should flow to the area where it earns its greatest return. Interest rates in a region where capital is in short supply would rise and attract capital until the shortage was eliminated. Real world imperfections prevent this from happening. Institutional restrictions, such as usury laws, prevent interest rates from rising to their proper levels. Alaska, prior to 1969, had a usury law which set a ceiling for interest rates of 8 percent. Risk also restricts the free flow of capital. Risk increases with distance from the source of capital, since less is known of places farther away. For both of these reasons, Alaska was not attracting the needed capital during this period. Editorials in the business press point to the difficulty of borrowing which reflected a capital shortage.[1]

[1] Editorial Opinion, Alaska Construction and Oil, September 1969, p. 6, and August 1969, p. 6.

Table IV.1

Growth of Population and Employment 1968-1973

	Employment[1]	Percent Growth	Population[2]	Percent Growth
1968	112,423		284,880	
1969	118,917	5.78	294,560	3.40
1970	123,892	4.18	302,361	2.65
1971	127,660	3.04	312,930	3.50
1972	130,693	2.38	324,800	3.79
1973	137,305	5.06	330,600	1.02

[1] Statistical Quarterly, Alaska Department of Labor, various issues.

[2] Current Population Estimates, Alaska Department of Labor, 1968-1973.

The usury laws which prevented local rates from rising to the required level were blamed for the capital shortage problem; Alaskan investment traditionally needed to pay 1-2 percent above Seattle rates to make investments worthwhile.[2] A period of tight money in the national money markets and interest rates which were inflexible upward prevented the needed flow of capital.

There is little documentation of this capital shortage, although the importance of the secondary mortgage markets and outside participation in large projects is recognized throughout the banking industry.

[2] "Home Building the Tight Money Loosens," Alaska Construction and Oil, July 1969, p. 32.

One report which attempted to document this situation was The Residential Mortgage Market in Alaska, a report done by the Federal Housing Administration in 1963.[3] This report documented the importance of outside capital to the Alaskan mortgage market in the early sixties. Because of the importance of outside funds for investment, changes in outside money markets had tremendous impacts on capital availability in Alaska. The tight money period which existed in outside money markets in 1969-1970 would logically have been extended into a tight money market in Alaska.

The banking industry in the period preceding the Prudhoe Bay lease sale has been described by Gene Erion.[4] By examining the insured commercial banks in Alaska during the period 1960-1966, Erion concluded,

> "The comparing of insured commercial banks in Alaska with insured commercial banks in the rest of Region 13 and in the United States as a whole, for the years 1960-1966, leads to the following conclusions:
>
> (1) Rates of earnings on loans and discounts were higher, and rates of interest paid on time deposits were lower, in Alaska. The higher rates on loans and discounts could not be attributed to higher prices (costs) in Alaska; nor, entirely, to greater riskiness of loans.
>
> (2) Profit rates on sales--current operating revenues--were lower in Alaska. Profit rates on capital invested were higher, but only because of the lower equity of owners in Alaska banks.

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[3] Federal Housing Administration, The Residential Mortgage Market in Alaska, 1963.

[4] Gene Erion, "Insured Commercial Banks in Alaska, 1960-1966," in Studies on Alaska Regional Inflation, Federal Field Committee for Development Planning in Alaska, 1969.

(3) As measured by net income per employee, assets per employee, and assets per bank office, Alaska banks were relatively inefficient.

(4) Assets per bank, however, were greater in Alaska. Alaska banks chose to serve Alaska's relatively sparse population by branching; thereby the proliferation of even smaller, weaker, and more inefficient unit banks was avoided.

(5) Assets per bank office and per bank employee, as well as the ratios of demand and time deposits to personal income, indicate that the scale of operation of Alaska banks was relatively smaller, with the distinct possibility that economies of large-scale operation were thereby precluded, and that some of the relative inefficiency of Alaska banks resulted therefrom.

(6) The ratios of demand and time deposits to personal income indicate that Alaska banks got a disproportionately small share of the domestic market for bank services, indicating that more aggressive competition, including price (rate) competition, might have led to a larger share of the market, and perhaps a larger market." [5]

Prior to the lease sale in 1969, the banking system consisted of eleven commercial banks with assets of $462,084,733 and two mutual savings banks with assets of $39,524,623.[6] There were also three savings and loan associations with assets totaling $66,000,000.[7] The banking sector during this period was highly concentrated with two banks having over 50 percent of the total assets of the commercial and mutual savings banks.[8]

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[5] Erion, "Insured Commercial Banks," pp. 69-71.

[6] Alaska Bank Statement of Condition, June 30, 1969.

[7] The Alaska Economy, State of Alaska Department of Commerce and Economic Development, 1977, Table 18, p. 31.

[8] Alaska Bank Statement of Condition, June 30, 1969.

C. Policy Goals

In September 1969, the State's Investment Committee which consisted of the Commissioners of Revenue, Commerce, and Administration determined the state should place $100 million in deposits in Alaskan banks. One general goal for this program can be defined from public statements made at the time; the goal of the program was to stimulate the state's economy by increasing the capital available within the economy. Through the placement of these funds, the state could attempt to ease the capital shortage which was much discussed at the time. Criticism of the decision centered on the fact that these funds in Alaskan banks would earn less than other North Slope lease funds invested by the Bank of America. The Investment Committee explained its rationale for this move was to provide money to the banks which they could use to stimulate general economic activity through loans.[9] The goal of using the money to stimulate the economy of the state by providing much needed capital was emphasized by public statements of officials. Governor Keith Miller stated at the time that the deposit of funds in state banks would meet the long-standing need for capital within the state.[10] Commissioner of Revenue, George Morrison, stated that placing the money in local banks would provide what bankers said was much needed capital to expand credit within the state.[11] These

[9] Anchorage Times, October 29, 1969.

[10] "Governor Tells Plans for Lease Revenues," Alaska Industry, October 1969, p. 98.

[11] Anchorage Times, December 3, 1969.

statements were also supported by members of the Egan administration. Director of Banking, J. K. Robertson, stated that the funds were deposited to be employed in the state's economy.[12]

The actions of the legislature and administrations during this time period define implicit goals for the entire North Slope Lease Fund which seem to agree with the stated goals for this particular program. The implicit goal was to improve the present Alaskan situation or quality of life through expenditures. Actions during the period illustrate this goal; the state budget increased 32 percent in Fiscal Year 1970 and 77 percent in Fiscal Year 1971 to provide for the increased programs and services made available to Alaskans.[13] Laurence Eppenbach, Deputy Commissioner, Treasury Division, in the Egan Administration, pointed out that one of the major benefits of the oil lease bonus was the increase in state spending which provided sound underpinnings for state economic growth.[14] Changes made by the legislature to the possible uses of the state's surplus revenue in 1970 also supported this general goal of spending to increase the current welfare of the state. The legislature expanded investment alternatives from only government securities and time certificates to allow the state to invest in mortgages and loans.

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[12] "Commercial Bank Deposits to Triple in Coming Decade," Alaska Construction and Oil, January 1971, pp. 37-38.

[13] "What Happened to the $900 Million," Memo to Governor Hammond from L. C. Eppenbach, December 27, 1974, p. 1.

[14] "Alaska's Treasury: A One Customer Bank with 325,000 Shareholders," Alaska Construction and Oil, May 1973, p. 29.

Chapter 206 SLA 1970 which defined these changes also specified an investment preference for loans and mortgages.[15] The concept of a permanent fund using parts of the lease funds, although suggested during this time period, was never adopted. One reason savings was not a primary consideration was the expectation of the rapid completion of the pipeline, and the beginning of the flow of oil royalties to the state.[16] The goal of stimulating the Alaskan economy through the placement of deposits in Alaskan banks fits within this general context of using the North Slope lease funds to improve the current Alaskan situation.

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[15] "Legislature Roundup," Alaska Construction and Oil Report, August 1970, p. 33.

[16] "What Happened to the $900 Million," Memo to Governor Hammond from L. C. Eppenbach, December 27, 1974, p. 1.

D. Placement of the Funds

The decision to place approximately $100 million in time deposits in Alaskan banks was originally made shortly before the North Slope lease sale in September 1969. This decision was made by the state's Investment Committee which consisted of the Commissioners of Revenue, Commerce, and Administration.[17] The money was originally scheduled for three placements in September and October 1969 and January 1970.[18] The first placement of $50 million in short-term certificates of deposit took place shortly after the lease sale in September. The other placements did not take place as scheduled but were postponed. The last placement occurred in June 1971. A total of $102 million was placed in Alaskan banks in certificates of deposit with terms ranging from one to fourteen years. Funds were deposited after negotiations, which determined that a competitive rate of 6.25 percent would be paid. Funds were disbursed in relation to the distribution of total deposits in the banking system.[19]

There were two major criticisms of this fiscal strategy. First, the strategy was criticized because the state was not earning the maximum amount possible on these funds. The certificates of deposit were issued at 6.25 percent interest, while state funds invested by the Bank

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[17] Anchorage Times, October 29, 1969.

[18] Anchorage Times, December 3, 1969.

[19] Anchorage Times, December 3, 1969.

of America were earning approximately 8 percent. State officials responded that the money loaned into the economy, generating economic activity would produce revenues in income taxes equal to another 1 percent in interest.[20] This strategy also supported the goal of using the funds for the immediate benefit of Alaskans and not as a savings account.

The second criticism of the program was responsible for the delay in the second and third disbursements of the money. Criticism of the way the banks were using these funds caused the state to investigate the use of the funds before issuing the next scheduled disbursements. The criticism suggested that banks might only have been investing these state deposits in Federal securities which did the state's economy little good; reasons for this included collateral requirements for state deposits.[21] These criticisms caused the state to investigate how the first $50 million was being used. These investigations showed the majority of banks were able to use the funds and the second disbursement was made.[22] The banks also criticized the length of term of the deposits, stating that this prevented the use of the funds for loans. As a result of this criticism, the state extended the terms of the first set of deposits just prior to the final disbursement in June 1971. Table IV.2 shows the terms and amounts of certificates of deposit from the North Slope lease bonus for Fiscal Years 1969-1972.

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[20] Anchorage Times, October 29, 1969.

[21] Anchorage Times, September 25, 1969.

[22] Anchorage Times, December 3, 1969.

Table IV.2

North Slope Lease Funds in Alaska Banks

Date Issued	Amount as of June 30 in Thousands of Dollars 1970	1971	1972	1973
(1 year term)				
12-69	$22,350			
2-70	380			
3-70	1,665			
6-70	605			
12-70		$ 2,250		
3-71		1,665		
6-71		655 (1/2 year)		
12-71			$ 2,905	
3-72			1,665	
12-72				$ 2,905
3-72				1,665
(5 year term)				
9-69	50,000	26,430[1]	26,430	26,430
12-70		43,460	44,010	44,010
6-71		550 (4 years)		
(10 year term)				
6-71		5,358	5,358	5,358
(11 year term)				
6-71		5,458	5,458	5,458
(12 year term)				
6-71		5,458	5,458	5,458
(13 year term)				
6-71		5,358	5,358	5,358
(14 year term)				
6-71		5,358	5,358	5,358
TOTAL	$75,000	$102,000	$102,000	$102,000

[1]State Investment Portfolio in 1971 had approximately $20,000,000 in three year certificates this year only. Based on other Portfolios, this amount was added to the five year certificates.

SOURCE: State Investment Portfilios, Department of Revenue, 1970-1973.

E. Other Programs

The impact of the passage of Chapter 206 SLA 1970 was to broaden the investment possibilities of the state. Chapter 206 allowed the state to invest surplus funds in:

(1) direct obligations of the United States;

(2) obligations of agencies and instrumentalities of the United States;

(3) notes issued by Farmer's Home Administration;

(4) bank certificates of deposit which are secured as to the payment of principal and interest in accordance with Alaska law;

(5) corporate obligations of prime or equivalent quality, as rated by a nationally recognized rating organization;

(6) other securities, including corporate securities;

(7) Federal Housing Administration mortgages;

(8) Federal Veterans Administration mortgages;

(9) loans made under the provisions of AS 03.10;

(10) conventional residential mortgages if the originating financial institution retains at least 25 percent of the mortgage;

(11) other secured loans, if the originating financial institution retains at least 33 1/3 percent of the mortgage.

The investment programs which resulted from this act fit into two major groups, the investments handled by the Bank of America and those handled by the Treasury. The major differences involved the terms and liquidity of these investments. The Bank of America emphasized highly liquid, short-term investments, and the Treasury emphasized long-term investments related to growth in the state. These Treasury loan programs were run with surplus general funds and are not the same as the investments made from specific funds such as Teacher's Retirement fund. Table IV.3 shows the change in these investments during the period of interest. The loan programs were included in the investment program run by Treasury.

The Bank Loan Incentive Program was begun in 1970 to buy loans from financial institutions in Alaska. All loans had to be secured and have Alaska residents as mortgagors.[23] This program was suspended in 1972. One reason for the suspension was the necessity to remain liquid. Since funds were being drawn down quite rapidly, it was felt the direct loan programs provided ample loans.[24] As Table IV.3 shows, the direct loan programs expanded throughout this period.

The Bank of America investments were made with the idea that the principal would be spent, so liquidity was important. Because of this, highest yielding investments were ignored; investments were made mostly in short-term, highly liquid assets, such as U.S. Government Securities.[25]

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[23] State Investment Portfolio, State of Alaska Department of Administration, June 30, 1971, p. 4.

[24] "Revenue News," Alaska Department of Revenue, February 16, 1971, and conversation with Richard Alexander, Alaska Department of Revenue, November 28, 1977.

[25] "Revenue News," Alaska Department of Revenue, May 24, 1972.

Table IV.3

State General Fund Loan Programs

	Amount as of June 30			
	1970	1971	1972	1973
Bank of America	$852,569,655	$772,928,476	$665,002,400	$504,566,000
Veterans Loans		1,587,000	9,703,800	16,315,200
Bank Loan Incentive Program		3,977,600	3,464,500	2,765,300
Agricultural Loans		---	709,900	843,000
Municipal Loans		6,833,300	6,213,900	14,367,500
Small Business Loans				1,546,800
Alaska Housing Finance Corporation				7,318,200

Source: State Investment Portfolio, Department of Revenue, 1970-1973.

F. The Impact of the Bank Placement Program

The impact of the program will be analyzed in relation to the goal of providing capital and stimulation to the state's economy. The program's impact will be examined in terms of its effects on growth, equity, and efficiency. Two sources of data will be used to examine these effects. First, a time series of Alaskan banking statistics produced by the Department of Commerce and Economic Development will be used. The data series provides information on deposits, assets, and loans for all Alaskan banks. The second source of information are the Federal Deposit Insurance Corporation Call Reports and Income Statements of Insured Commercial Banks. These provide detailed data on a portion of the banking system, insured commercial banks. Commercial banks are unique among financial institutions, because their liabilities include demand deposits, and their lending and investing activities are diversified along their whole range of possibilities. Because of this, commercial banks are assumed to typify the economy's financial sector. This is particularly true in Alaska where Commercial banks are more involved in the mortgage market than is typical outside. Commercial banks are the major type of financial institution in Alaska which held 92 percent of the assets in 1969, and they were major participants in the placement program holding approximately 90 percent of the certificates by 1972.[26] The F.D.I.C. information can only be used to provide insight into the effects of this program, since it provided only partial coverage of the Alaskan banking system.

[26]Alaska Department of Revenue, "Alaska Banks Statement of Condition," June 1969, and Alaska Department of Administration, State of Alaska: State Investment Portfolio, 1972.

F.1. Growth Impact

Table IV.4 describes the change in some measures of economic activity during the period 1968-1973. Although this table shows a general upward trend in all of the variables, it is hard to see a consistent relation between banking activity and any variable. Even if a relationship could be seen, it would be impossible to judge the direction of causation. The banking system, through its loan activity, may encourage growth; but at the same time, growth of the economy would have positive effects on the banking system through increasing its deposits.

An indication of the growth impact of this program can be determined by examining the loans made by the banking system. The ultimate impact on the economy depends on the effectiveness of the use of the loan funds, but the impact of the banking system on the economy can be judged by the proportion of its deposits it gets back into the economy in the form of loans. Constraints placed on the bank's ability to loan money, such as reserve requirements set by the Federal Reserve Bank and the distribution of deposits between demand and time deposits, will prevent banks from loaning all of its deposits. Investment of deposits in other types of assets will also reduce the amount of loans made.

Examination of the ratios of loans to deposits and changes in loans to changes in deposits shows that initially fewer loans were made out of these deposits than usual. The relationship between loans and deposits is shown in Tables IV.5 and IV.6. Table IV.5 shows the change which

Table IV.4

Economic Growth

	Total[1] Employment	% Change	Construction[1] Employment	% Change	Value[2] of Construction (millions of $)	% Change
1968	112,423		5,998			
1969	118,917	5.78	6,653	10.92	193	
1970	123,892	4.18	6,894	3.62	238	23.32
1971	127,660	3.04	7,445	7.99	259	8.82
1972	130,693	2.38	7,893	6.02	373	44.02
1973	137,305	5.06	7,837	-.71	421	12.87

	Housing[2] Units (thousands of units)	% Change	Total[3] Deposits (millions of $)	% Change	Total[3] Loans (millions of $)	% Change
1968	1.2		481.8		302.2	
1969	1.5	25.0	585.6	22.78	345.0	14.16
1970	1.7	13.33	699.6	26.54	409.3	18.64
1971	1.8	5.88	808.6	19.54	497.0	21.43
1972	2.4	33.3	934.1	17.57	608.5	22.43
1973	1.7	-29.0	999.9	5.69	765.3	25.77

[1] Alaska Department of Labor, Statistical Quarterly, various issues.

[2] U.S. Department of Commerce, Statistical Quarterly, 1974.

[3] Alaska Department of Commerce and Economic Development, Mid-Year Performance Report, 1977, Tables 17 and 18.

Table IV.5

Ratio of "New" Loans to New Deposits

(Millions of Dollars)

	(1) Change in Loans & Discounts	(2) Change in Total Deposits	(3) Change in Time Deposits	Ratio (1)/(2)	Ratio (1)/(3)
1967	15.9	40.9	44.3	.39	.36
1968	18.2	6.4	6.9	2.84	2.64
1969	40.8	101.8	61.4	.40	.66
1970	45.3	106.0	84.0	.43	.54
1971	64.7	85.0	61.7	.76	1.05
1972	75.5	96.5	68.1	.78	1.11
1973	64.8	59.8	29.1	1.08	2.23
1974	107.0	213.9	65.9	.50	1.62
1975	161.1	278.9	124.3	.58	1.30
1976	148.0	155.0	123.1	.95	1.20
Average				.87	1.27

SOURCE: Table 17, The Alaska Economy: Mid Year Performance Report 1977, Alaska Department of Commerce and Economic Development, 1977.

Table IV.6

Loan to Deposit Ratio

(Millions of Dollars)

	(1) Total Loans and Discounts	(2) Total Deposits	(3) Total Time Deposits	Ratio (1)/(2)	Ratio (1)/(3)
1967	232.0	423.4	224.3	.55	1.03
1968	250.2	429.8	231.2	.58	1.08
1969	291.0	531.6	292.6	.55	.99
1970	336.3	637.6	376.6	.53	.89
1971	401.0	727.6	438.3	.55	.91
1972	476.5	824.1	506.4	.58	.94
1973	541.3	883.9	535.5	.61	1.01
1974	648.3	1,097.8	601.4	.59	1.08
1975	809.4	1,376.7	725.7	.59	1.12
1976	957.4	1,531.7	848.8	.63	1.13
Average				.58	1.02

SOURCE: Table 17, The Alaska Economy: Mid Year Performance Report 1977, Alaska Department of Commerce and Economic Development, 1977.

occurred in the ratio of changes in loans to changes in deposits.[27] The change in loans and discounts is a proxy for new loans made which also may be affected as loans are paid off or sold in the secondary market. Table IV.6 shows the changes during the period in the ratio of Total Loans and Discounts to Deposits. During the period in which the state deposited the $100 million, 1969-1971, these ratios all fell below the average for the ten-year period. This indicates that during this period, although loans were increasing, they were not increasing as fast as deposits. In 1969 and 1970, less than half the new deposits reached the economy through the creation of "new" loans, while an average $.87 was loaned out of every dollar deposited. Although the initial impact was minimal, Table IV.6 indicates that more of the state's deposits may have eventually reached the economy. Beginning in 1972, the ratio of Loans and Discounts to Total Deposits began to increase toward the average. This indicates that loans were increasing at a rate greater than deposits, which may have resulted from the shifting of some state deposits to loans from other assets.

More insight into what happened might be obtained by examining how the banks invested their funds during this period. Table IV.7 shows the distribution of the assets held by insured commercial banks during this period.

[27] Tables IV.5 and IV.6 do not include information on savings and loans, but this is not important since savings and loans did not participate in the deposit placement program. See bank listings in State Investment Portfolio, Department of Administration.

Table IV.7

Distribution of Assets of Commercial Banks 1969-1973

	Cash and Balances	U.S. Government Obligations	Other Securities	Loans and Discounts	Other Assets
1968	11.6%	15.2%	18.8%	50.3%	4.1%
1969	13.4%	18.3%	15.6%	48.9%	3.8%
1970	13.5%	17.3%	18.0%	47.2%	4.0%
1971	14.0%	16.1%	17.6%	48.4%	4.0%
1972	12.0%	13.1%	19.2%	51.3%	4.3%
1973	11.9%	11.7%	16.1%	55.6%	4.7%

Source: Federal Deposit Insurance Corporation, FDIC Call Reports, 1968-73.

During the initial years of the placement, there was a shift in the asset distribution of insured commercial banks. Banks shifted their assets from loans and discounts into U.S. government obligations. This shift partially explains the reduction in loan to deposit ratios shown previously. These data allow us to infer that a greater than usual proportion of deposits made during the time period in which the initial placement of North Slope funds took place was invested in U.S. government obligations. This action, because it reduced the funds which went into loans, reduced the initial impact of the banks on the economy. The data in Table IV.7 indicates that this shift was a short-run shift in portfolio balances. Beginning in 1971, banks began to shift their assets back toward the pre-1969 distribution.

There are three factors which may explain the actions of the banks; the size of the original deposits, the term of the deposits, and the fact that they were state deposits. First, the state's deposits were so large in relation to deposits of the banking system that it caused major changes in the banking system. The state's deposit of $75 million of the North Slope funds in state banks in 1969 was over a 30 percent increase in time deposits in the banking system as of December 1969. The North Slope deposits were over 27 percent of the total time deposits in the banking system in 1970. This massive change in the structure of the banking system may have taken time to adjust to. Because this large increase in deposits was not generated by economic activity, it may also have taken some time to generate loan opportunities. The return on U.S. securities provided a floor for interest rates, the banking system could have held these state funds in U.S. obligations while waiting for the economy to absorb them through loans. Tables IV.5 and IV.6 show that a more normal relation between loans and deposits exists beginning in 1971 after bankers were allowed time to adjust to the tremendous changes which had taken place.

The second factor which could explain the poor showing of the banking industry in providing loans from the North Slope deposits is the term of the original deposits. The main criticism of the original placement by the banking industry was that they were short term. The original placement in 1969 and 1970 was in one and five-year certificates of deposit, which the bankers claimed was too short a time period to invest.[28] Because of these complaints, the state lengthened the term on these deposits in 1971. This is the period when the ratio of loans and discounts to deposits began to rise. The shortness of term argument revolves around the concept of "hot money."[29] The state's money was considered "hot money" because there was no guaranteed replacement for it at the end of its term. Banks can use private deposits, which are short-term, to make long-term investments because they know deposits will continue to grow and they can account for the turnover. The banks had no reason to believe state deposits would be replaced at the end of their term, so they were reluctant to issue loans based on them. This argument may provide an explanation for the lack of investment in long-term loans, but it doesn't explain why short-term loans were not made. Lack of short-term loans may have resulted because of the massive increase in funds which may have taken some time for the demand for this type of loan to reach these levels. No risk U.S. Treasury bills may have been a profitable alternative to holding risky short-term loans.

The most important reason for the limited use of the state deposits to make loans could simply be that they were state deposits. Until 1971 when the state allowed conventional loans to be used as collateral for state deposits, the state required that its deposits be collateralized

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[28] Alaska Department of Revenue, "Revenue News," May 3, 1971.

[29] Interview with Bob Sullivan, November 29, 1977.

100 percent with obligations of the U.S. Government.[30] This meant that, legally, loans could only be made from state deposits to the extent that banks were already holding U.S. Government obligations which were not collateral for other deposits. This could explain not only the limited loans made from these deposits, but also the movement of bank assets into U.S. securities. The liberalization of the collateral requirement coincides with the increase of the ratios of loans to deposits.

During the period of the initial placement of the North Slope lease funds in Alaskan banks, we can observe a reduction in the rate at which deposits were converted into loans and a movement of bank assets into federal securities. These actions limited the impact of the state's deposit on the economy in the short run. As can be seen from Tables IV.5 and IV.6, the long-run trend, after the factors mentioned above were taken care of, was to more normal creation of loans from deposits. This may mean that the initial limited economic impact of the deposit resulted not from unconstrained policies of the banks, but from the institutional constraints which directed the bank's policies.

F.2. The Equity Impact

Three types of equity effects which all involve the redistribution of income can be discussed. First, the data on insured commercial banks

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[30] J. K. Robertson, "Commercial Bank Deposits to Triple in Coming Decade." Alaska Construction and Oil Report, January 1971, pp. 37-38.

can be examined to determine the effect on the profits of the banking industry of this placement of state deposits. Secondly, the impact of these deposits on the cost of borrowing can be examined to see if the cost of borrowing was significantly reduced by the placement of state funds. Thirdly, the opportunity cost of this policy of making deposits can be examined. Tables IV.8, IV.9, and IV.10 provide the information required to deduce tentative answers to these questions about the equity impacts of the policy.

Table IV.8

Interest and Fees Earned on Loans as a Percentage of Loans

	Alaska Insured Commercial Banks	U.S. Insured Commercial Banks
1969	8.18%	7.17%
1970	8.95%	7.65%
1971	8.89%	6.98%
1972	8.45%	6.54%
1973	8.43%	7.62%
Average	8.6%	7.2%
1960-66 Average[1]	8.6%	6.0%

[1]G. Erion. "Insured Commercial Banks in Alaska, 1960-66" in Studies on Alaska Regional Inflation, Federal Field Committee, 1969.

Source: Federal Deposit Insurance Corporation, FDIC Call Report and Income Statements.

Table IV.9

Interest Paid on Time Deposits as a Percentage of Total Time Deposits

	Alaska	U.S.
1969	3.77	3.19
1970	4.54	4.95
1971	4.98	4.43
1972	4.85	4.38
1973	5.39	4.29
Average	4.71	4.25
1960-66 Average[1]	2.71	3.19

[1] G. Erion. "Insured Commercial Banks in Alaska, 1960-66" in Studies on Alaska Regional Inflation, Federal Field Committee, 1969.

Source: Federal Deposit Insurance Corporation, FDIC Call Report and Income Statements.

Table IV.10

Net Income Before Taxes as a Percentage of Current Operating Revenues

	Alaska	U.S.
1969	17.01	21.85
1970	15.75	20.53
1971	15.87	18.46
1972	13.23	18.02
1973	13.90	16.42
Average	15.15	19.06
1960-66 Average[1]	16.3	24.4

[1] G. Erion. "Insured Commercial Banks in Alaska, 1960-66" in Studies on Alaska Regional Inflation, Federal Field Committee, 1969.

Source: Federal Deposit Insurance Corporation, FDIC Call Report and Income Statements.

These tables provide proxies for the real variables, profits and interest rates. Because these are only proxies, they can only be used to infer general trends. For instance, the proxies for interest rates in Table IV.8 actually show earnings on the total loan portfolio which varies with the age and type of loans held.

These tables show that neither borrowers nor lenders made any real gains during this period. Banks' earnings on loans, although they initially went up during 1970 and 1971, showed no overall increase from the period 1960-66. This two-year increase may have resulted from the temporary increase in the usury law which went into effect in 1970.[31] These figures do show a benefit to borrowers in that the average rate paid on loans did not increase as was the general trend in the United States. The insured commercial banks in Alaska also experienced a fall in "profits" as shown in Table IV.9. This fall in the profit rate reflected a general trend throughout the United States. Alaskan banks did not absorb quite the fall in profit rates experienced by U.S. banks in general; the profit rate of Alaska banks was 79 percent of the U.S. profit rate during the period 1969-73, compared to only 67 percent during the period 1960-66.

With the limited information available, it is impossible to determine whether or not the banks earned a profit on the state's deposits

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[31] "Legislative Roundup," Alaska Construction and Oil Report, August 1970, p. 3.

which was greater than, equal to, or less than their average rate of earnings. Greater earnings on the state's deposits could have been one reason profits of Alaskan banks did not fall as much as bank profits in the U.S. The reduction in profit rates may have been due in part to the increase in the interest paid by banks during the period for time deposits. The average interest paid during 1969-1973 was greater than that paid in the United States, which reversed the earlier relationship. Examination of data on insured commercial banks shows neither increases in profits or reductions in loan costs which can be attributed to the placement of North Slope lease funds in Alaska banks.

The opportunity cost of this program is the state's lost income which resulted from investing in this program. The opportunity cost would be equal to the income the state could have earned by investing the money minus the 6.25 percent they earned by placing the money in Alaska banks. The most obvious alternative for the state would have been to invest these funds like the rest of the North Slope surplus funds. From the time of the North Slope lease sale to December 1973, the state earned a compound annual rate of return on the investment account of 7.5 percent.[32] The 6.25 percent earned on the certificates of deposits in Alaska banks by the state was 1.25 percent less than the state could have earned if it would have invested in a manner similar

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[32] Alaska Department of Revenue, "Revenue News Annual Supplement," 1974, p. 19.

to the remainder of the investment account. Consideration of the income generated both to the bank and through the investment of loaned funds would increase the return from this placement allowing it to compare more favorably with the return on the remainder of the Investment Account.

F.3. The Efficiency Impact

The efficiency of the program can be examined by determining whether this approach was the best way to reach the goals set. The goal which seemed to be set for this program was to generally stimulate the economy by expanding capital available to the economy. The analysis of the program's growth impact showed that this was probably not the best way to get capital into the economy. Direct loan programs are a better approach for meeting this goal. Banks, because of reserve or collateral requirements, cannot invest the entire amount of funds in the economy. Banks also are profit oriented, so they will adjust their portfolios to maximize profits; these portfolio adjustments may not provide the loans desired by the policy makers. For example, placing a fixed amount in the banking system to stimulate investment in housing will not be as effective as directly providing funds for mortgages, such as through Alaska Housing Finance Corporation (AHFC), since the mortgage market may not be the most profitable way for the banks to invest the entire amount of the deposit.

Interpreting the goal of stimulating the economy more broadly, the placement of the funds in the banking system may have been the best approach to achieving this goal. The financial sector is important for economic development; a well-functioning capital market provides for the efficient flow of capital to various sectors in the economy. Because of this, one aspect of the goal of stimulating the economy may have been to expand and improve the local banking sector. To the extent that this was a goal, placing the funds in the Alaska banks may have been a good approach to economic stimulation. As Erion pointed out, the scale of banking in Alaska was smaller than nationally, allowing the possibility of large-scale economies to be captured through expansion.[33] The deposit of state North Slope lease funds allowed the expansion of the banking system. To the extent these large-scale economies were achieved, the approach was efficient in meeting these broader goals.

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[33] Gene Erion. "Insured Commercial Banks in Alaska, 1960-1966," p. 71.

G. Conclusions

The lessons learned from this program which are directly applicable to the permanent fund are limited because of the differences in the goals of the programs. The state deposit program was not intended as a savings program. It was not even intended to maximize income as were the investments made by the Bank of America with North Slope lease funds, but it was intended to achieve the specific policy goal of stimulating the state economy. Two lessons which are valuable concern the use of the banking system to achieve specific goals and the importance of a coordinated state program.

First, the banking system offers an important quality which should be considered when designing programs which use it; it is a profit maximizing system. Because of this, it offers efficiency, but at the same time, it may not direct investments to those areas considered important by program managers. Bankers will invest funds where they will earn the greatest return, not necessarily in the socially important areas. The tradeoffs between gain in efficiency of investments and the loss of control should be weighed when designing programs which use the banking system.

Secondly, the experience of the state deposit program showed that coordination of all aspects of state government affecting a program is important. To a certain extent, the failure of this program to provide loan funds to the economy was a result of a lack of coordination. The high collateral requirements, usury limits, and short-term nature of the deposits all needed more examination. Another aspect which should have been examined more fully was the amount placed in banks. Some attempt should be made to provide an estimate of capital needs before a similar program is attempted. This will be particularly important as other state programs increase the state's participation in supplying the needed capital to the state economy.

Appendices

APPENDIX A

GROWTH IN STATE AND LOCAL GOVERNMENT EXPENDITURES IN ALASKA

A.I. Theory of Public Expenditure Growth

Early discussions of the determination of the level of public expenditures concentrated on a proposition known as "Wagner's Law." This proposition boldly stated that the scale of state activity would increase. There is little doubt that this has been true, but the more interesting questions are whether the share of government activity as a portion of total economic activity has been increasing, and what specific factors account for growth in the government sector. The first section of this appendix looks at that second question, while the first is taken up in the following section. The Alaskan experience is looked at in the final part of this appendix.

Richard Musgrave has categorized the determinants of public expenditures and developed some hypotheses on the effect of these variables over time.[1] He identifies one group as non-economic factors and the other as economic. The non-economic are technological, demographic, and social. The economic are incomes, productivity, and prices.

Technological change alters the composition of potential public and private goods from which people will choose the goods they most desire.

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[1] Much of this discussion is taken from Richard Musgrave, Fiscal Systems (New Haven and London: Yale University Press, 1969).

The impact of technological change upon this mix can be dramatic. The outstanding example of this in the twentieth century has been the automobile. This private good has generated a demand for public goods in the form of highways which have, in turn, generated a different mix of both public and private goods that has essentially transformed the environment. Technological change can begin in the public sector and create complimentary or "spin-off" demands in the private sector. The federal space program is an example of this phenomenon. From these two examples, it is clear that it is impossible to generalize regarding the impact of technological change on the growth of demand for public goods.

Demographic considerations involve not only the level of population but also its composition and geographic distribution. Some goods are purely "public" such that the quantity required and, thus, the cost is independent of the number of consumers. Each state has only one governor. But for most public expenditures, the total cost of the service is not independent of the number of consumers. In large states, governors have large staffs.

Both economies and diseconomies of scale may be the result of increases in population density. Obviously, a young population requires a larger number of schools and a mature population more facilities for the aged. For this reason, expenditures can increase more or less rapidly than population.

Social factors play an important role in the determination of the environment in which budgetary decisions are made. Cultural values and social philosophy affect the extent to which demand is directed toward public goods, as well as the public role in redistribution of income and wealth. Changes in political direction may change the perceived best mix between public and private goods as different components of the electorate with different preferences become more or less powerful. War and social disturbance may have a significant permanent impact on the trend in public expenditure growth. This may be the result of either a reassessment of social values or a shift in taxpayers' feelings about the maximum tolerable level of taxation. The latter idea is based on the notion that the level of expenditures is generally constrained by the availability of revenues rather than the opposite hypothesis that the desired expenditure level determines revenues.

Turning to economic considerations, the level of personal income is the most important economic consideration in the determination of public expenditure levels. A meaningful discussion of this relationship must separately treat four categories of public expenditures: capital formation, consumption, redistribution, and merit wants.

Generally as an economy matures, the ratio of total capital formation to gross national product tends to rise. Thus, if the ratio of public to private capital formation remains constant as an economy develops, public expenditures on capital formation would increase more rapidly than total income. This latter ratio is subject to variation however, and two distinct periods in the development of an economy have been identified when the public to private ratio of capital formation may tend toward more public capital formation. The first would be in the early stages of economic development when the creation of social overhead capital, or infrastructure, is a necessary prerequisite for private economic development. In a later stage of development, the consumption of private goods which require complementary public goods may become more important. Highways are the most often indicated example. Urban concentration and the complexities of industrialization may also require large public capital formation programs.

The problem with this explanation is that it may be historically accurate, but it does not explain present conditions very adequately. Highways are as much basic infrastructure as they are complementary public goods to automobiles. Is growth of highway expenditures the result of the former or latter requirement? This indicates that economic theory with respect to public capital formation does not offer any well-defined hypotheses regarding the role of personal income as a determinant of its growth.

With respect to public consumption goods, the question of its growth in relation to personal income is usually put in terms of the income elasticity of demand for these goods. If the elasticity exceeds unity, public consumption grows as a percentage of personal income. Musgrave suggests that as a consequence of Engel's law, the share of the budget going towards public expenditures might increase with increasing income. Engel's law states that the share of consumer outlays going into private expenditures on the basic needs for food, shelter, and clothing declines as income rises. On the other hand, he points out that there are certain public functions which must be regarded as basic necessities also, such as public protection, which would also behave according to Engel's law.

As in the area of public capital formation, the ideas about public consumption goods are not theory but speculation, since they discuss potential public consumption as incomes rise but are unable to provide real insight into the public private ratio.

Government expenditures which attempt to affect the distribution of income may be a declining percentage of income or might even be declining absolutely as income rises according to speculations by Musgrave. The choice is dependent upon the objective of the distributional adjustment, and implicit in his notion is a minimum level of income for all.

It seems that a stronger argument can be made for the notion of rising percentage of income going into public expenditures for income redistribution as incomes rise because of a switch from private to public welfare programs. Rising incomes and economic complexity increase the ability of people to insure themselves against economic risk while, at the same time, probably raising the level of economic risk itself. Where formerly the extended family and the farm provided this insurance, social security largely performs that function in our society.

Merit wants are those government expenditures which do not fall into the traditional economic framework of being either private goods, such that the level of consumption by one individual does not affect the ability of others to consume that same good, or private goods. Rather, they are government expenditures based upon the notion that it is socially proper to consume some things and not others. The decision-making group is assumed to be capable of judgment superior to the individual and the result is subsidized milk for school children and prohibitive taxes on liquor.

Musgrave relates merit wants closely to expenditures for income redistribution and hypothesizes that, as a result, they may be a declining percentage of expenditures as incomes rise. But even if the definition of merit wants is limited to necessities, changing perceptions of necessities could make this component of consumption increase as personal income expands.

In sum, the economic theory which attempts to determine whether public expenditures are a superior good, taking a rising percentage of the total budget as incomes rise, is founded upon little more than speculation. Upon reflection, this is not an unexpected result because of the large variety of goods and services typically provided by a government. Among them would be superior, inferior, and Giffen goods (consumption declines absolutely when income rises) and the public expenditures would be some weighted average of all these different types of goods, of which some are necessities and some luxuries. In a sense, it is perhaps encouraging to come to this indeterminate conclusion, rather than the opposite, that there is an inexorable relationship between rising incomes and public expenditures which predestines that an ever increasing percentage of economic output be channeled through the public sector.

Turning next to the question of productivity, there is an argument that productivity gains in the production of those goods supplied by the public sector lag behind productivity gains in the private sector. This thesis was put forward by Baumol[2] where he points to the obvious potential differences in productivity increases in labor used in a typical manufacturing process, and used in the production of a symphony.

Whether this lagging productivity increase concept is valid for the public sector in general depends upon the particular mix of public sector goods relative to those in the private sector. Examples of functions in which labor productivity increases are minimal in the public sector, such as education, occur in the private sector also in service industries, such as restaurants. And many public expenditures are in areas where labor productivity increases are potentially as rapid as in the private sector. Highway maintenance is one example and construction activity, in general, another.

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[2] William Baumol, "Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crises," American Economic Review, Vol. LVII, No. 3 (June 1967), pp. 415-426.

The existence of such a differential in productivity increases is thus an empirical question, just as is the size of the income elasticity of public expenditures. The difficulty which arises in attempting to make an empirical measurement of productivity is that the product of many public sector activities is difficult to measure independently of the inputs in terms of man hours. Some attempts have, however, been made. The gross product deflator of the Department of Commerce, a ratio used to obtain comparability among prices of outputs in different time periods, has historically grown more rapidly for state and local government expenditures than for the average of all products of the economy. This tends to support the hypothesis that productivity is rising more slowly in government than in the economy generally.

If this is the case, there would be a tendency over time, other things being equal, for the cost of public expenditures to rise relative to private expenditures and the share of personal income directed into public expenditures to rise. This would be the case as long as labor markets are relatively unconstrained so that wage increases due to productivity gains would be reflected in wage increases in those industries where productivity gains are not possible.

This introduces a final element, price elasticity of demand, into the consideration of elements determining the growth rate of public expenditures relative to private in an expanding economy. To the extent that productivity increases in the public sector fall behind those in the private economy, the relative price of public goods will tend to rise. Other things being equal, the higher price for the product will cause a decline in demand. This factor would tend to offset increasing public sector expenditures resulting from both income and productivity effects. Little speculation has been done on the price elasticity of public goods because of both the difficulty in identification of the price for a particular product, and of identifying the product itself. From the point of view of the consumer, the individual taxpayer, the existence of a behavioral relationship between the cost of a public service in terms of taxes and the amount consumed is difficult to trace.

In sum, there are three economic considerations operating on the growth of public expenditures: income growth, productivity increases, and price effects. In a static political and social atmosphere, there is no a priori reason to expect that the public sector needs to grow relatively faster than output in general. In a world of changing expectations and political alliances, economic considerations may be of secondary importance. To examine the actual trends in this century in government spending in the United States is the topic of the next section.

A.II. Historical Public Expenditure Patterns in the U.S.

A cursory analysis of total government spending in this century reveals that government expenditures have accounted for an increasing percentage of gross national product (GNP) over time. Government expenditures at all levels increased from 7.1 percent of GNP in 1890 to 33.2 percent in 1963.[3] The largest component of this growth has been the military budget which increased from 1.4 percent to 10.6 percent of GNP. Musgrave attributes a substantial portion of the rise in the civilian budget of from 5.0 percent to 18.3 percent of GNP to the growth in social services. Of these, transfer payments grew from .1 percent to 7.0 percent of total GNP. Capital outlays fluctuated over this period between 20 percent and 30 percent of total public expenditures with no observable pattern.

The income elasticity of public expenditures over this same period averaged greater than one with the period after 1929 having a higher elasticity than the average. For the category of civilian expenditures, the elasticities were lower than for total expenditures. The pre-1929 elasticity was calculated at 1.7 and the post-1929 elasticity at 2.4 for civilian expenditures.

Table A.1 provides an analysis of more recent data for just state and local government expenditure growth as it relates to the growth of

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[3] Musgrave, op. cit., p. 94.

TABLE A.1

PATTERNS IN STATE & LOCAL

GOVERNMENT EXPENDITURES

TOTAL U.S.

Year	State & Local Gov't. Expenditures (Million $)	Personal Income (Million $)	Resident Population (Million)	Implicit Price Deflator State & Local Gov't. 1958 = 100	Implicit Price Deflator Gross National Product 1958 = 100	State & Local Gov't. Expenditure as Percentage of Income	State & Local Gov't. Expenditures Per Capita ($)	State & Local Gov't. Real Expenditures Per Capita ($)	Personal Income Per Capita ($)	Real Personal Income Per Capita ($)	Real Share of State & Local Government
1930	8432	77015	123.077	38.7	49.3	.10	68.50	170	625.74	1260	.13
1935	8550	60405	127.250	37.0	42.6	.14	67.19	180	474.69	1110	.16
1940	9319	78285	132.594	37.3	43.9	.11	70.28	180	590.41	1340	.13
1945	9018	171113	140.468	48.6	59.7	.05	64.19	130	1218.16	2040	.06
1950	22342	227619	152.271	70.8	80.2	.09	146.72	200	1494.82	1860	.10
1955	32663	310889	165.931	87.5	90.9	.10	196.84	220	1873.60	2060	.10
1960	49636	400953	180.671	105.9	103.3	.12	274.73	250	2219.24	2140	.11
1965	73656	535083	194.303	123.2	110.9	.13	379.07	300	2753.85	2480	.12
1970	132212	808290	204.875	164.6	135.2	.16	645.33	390	3945.28	2910	.13
1975	214536	1249673	213.540	218.0	185.9	.17	1004.66	460	5852.17	3140	.14
Annual Growth Rate	7%	6%	1%	4%	3%	-	6%	2%	5%	2%	-

Source: U. S. Dept. of Commerce, Office of Business Economics, Survey of Current Business, various issues.
U. S. Dept. of Commerce, Bureau of Census, Current Population Reports, various issues.

personal income in the United States. Generally, state and local government expenditures are best analyzed together because of the variation from state to state in the jurisdictional division of functions. Between 1930 and 1975, total state and local government expenditures increased from $8 billion to $215 billion, an annual rate of growth of 7 percent. Over the same period, personal income increased at an annual rate of 6 percent. As a result of this differential growth, state and local government expenditures increased as a percentage of personal income from 10 percent to 17 percent between 1930 and 1975.

The actual increase in the ratio occurred in the last 20 years after 1955, at which time the ratio was still at 10 percent. Much of the rapid increase since that time must be attributed to transfer programs from the federal government to state and local governments.

Table A.1 includes the implicit price deflators for state and local government and for GNP for the same period. The price deflator for state and local government increased over the period at an annual 4 percent rate, while the GNP deflator increased 3 percent annually, reflecting more rapid productivity increases in the economy in general than in those goods provided by state and local governments.

If state and local government expenditures and personal income are converted to real figures using these deflators, the pattern of growth is somewhat different. Both real personal income per capita and real state and local government expenditures per capita increase at an annual rate of 2 percent. This is equivalent to a proportionate increase in the real value of output of state and local government expenditures over the period.[4]

A classic study done in the 1950s analyzed the growth of state and local government expenditures in the United States during the first half of the 20th century and interstate variations in growth rates.[5] Fabricant concluded from his analysis that differences among states in per capita expenditures in various categories of expenditures declined over time but were not eliminated. Every state expanded nearly all of its functions in terms of nominal expenditures but the more backward states, in 1903, increased expenditures more rapidly over the period.

In addition, he found that a majority of the variation among the states in expenditure levels could be explained by three factors: income,

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[4]Dividing government expenditures and personal income by this price deflator involves a simplification in each case, although the resulting biases are compensating. A small component of state and local government expenditures is transfers which are not a component of the price deflator for state and local government since it does not appear in GNP. Since transfers would have a "real index" closer to the total of GNP, the growth of the deflator may have a slight upward bias. The price deflator for GNP, however, contains capital expenditure elements not reflected in expenditures out of personal income. Personal income is more commonly deflated by the consumer price index or the deflator for consumer expenditure goods. This index grew less rapidly than the GNP deflator, so the bias from using the GNP deflator is in the same direction as that resulting from the transfer component of state and local government expenditures.

[5]Solomon Fabricant, The Trend of Government Activity in the United States Since 1900 (New York: National Bureau of Economic Research, 1952).

urbanization, and density. The elasticity of income coefficient for the period was calculated to be .9, holding other factors constant. This implies that state and local government expenditures would increase as income rises, but at a somewhat slower rate. Urbanization was also found to be positively correlated with expenditures, while density was inversely related.

A shortcoming of this type of statistical analysis is that there is often high correlation among the explanatory variables, for example, income and urbanization. As a result, it is difficult to identify the net contributions of the explanatory variables separately from one another with confidence, and important variables not included but correlated with included variables (such as education level which is often correlated with income) can also result in incorrect conclusions. This reduces the applicability of the results to specific situations such as an analysis of Alaskan expenditures.

This cursory review has shown that there has been a significant growth in government expenditures as a percentage of GNP over this century. State and local government taken together, however, have grown much more slowly than the federal government and in real terms, deflated to account for inflation, the percentage of output accounted for by state and local government has remained fairly constant since the 1930s.

A.III. Alaska Historical Public Expenditure Patterns

The historic pattern of Alaska state government operating expenditures is detailed in Table A.2. Total expenditures have increased from $37 million in fiscal year 1960 to an estimated $893 million in 1977. This represents an annual growth rate since statehood of 21 percent. The increase from year to year has been calculated, as well as the percentage increase over the previous year. Examination of this percentage increase from year to year indicates the existence of several distinct periods of expenditure growth which show great variation. In 1964 expenditures were 2 percent higher than the previous year, while in 1971 they were 59 percent higher than in 1970.

Shortly after statehood, expenditure growth was rapid because a need was felt to develop social overhead capital as a prerequisite to private economic development. The source of funds for these expenditures was the federal transitional grants provided to get the new state on its feet. Unfortunately, a large portion of the transitional grants was spent on programs previously funded by the federal government before statehood.

The transitional grants were available for only a few years and alternative revenue sources did not develop to replace the gap left when those grants were spent. As a result, tax increases in the early 1960s were necessary to keep the level of state expenditures growing from year to year.[6]

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[6]George W. Rogers, The Future of Alaska (Wash. D.C.: Resources for the Future, 1962), pp. 180-220.

Table A.2.

State of Alaska Operating Expenditures by Function 1963-1976

(Million $)

FUNCTION / YEAR	Education $	Education %	Social Services $	Social Services %	Health $	Health %	Natural Resources $	Natural Resources %	Public Protection $	Public Protection %
1960	-	-	-	-	-	-	-	-	-	-
1961	-	-	-	-	-	-	-	-	-	-
1962	-	-	-	-	-	-	-	-	-	-
1963	33.0	41.1	7.4	9.2	5.8	7.2	6.5	8.1	1.1	1.4
1964	31.3	38.1	8.0	9.7	6.2	7.6	6.2	7.6	.8	1.0
1965	35.6	40.3	8.6	9.7	6.6	7.5	6.1	6.9	1.4	1.6
1966	39.9	39.7	9.1	9.1	7.0	7.0	7.4	7.4	1.7	1.7
1967	45.6	40.1	9.9	8.7	7.6	6.7	8.5	7.5	1.9	1.7
1968	52.0	40.2	11.4	8.8	8.0	6.2	9.5	7.3	2.3	1.8
1969	63.4	41.7	14.5	9.5	8.0	5.3	10.7	7.0	2.6	1.7
1970	84.9	42.7	19.8	10.0	10.9	5.5	15.5	7.8	3.0	1.5
1971	118.0	37.4	39.6	12.6	13.5	4.3	19.5	6.2	5.0	1.6
1972	155.3	42.4	44.9	12.3	13.3	3.6	24.0	6.5	6.1	1.7
1973	175.7	41.7	53.7	12.7	22.7	5.4	23.3	5.5	7.0	1.7
1974	193.8	40.1	61.5	12.8	27.6	5.7	27.6	5.7	9.4	1.9
1975	228.7	38.3	65.0	10.9	34.6	5.8	36.2	6.1	13.8	2.3
1976	328.7	42.2	89.4	11.5	44.4	5.7	48.6	6.2	18.1	2.3
1977 Estimate	373.5	41.8	97.5	10.9	52.0	5.8	58.0	6.5	20.3	2.3
Annual Growth Rates										
Overall Growth rate	19%		20%		17%		17%		23%	
Since Prudhoe 1969-1976	25%		27%		26%		24%		29%	
Before Prudhoe	12%		12%		6%		9%		15%	

Source: State of Alaska, Budget Document, various issues. Figures adjusted after 1962 for compatibility over time.

Table A.2. continued

State of Alaska Operating Expenditures by Function 1963-1976

(Million $)

FUNCTION / YEAR	Administrative of Justice $	%	Development $	%	Transportation $	%	General Government $	%	Total $	Increase Over Previous Year $	%
1960	-	-	-	-	-	-	-	-	36.6	-	-
1961	-	-	-	-	-	-	-	-	51.4	14.8	38.5
1962	-	-	-	-	-	-	-	-	63.2	11.8	23.0
1963	5.3	6.6	.4	.5	13.4	16.7	4.8	6.0	80.3	17.1	27.0
1964	6.7	8.2	.7	.9	17.0	20.7	5.2	6.3	82.1	1.8	2.2
1965	7.0	7.9	.7	.8	17.9	20.3	5.6	6.3	88.4	6.3	7.6
1966	7.5	7.5	.9	.9	19.5	19.4	7.5	7.5	100.5	12.1	13.7
1967	9.0	7.9	1.2	1.1	21.3	18.8	8.6	7.6	113.6	13.1	13.0
1968	9.7	7.5	1.3	1.0	25.3	19.6	9.9	7.7	129.3	15.7	13.8
1969	12.1	8.0	1.1	.7	29.7	19.5	12.6	8.3	152.1	22.8	17.6
1970	14.6	7.3	1.7	.9	36.1	18.1	18.1	9.1	199.0	46.9	30.8
1971	21.4	6.8	15.0	4.8	44.4	14.1	39.3	12.4	315.8	116.8	58.7
1972	26.2	7.1	17.0	4.6	56.5	15.4	23.3	6.4	366.5	50.7	16.1
1973	29.1	6.9	20.0	4.7	62.8	14.9	27.7	6.6	421.8	55.3	15.1
1974	35.0	7.3	21.7	4.5	70.4	14.6	35.3	7.3	482.3	60.5	14.3
1975	47.5	7.9	40.5	6.8	90.8	15.2	40.0	6.7	597.6	115.3	23.9
1976	59.5	7.6	37.0	4.8	101.8	13.1	51.4	6.6	778.9	181.3	30.3
1977 Estimate	69.3	7.8	43.1	4.8	122.3	13.7	56.7	6.4	892.6	113.7	14.4
Annual Growth Rates											
Overall Growth Rate	20%		40%		17%		19%		21% (1960 to 1977)		
Since Prudhoe 1969-1976	24%		58%		19%		21%		25%		
Before Prudhoe	15%		18%		14%		17%		17% (1960 to 1969) 11% (1963 to 1969)		

In the latter 1960s, there were significant increases in the level of federal grants-in-aid, particularly in the area of transportation, and this allowed the annual growth rate to increase to over 13 percent until the bonus lease sale at Prudhoe Bay in late 1969.

Since that time, the change from year to year has been erratic, going from a high of 59 percent in 1970 to a low of 14 percent in 1974. If any pattern is discernible in the aggregate figures, it is that expenditure level increases have been higher when revenues, expectation of revenues, or population increase is high. The average annual growth rate in expenditures since the Prudhoe Bay lease sale has been 25 percent, while the average for the period since statehood and before the sale was 17 percent.

Table A.2 also presents a functional breakdown of state expenditures from 1963 onward. The most striking observation from this breakdown is the fact that the percentage of the state budget going to each of the nine functional categories has remained fairly stable over the historic period in spite of the rapid growth rate of total expenditures. The education budget, for example, has fluctuated between 37 percent and 42 percent of the total with no observable trend, either before or after the Prudhoe Bay lease sale.

Since the education budget makes up such a large percentage of the total, one could argue that it, to a large extent, determines the growth rate for total expenditures but the same pattern applies generally with minor variation. Before 1969, the health and natural resource budgets grew considerably slower than the average; while public protection, administration of justice, development, transportation, and general government increased their shares. Since 1969, the percentage increases have come in the areas of social services, health, and development.

The social services budget jumped relatively in the early 1970s but has declined in recent years. The health budget, in contrast, lost out relatively in the early 1970s but has been increasing its share recently. The development budget has shown the largest increase, mainly because of the advent of municipal revenue sharing in the early 1970s. The transportation portion of the budget was at a maximum in the early and mid-1960s and has been on the decline ever since. This reflects the large reliance of this portion of the budget on federal grants-in-aid. General government increased dramatically in the years immediately following 1969 as a result of the advent of new programs. In later years, as these programs matured, they moved into the other functional categories and general governmental share of the total returned to its previous level.

This functional expenditure analysis indicates that the growth in state government expenditures has occurred in all categories. In addition, the functional growth since 1969 has not been particularly biased with respect to any categories except toward local transfers in the development budget and away from transportation. Thus, any "backlog of felt needs" at the time of the Prudhoe Bay lease sale seems to have been either a generalized feeling, or else "felt needs" in some functional areas have been balanced by "compensating growth" in other areas.

Table A.3 shows the relationship between total state government operating expenditures and those accounted for out of the general fund. There appears to have been no pattern of change over time in the ratio of general fund to total expenditures. Also included is a calculation of the percentage of total state operating expenditures accounted for by federal grants. The period immediately after statehood was when federal grant budget contributions were the highest percentage. Since that time, there has been a consistent decline in the percentage of expenditures financed by federal transfers. In contrast to 29 percent in the peak year of 1961, in 1976 the percentage was 11 percent.

A more detailed analysis of total state operating expenditures is provided in Table A.4. Since 1961, total operating expenditures increased approximately 20 percent annually. Netting out an annual population increase of nearly 4 percent reduces the rate of increase in expenditures per capita to 15.5 percent.

If the real per capita expenditure figure for Alaska is deflated by the Anchorage Consumer price index, the real expenditure growth rate per capita becomes 11 percent. This is a rate of growth more than

TABLE A.3

ALASKA STATE GOVERNMENT

ANALYSIS OF BUDGET

COMPOSITION

Year	State Operating Expenditures	General Fund as a Percentage of Total	Federal Grants as Percentage of Total
1960	36.6	70	26
1961	51.4	71	29
1962	63.2	71	27
1963	83.3	76	19
1964	116.2	70	20
1965	98.9	75	17
1966	109.9	75	21
1967	123.3	74	21
1968	144.9	73	21
1969	177.5	74	21
1970	226.1	72	21
1971	332.8	78	14
1972	377.3	75	18
1973	435.3	71	16
1974	496.3	73	17
1975	613.3	74	15
1976	778.9	73	11

Source: State of Alaska, Budget Document, various issues.

TABLE A.4

STATE OF ALASKA

OPERATING EXPENDITURE ANALYSIS

Year	Total Operating Expenditures 1 (Million $)	Population 2 (Thousand)	Expendi. per Capita 3 ($)	Anchorage Consumer Price Index 4 (1967=100)	Real Expendi. per Capita 5 (1967 $)	Real Personal Income (Million 6 1967 $)	Real Personal Income Per Capita 7 ($)	Ex/Income Real Per Capita 8 (%)	Implicit Price Deflator 9: State & Local Gov't. (1958=100)	Implicit Price Deflator 9: Personal Consumption Expenditures (1958 = 100)
1960	36.6	226.2	162	-	-	-	-	-	105.9	102.9
1961	51.4	236.7	217	92.3	235	705.6	2981	8	109.4	103.9
1962	63.2	242.8	260	92.5	281	734.2	3024	9	113.2	104.9
1963	80.3	249.9	321	93.1	345	762.9	3053	11	116.3	106.1
1964	82.1	253.2	324	93.4	347	853.8	3372	10	119.3	107.4
1965	88.4	265.2	333	94.2	354	917.3	3459	10	123.2	108.9
1966	100.5	271.5	370	97.9	378	954.3	3515	11	129.4	111.5
1967	113.6	277.9	409	100.0	409	1042.2	3750	11	136.4	114.4
1968	129.3	284.9	454	102.6	443	1097.8	3853	11	144.7	118.5
1969	152.1	294.6	516	105.9	487	1195.4	4058	12	153.6	123.8
1970	199	302.4	658	109.6	600	1316.3	4353	14	164.6	135.2
1971	315.8	312.9	1009	112.9	894	1395.2	4459	20	175.8	141.6
1972	366.5	324.8	1128	115.9	973	1500.5	4620	21	183.2	146.1
1973	421.8	330.6	1276	120.0	1063	1670.0	5051	21	196.6	154.1
1974	482.3	351.2	1373	133.9	1025	1793.9	5108	20	218.0	170.8
1975	597.6	404.6	1477	152.3	970	2182.5	5394	18	237.8	184.5
1976	778.9	413.3	1885	164.1	1149	2321.8	5618	20	254.1	193.9
1977est.	892.6	-	-	-	-	-	-	-	-	-
Rate of Increase 1961-76	19.87	3.79	15.5	3.91	11.16	8.26	4.32	-	5.78	4.25

1. Table A.2
2. MAP model thru 1974 then State of Alaska estimates 1960 from U. S. Census.
3. Column 2/Column 1
4. U. S. Dept. of Labor, Bureau of Labor Statistics.
5. Column 3/Column 4
6. Personal income taken from U. S. Department of Commerce, Bureau of Economic Analysis, deflated by Anchorage consumer price index.
7. MAP model.
8. Column 5/Column 7.
9. U. S. Dept. of Commerce, Bureau of Economic Analysis.

2.5 times faster than the growth in real personal income per capita over the same period which was 4 percent.

As noted previously, the consumer price index probably underestimates the increase in the cost of delivery of public goods and services because productivity gains in those areas do not occur as rapidly as in the private sector. Comparison of the implicit price deflator for state and local government with that for personal consumption expenditures over the same period tends to support that contention. The price deflator for personal consumption expenditures, a close proxy for the consumer price index, increased at an annual rate of 4 percent, while the price deflator for state and local government grew at a 6 percent rate. Deflation of state operating expenditures per capita by the implicit price deflator for state and local government would result in a calculated growth rate in real expenditures per capita closer to 9 percent. This is only slightly more than twice the rate of growth of real income per capita.

As a percentage of income per capita, state expenditures have shown an interesting pattern. In the period before 1970, there was growth from 8 percent to 12 percent of income in the form of state expenditures in a fairly steady fashion. In the two years between 1969 and 1971, the ratio increased 67 percent to 20 percent. Since 1971, the percentage has hovered at 20 percent.

Table A.5 compares Alaska state and local government expenditures with national averages. Examination of the ratio of total per capita expenditures in Alaska and the U. S. shows that Alaskan expenditures have indeed grown relatively more rapidly than the national average; but during the period from 1963 to the present, the increase has not been large. In 1965 the ratio was 2.4 and in 1974 the ratio had increased to 2.66.

The ratio differs significantly among the functional categories. In the largest identified category, education, the ratio has increased significantly consistent with overall growth. This has not been the pattern in the other categories, however. The ratio of highway expenditures in Alaska is about 3.5 times the national average and was that way in 1963 also. In the interim, it was as high as 6 times. Public welfare expenditures had a ratio of between 66 and 81 percent of the national average until 1971 when they jumped to 1.05 percent. Since that time, they have remained close to the national average. Health and hospital expenditures have shown a random variation around and close to the national average. The largest ratio in recent years has been in the unidentified category, where in 1974 it was 3.86. This category has shown almost continuous growth since 1963.

Table A.6 shows that the ratio of combined state and local expenditures to personal income in Alaska relative to the U.S. average increased substantially since 1963. In that year, the ratio was 1.67 and by 1974

Table A.5

Direct General Expenditure of

State & Local Governments

Alaska and The U. S. Average

($ Per Capita)

Year		Total	Education	Highways	Public Welfare	Health and Hospitals	All Other
1963	Alaska	670	210	210	23	32	195
	U.S.	344	127	59	29	25	103
	Ratio	(1.95)	(1.65)	(3.56)	(.79)	(1.28)	(1.89)
1964	Alaska	-	-	-	-	-	-
	U.S.	-	-	-	-	-	-
	Ratio	-	-	-	-	-	-
1965	Alaska	928	247	326	26	29	298
	U.S.	386	149	63	32	27	113
	Ratio	(2.40)	(1.65)	(5.17)	(.81)	(1.07)	(2.63)
1966	Alaska	923	276	273	27	28	319
	U.S.	423	170	65	35	30	123
	Ratio	(2.18)	(1.62)	(4.20)	(.77)	(.93)	(2.59)
1967	Alaska	1191	309	440	35	32	374
	U.S.	472	192	70	42	34	135
	Ratio	(2.52)	(1.60)	(6.28)	(.83)	(.94)	(2.77)
1968	Alaska	1203	319	345	35	36	467
	U.S.	512	206	72	49	38	147
	Ratio	(2.34)	(1.54)	(4.79)	(.71)	(.94)	(3.17)
1969	Alaska	1216	390	247	40	42	497
	U.S.	578	234	76	60	42	166
	Ratio	(2.10)	(1.66)	(3.25)	(.66)	(1.0)	(2.99)
1970	Alaska	1350	439	254	51	40	566
	U.S.	646	259	81	72	48	186
	Ratio	(2.08)	(1.69)	(3.13)	(.70)	(.83)	(3.04)
1971	Alaska	1828	643	326	93	63	702
	U.S.	731	288	88	88	54	212
	Ratio	(2.50)	(2.23)	(3.70)	(1.05)	(1.16)	(3.31)
1972	Alaska	2147	728	389	105	62	863
	U.S.	801	312	91	101	62	236
	Ratio	(2.68)	(2.33)	(4.27)	(1.03)	(1.00)	(3.65)
1973	Alaska	2376	867	384	122	63	940
	U.S.	863	332	89	112	66	264
	Ratio	(2.75)	(2.61)	(4.31)	(1.09)	(.95)	(3.55)
1974	Alaska	2501	827	345	120	74	1135
	U.S.	940	359	94	117	75	294
	Ratio	(2.66)	(2.30)	(3.67)	(1.03)	(.99)	(3.86)

Source: U.S. Dept of Commerce, Bureau of Census, Statistical Abstract, various issues.

TABLE A.6

DIRECT GENERAL EXPENDITURE OF

STATE & LOCAL GOVERNMENTS

ALASKA AND THE U. S. AVERAGE

($ PER $1000 OF PERSONAL INCOME)

Year		All General Expendi.	Total Education	Local Education Only	Highways	Public Welfare	Health & Hosp.
1963	Alaska	236	74	54	74	8	11
	U.S.	141	52	41	24	12	10
	Ratio	(1.67)	(1.42)	(1.32)	(3.08)	(.67)	(1.10)
1964	Alaska	-	-	-	-	-	-
	U.S.	-	-	-	-	-	-
	Ratio	-	-	-	-	-	-
1965	Alaska	301	80	57	106	8	9
	U.S.	152	59	45	24	12	10
	Ratio	(1.98)	(1.35)	(1.26)	(4.41)	(.66)	(.90)
1966	Alaska	294	88	54	87	8	9
	U.S.	155	62	47	23	12	11
	Ratio	(1.89)	(1.41)	(1.14)	(3.78)	(.66)	(.81)
1967	Alaska	-	-	-	-	-	-
	U.S.	-	-	-	-	-	-
	Ratio	-	-	-	-	-	-
1968	Alaska	327	86	61	94	9	9
	U.S.	163	65	46	23	15	12
	Ratio	(2.00)	(1.32)	(1.32)	(4.08)	(.60)	(.75)
1969	Alaska	302	97	63	61	10	10
	U.S.	171	69	49	23	18	12
	Ratio	(1.76)	(1.40)	(1.34)	(2.65)	(.55)	(.83)
1970	Alaska	324	105	79	61	12	10
	U.S.	176	71	50	22	20	13
	Ratio	(1.84)	(1.47)	(1.58)	(2.77)	(.60)	(.76)
1971	Alaska	-	-	-	-	-	-
	U.S.	-	-	-	-	-	-
	Ratio	-	-	-	-	-	-
1972	Alaska	417	142	-	75	20	12
	U.S.	178	69	-	20	23	14
	Ratio	(2.34)	(2.06)	-	(3.75)	(.87)	(.86)
1973	Alaska	400	150	-	60	20	10
	U.S.	170	70	-	20	20	10
	Ratio	(2.35)	(2.14)	-	(3.00)	(1.00)	(1.00)
1974	Alaska	363	120	-	50	18	11
	U.S.	172	66	-	17	21	14
	Ratio	(2.11)	(1.82)	-	(2.94)	(.86)	(.79)

Source: U.S. Dept of Dept of Commerce, Bureau of Census, Statistical Abstract, various issues.

it had increased to 2.11. Interestingly, in 1968 it was already 2., which reflects not only the fact that the U.S. average expenditure level as a percentage of personal income was increasing rapidly over the period but also that the very rapid growth in Alaska in state government expenditures as a function of income has been partially offset by an apparent slow growth in expenditures at the local level. Expenditures in all indicated categories, with the exception of highways, appear to be more income elastic over the period 1963 to 1974 than the U.S. average.

For highways, one can identify a decline over time nationally in expenditures as a percentage of income, while for Alaska no trend is identifiable in the significant year-to-year fluctuations. For total education, there seems to have been a significant increase in the Alaska margin in the early 1970s with Alaska now spending twice the national average on education when adjusted for personal income. In contrast, public welfare and health and hospital expenditures are considerably less than the national average, although public welfare expenditures have increased substantially since the early 1970s.

To summarize these patterns of growth, a few general conclusions can be stated. First, the majority of the rapid growth in government in this century appears to have been generated by increases in two areas of federal expenditures--military and transfer programs. Over the last 40 years, state and local government has increased more rapidly than personal income. This has resulted in a larger share for state and local government but when corrected for productivity growth, governments' share appear fairly constant.

State expenditures in Alaska have grown rapidly since statehood by all measures. At the same time, expenditures have been rapidly increasing in other states so the Alaska differential, though rising, has not increased as much as might have been expected. There has been no average period of growth since statehood but rather several distinct periods of very different growth rates basically determined by revenues available and population and income increases. In spite of this growth, Alaska spends no more per capita in some functional categories of expenditures than the national average.

APPENDIX B

MODIFICATIONS TO MAP ECONOMETRIC MODEL FOR ANALYSIS OF PERMANENT FUND

B.I. Accommodations to Simulate to 1999

Two modifications were necessary to allow the model to simulate to the year 1999. The first involved extending the exogenous data series from their previously final year of 1990 for an additional nine years. Most data series were trended from 1990 to 1999, but those which involved the petroleum sector were consistent with the assumptions used to develop the variable values for earlier years. These are discussed in more detail in Appendix C.

The second change involved simplification of the model in several respects to allow the computer to rapidly identify a solution to the model at minimum cost. These simplifications significantly reduced the necessary computer time for each simulation at virtually no cost in terms of validity of the model results for the purposes of permanent fund analysis.

The simplifications involved the substitution of a lagged independent variable for its simultaneous value in five equations. The equations were then reestimated using the lagged relationship. This reduced the model simultaneity and allowed rapid solution. The equations involved determine the number of Alaska taxpayers, Alaska tax deductions, and Alaska personal exemptions, as well as Federal personal income tax receipts and the gross product deflator in the construction sector.

Extension of the simulation period for the model beyond 1990 introduces a potential problem in terms of the symmetry of response of variables to changes in independent variables affecting them. In some simulations, there are substantial reductions in state spending necessitated by the depletion of state fund balances. It is assumed that responses of variables such as state government employment in such periods of reduced economic activity are symmetrical with those in periods of economic growth. One might expect some "ratchet effect" preventing a downside response identical to the upside; but for the purposes of this exercise, the symmetry assumption will not limit the value of the simulations as long as it is recognized.

B.II. Treatment of Permanent Fund

Each year there is a basic permanent fund contribution (RPFS1) based upon petroleum revenues available for contributions (RP7S) and the contributions percentage (PFPER).

RPFS1 == PFPER*RP7S

Interest (IPF1) is earned each year on the balance in the permanent fund carried forward from the previous year (PFBAL(-1)). The interest can remain in the permanent fund (IPFPF) or be transferred out (IPF). A portion of this latter amount may become Alaska Inc. payments (ALINC). Any transfers not channeled into Alaska Inc. go into the general fund (RIPF).

IPF1 == IF PFBAL(-1) GT 0 THEN PFBAL(-1)*RORPF ELSE IPF

IPF == PART*IPF1

```
IPFPF == (1-PART)*IPF1

RIPF == IF YR GT 1980 THEN (1-ALINCPR)* IPF1 ELSE 0

ALINC = IF YR GT 1980 THEN ALINCPR*IPF ELSE 0
```

After the level of state expenditures has been determined, a decision is made whether to make an additional contribution to the permanent fund (PFSUP) or to make a permanent fund withdrawal (WPFSUP) in order to keep the balance in the general fund (GFBAL) at a desired level.

```
PFSUP1 == IF CRACT*RGF99S1 GT E99S-ECPS AND YR GT 1977 THEN
          A*PORTION*(RGF99S1-(E99S-ECPS))+B*(RGF99S1-(E99S-ECPS)-
          GFCUSH) ELSE 0

PFSUP == IF PFSUP1 LT 0 THEN 0 ELSE PFSUP1

PFDRAIN == IF DRAIN*(E99S-ECPS-RGF99S1) GT PFSUPBL(-1) THEN
           PFSUPBL(-1) ELSE DRAIN*(E99S-ECPS-RGF99S1)

WPFSUP1 == IF PFSUPBL(-1) GT 0 AND GFBAL(-1) LT 0.25*(E99S(-1)-
           ECPS(-1)) THEN PFDRAIN ELSE 0

WPFSUP == IF WPFSUP1 LT 0 THEN 0 ELSE WPFSUP1
```

Permanent fund supplements can take several forms which are not limited by those depicted in the equation which determines PFSUP1. There the supplement can take the form of either a portion of the difference between general fund revenues and general fund expenditures (RGF99S1-ECPS) which is the surplus on current account or the difference between the surplus on current account and an incremental cushion amount to be retained in the general fund (GFCUSH).

A permanent fund withdrawal (WPFSUP) into the general fund would occur if there were a deficit on current account and if there were not sufficient funds in the general fund to cover the deficit and at the same time retain sufficient general fund balances for normal operations.

Permanent fund withdrawals for operating expenditures can only occur from supplemental balances previously deposited, but not from basic contributions. Thus there are three permanent fund balances at any time. There is first the balance in the fund from the basic percentage payment (PF1BAL). The second component consists of the amount of accumulated interest and any net supplemental payments to the fund (PFSUPBL). The sum of these two is the total in the permanent fund at any time (PFBAL). The change in the balance from year to year is also calculated (PFBALCH).

```
PF1BAL = IF YR EQ 1977 THEN 2.4 ELSE PF1BAL(-1)+RPFS1
PFSUPBL = PFSUPBL(-1)+PFSUP-WPFSUP+IPFPF
PFBAL = IF YR EQ 1977 THEN 2.4 ELSE PFBAL(-1)+RPFS-WPFSUP
PFBALCH == PFBAL-PFBAL(-1)
```

This method of handling the permanent fund has two interpretations. The first would be that supplemental permanent fund contributions would not be subject to the same limitations on withdrawal as the basic percentage contribution. Alternatively, this treatment is equivalent to putting funds in excess of current needs in an account where, because the funds will not be immediately called upon, they can earn a somewhat higher return than those remaining in the general fund.

General fund revenues are calculated a second time, after accounting for any supplementary additions to the permanent fund or withdrawals from the permanent fund to equate revenues and expenditures (RGF99S). Finally, the general fund balance is calculated (GFBAL) as well as the year-to-year change in the general fund balance (GFBALCH).

RGF99S = R99S-RPFS-RSFS+WPFSUP-RRDF-ALINC

GFBAL = GFBAL(-1)+RGF99S-E99S+ECPS

GFBALCH == GFBAL-GFBAL(-1)

The total permanent fund contribution is calculated (RPFS) as is the present value of future petroleum related revenues (PVRP9S) which may serve as an indicator of the future revenue expectations of the state. Future revenues are deflated by one plus the social discount rate (SDR).

RPFS == RPFS1+PFSUP+IPFPF

```
PVRP9S == (RP8S(1)+RPBS(1))/SDR+(RP8S(2)+RPBS(2))/SDR**2+
          (RP8S(3)+RPBS(3))/SDR**3+(RP8S(4)+RPBS(4))/SDR**4+
          (RP8S(5)+RPBS(5))/SDR**5+(RP8S(6)+RPBS(6))/SDR**6+
          (RPBS(7)+RP8S(7))/SDR**7+(RP8S(8)+RPBS(8))/SDR**8+
          (RP8S(9)+RPBS(9))/SDR**9+(RP8S(10)+RPBS(10))/SDR**10
```

Alaska Inc. payments (ALINC) become an added component of personal income that is not taxed at the federal or state levels. Disposable personal income per capita is a factor determining net migration to the state, but Alaska Inc. payments are not included in a component of disposable personal income for this purpose, just as native claims payments are excluded because new migrants could not be recipients of monetary benefits under either of these income transfer plans.

B.III. Treatment of State Expenditures

State expenditures are modeled in three different ways corresponding to three basic notions about the process by which budgetary decisions are reached.

B.III.a. Growth of Expenditures as a Function of Available Revenues and Historical Determinants

In this formulation, growth of state operating expenditures by functional category is a function of both a demand variable--personal income per capita--and a series of supply variables which include not only the present level of state government revenues, but also the level of balances available for spending in the general fund. A typical equation would be as follows:

```
LOG(EEDS1/POP(-1)) = EX1A+EX1B*LOG(RGF99S1-RFDSN-EXDSS+PTTRANS*
                     RTPL)*PBDUM+EX1C*LOG(RGF99S1-RFDSN-EXDSS)+
                     (EX1B+EX1C)*MYOPIA*LOG(GFBAL1(-1)+EXSUM)+
                     EX1D*LOG(PI/POP)
```

In this equation, education expenditures per capita are a function of state revenues net of federal transfers and debt service, personal income per capita, and the general fund balance. The relationship between revenues and expenditures changes after the Prudhoe Bay lease sale.

In the capital expenditure sector, the real per capita growth rate (GRCEXP) is set exogenously for each of four categories of capital expenditures--general fund highway expenditures (GFCPH1), bond-funded highway expenditures (ECPSHY1), general fund non-highway expenditures (GFCPNH1), and bond-funded non-highway expenditures (ECPSNH1).

```
GFCPH1 = IF YR LT 1979 THEN GFCAPHX ELSE GFCAPHY(-1)*(POP(-1)/
         POP(-2)-1+RPI(-1)/RPI(-2)+GRCEXP)-CSAV2*SAVS

ECPSHY1 = IF YR LT 1979 THEN ECPSHYX ELSE ECPSHY(-1)*(POP(-1)/
          POP(-2)-1+RPI(-1)/RPI(-2)+GRCEXP)-CSAV3*SAVS

GFCPNH1 = IF YR LT 1979 THEN GFCPNHX ELSE GFCPNHY(-1)*(POP(-1)/
          POP(-2)-1+RPI(-1)/RPI(-2)+GRCEXP)-CSAV4*SAVS

ECPSNH1 = IF YR LT 1979 THEN ECPSNHX ELSE ECPSNHY(-1)*(POP(-1)/
          POP(-2)-1+RPI(-1)/RPI(-2)+GRCEXP)-CSAV5*SAVS
```

In this formulation of the expenditure equations, as in those following, allowance is made for the possibility that desired expenditures exceed available state resources so that cutbacks from desired spending levels must be employed (SAVS1). In all formulations of the expenditure equations, the cutback in spending is a function of a shortfall in revenues on current account in the previous fiscal year (E99S(-1)-ECPS(-1)-RGF99S1) if the shortfall cannot be accommodated by a general fund balance.

```
SAVS1 = IF GFBAL(-1) LT GFBAL(-2) OR GFBAL(-1) LT 0.25*(E99S(-1)-
        ECPS(-1)) THEN SAVX-TAXCHPC*TT*QREVQ+ADJ*(E99S(-1)-ECPS(-1)-
        RGF99S1(-1))*(1+(E99S(-1)-ECPS(-1)-RGF99S1(-1))/
        RGF99S1(-1))**1.1 ELSE SAVX-TAXCHPC*TT*QREVQ
```

Any cutback which must be incurred is spread among all functional operating expenditure categories and capital expenditure categories through the parameters CSAV1-5. (This equation also provides the capability of analyzing the impact of a change in the personal income tax rate which is not compensated for by a reduction in state expenditures.)

B.III.b. Growth of Expenditures Determined by Demand

In this approach, the growth rate of total state operating expenditures is linked to indicators of demand and represents setting state expenditure growth at some target level.

```
EXOPS = IF YR LT 1979 THEN EXOPSX ELSE EXOPS(-1)*(POP(-1)/
        POP(-2)+RPI(-1)/RPI(-2)-1+GREXS+C*(PIRPC(-1)/
        PIRPC(-2)-1))-CSAV1*SAVS
```

In this equation, if GREXS is set to zero and C to one, growth in operating expenditures will be unitary elastic with respect to real per capita personal income. Total operating expenditures is then allocated among functions on the basis of the historic ratio.

Capital expenditures are determined in the same fashion.

B.III.c. Growth of Expenditures Jointly Determined by Targeted Expenditure Levels and Revenue Availability

In this framework, expenditure behavior is determined by an exogenously set target rate as before and also by the availability or expectation of revenues from petroleum. For example, any increases in real state operating expenditures per capita would be based on a function of future expected petroleum revenues if D were to take a value different from zero.

```
EXOPS = IF YR LT 1979 THEN EXOPSX ELSE EXOPS(-1)*(POP(-1)/
        POP(-2)+RPI(-1)/RPI(-2)-1+GREXS+C*(PIRPC(-1)/PIRPC(-2)
        -1))-CSAV1*SAVS+CSAV1*(D*PVRP9S(-1)+E*PFBAL(-1))
```

A similar functional form would govern the growth of capital expenditures.

B.IV. Renewable Resources Development Fund

The renewable resources development fund (RRDF) receives 5 percent of those petroleum revenues annually which are eligible for the permanent fund (RP7S). Within the year, those funds allocated to the renewable resources development fund, but not expended, are transferred into the renewable resources permanent fund (RRPF). This fund is allowed to grow to a level of $250 million before contributions to the renewable resource development fund are terminated.

RRDF = IF RRPF(-1) LT 250 AND YR GT 1978 THEN RP7S*0.05 ELSE 0

RRPF = RRPF(-1)+0.5*RRDF

It is arbitrarily assumed that 50 percent of the renewable resource development fund is expended annually and 50 percent placed in the renewable resources permanent fund. The natural resources permanent fund generates interest earnings of 7 percent annually (RRRPF) which, together with the 50 percent of the development fund, constitutes total expenditures (EXRRDF).

The level of expenditures of the development fund and permanent fund earnings (EXRRDF9) are assumed to generate employment in the agriculture, forestry, and fishery sector of the economy (EMA9T) at the rate of one permanent employee per $100,000 of capital investment. This increases Alaskan personal income through an increase in wages and salaries paid in that sector (WSA9).

```
RRRPF = RRPF(-1)*0.07

EXRRDF = 0.5*RRDF+RRRPF

EXRRDF9 = EXRRDF9(-1)+EXRRDF

EMA9T = IF YR LT 1976 THEN EMA9 ELSE EMA9+0.01*EXRRDF9

WSA9 == EMA9T*WRA9/1000
```

B.V. Guide to Variables Used in Analysis

B.V.a. Policy Parameters

Name	Default Value[1]	Definition
A	1	(if = 1) allows a bonus payment into the permanent fund which is a portion of the current year budget surplus (used with PORTION).
ADJ	.95	The percentage by which excess spending on current state account in previous years is compensated for in state spending in the current year.
ALINCPR	0	Percentage of the component of permanent fund interest not reinvested in fund which is distributed as Alaska Inc. payments.
B	0	(if = 1) allows a bonus payment into the permanent fund which is the total of the current year budget surplus net of a cushion (GFCUSH) which remains in the general fund.
C	1	Income elasticity of public goods.
CRACT	.8	Ratio of expenditures to current account revenues which must be reached before permanent fund supplements are considered.
CSAV1-5	.8 - .14 - .03 .06 - .08	Percentages which distribute any required cutback in state spending among the current and capital accounts.

[1] As used in the model version called PERFUND.

Name	Default Value[1]	Definition
D	0	Coefficient on future revenues in expenditure equations.
DRAIN	1	Percentage by which excess expenditures on current account are compensated out of permanent fund.
E	0	Coefficient on permanent fund balance in expenditure equations.
GRCEXP	0	Desired growth rate of real per capita state capital expenditures.
GREXS	0	Desired growth rate of real per capita state current expenditures.
L1	0	Switch channeling exogenous level of Alaska Inc. payments (ALINX) into personal tax cut.
L2	0	Switch channeling exogenous level of Alaska Inc. payments (ALINX) into state expenditure increase.
PORTION	.75	The percentage of current year budget surplus transferred to the permanent fund (A must be set = 1)
ROR	.06	Overall rate of return on general fund.
RORPF	.07	Overall rate of return on the permanent fund.
SDR	1.1	Rate at which society prefers the capacity to spend on public goods in this year over the capacity in the next year.

[1] As used in the model version called PERFUND.

B.V.b. Policy Variables

Name	Definition
GFCUSH	General fund reserve level increment (B must be set = 1).
PART	Proportion of total permanent fund interest withdrawn from permanent fund.
PFPER	Percent of eligible revenues channeled into the permanent fund.

B.V.c. Endogenous Variables (million $ unless noted)

Name	Definition
ALINC	Total Alaska Inc. payments.
ALINCSH	Value of individual Alaska Inc. share (nominal dollars).
CRUNCH	Savings as a percentage of expenditures (%).
E99LRPC	Total real per capita local expenditures (dollars).
E99RPC	Total real per capita state plus local expenditures (dollars).
E99S	Total state capital and operating expenditures.
E99SRPC	Total real per capita state expenditures (dollars).
ELIGIBL	Individuals eligible for Alaska Inc. payments (thousands).
ELIGn	Individuals eligible for n Alaska Inc. payments (thousands).
EMA9T	Agriculture, forestry, and fishery employment, including employment generated by expenditures of renewable resources development fund.
EXOPS	State government total operating expenditures.
EXPFPER	Permanent fund contribution rate, including supplemental contributions (%).

Name	Definition
EXRRDF	Expenditures out of the renewable resources development fund.
GFBAL	General fund balance.
IPF	Permanent fund interest earnings not retained in permanent fund.
IPF1	Total permanent fund interest earnings.
IPFPF	Permanent fund interest earnings retained in permanent fund.
NONRP9S	General fund expenditures minus petroleum revenues.
PERNPR	Non-petroleum revenues as a percentage of total revenues (%).
PFBAL	Permanent fund balance.
PF1BAL	Balance in permanent fund from basic percentage dedications.
PFBALPC (PFBALRPC)	Permanent fund balance per capita (nominal and real dollars).
PFCON	Permanent fund interest as a percentage of current state expenditures (%).
PFSUPBL	Balance in permanent fund from retained interest and contributions in excess of basic dedication.
PFSUP	Contribution to permanent fund from general fund which is in excess of basic percentage contribution.
PREVRAT	Total petroleum revenues divided by total expenditures (%).
PVRP9S	Present worth to state of 10 year future stream of petroleum revenues.
R99LRPC	Total real per capita local revenues (dollars).
R99RPC	Real per capita state plus local revenues (dollars).

Name	Definition
R99S	Total state revenues from all sources except Native claims payments.
R99SRPC	Total real per capita state revenues (dollars).
REVRAT	Total revenues divided by total expenditures (%).
RGF99S	General fund revenues used to pay current expenses of government operations.
RGF99S1	General fund revenues net of percentage determined permanent fund contribution, Native claims payments, and Alaska Inc. payments.
RINS	Interest earnings on general fund.
RIPF	Permanent fund interest paid into general fund.
RIPFPC (RIPFRPC)	Permanent fund interest per capita (nominal and real dollars).
RPFS	Total permanent fund gross contributions.
RPFS1	Percentage determined permanent fund contributions.
RRDF	Renewable resource development fund payments.
RRPF	Renewable resources permanent fund.
RRRPF	Earnings from the renewable resources permanent fund.
RTSLRPC	Real per capita state and local transfers (dollars).
SAVS	Reduction in state spending from target level.
SHARES	Total Alaska Inc. shares paid (thousand).
WPFSUP	Withdrawals from the permanent fund for state capital and operating expenditures.
YDNNPC2	Non-Native disposable income per capita net of Alaska Inc. payments.

B.V.d. Independent Variables

Name	Definition
RP7S	Revenues eligible for permanent fund dedication (million $).

APPENDIX C

PETROLEUM REVENUE ASSUMPTIONS

C.I. Prudhoe Bay Oil

Production - Based upon Legislative Affairs model of Prudhoe Bay field development using the agreed upon Management Schedule. Field capacity is 8 billion barrels and pipeline capacity 1.7 million barrels/day at peak.

Wellhead Value - From the present to 1985, figures are from Case II, Legislative Affairs Agency, memorandum of July 14, 1977. This is determined by taking an initial 1978 Los Angeles refinery price of $13.75/barrel and netting back to Prudhoe. The refinery price escalates at 5 percent annually. The Alyeska pipeline tariff is constant over the period at $4.90. Lower-48 transportation charges in 1978 are $1.50. This rises to $2.50 in two years and this remains constant.

After 1985, the refinery price continues to increase at a 5 percent rate annually, while all delivery costs remain constant. Thus, the wellhead price increases at a rate which declines over time from 8 percent to 5 percent annually.

Royalties - Calculated as 12.5 percent of the wellhead value of production. This is reduced for 1978 to maintain consistency with the projections of Legislative Affairs Agency which appear in their memorandum of September 15, 1977. There, the impact on production of the explosion at pump station #8 is calculated.

Production Tax - Calculated at 12 percent of the non-royalty portion of the oil (.875). Adjusted downward in 1978 for the impact of the explosion at pump station #8.

Corporate Income Tax - To 1985 from Legislative Affairs memorandum of July 14, 1977. Subsequent values are author's estimate. Basis for this decline is a Legislative Affairs memorandum dated June 1, 1976, which indicated total corporate taxes paid on Cook Inlet production between 1956 and 1974 were $2.057 million. Peak production from Cook Inlet was 70 to 80 million barrels annually.

TABLE C.1

Prudhoe Bay Oil Revenues

Year	Production Million Barrels	Wellhead Value $/Barrel	Royalties Million $	Production Severance Tax Million $	Corporate Income Taxes Million $
1974	–	–	0	–	–
1975	–	–	0	–	–
1976	–	–	0	–	–
1977	–	–	0	–	–
1978	343.2	7.35	202.37	170.87	46.0
1979	483.6	7.54	455.79	382.86	51.0
1980	547.6	7.76	531.17	446.18	54.0
1981	547.6	8.52	583.19	489.88	55.0
1982	584	9.31	679.63	570.89	56.0
1983	584	10.45	762.85	640.79	58.0
1984	620.6	11.03	855.65	718.75	59.0
1985	620.6	11.95	927.02	778.7	60.0
1986	589	12.92	951.24	799.04	61.0
1987	491.6	13.93	856.0	719.04	39.0
1988	391.8	15.00	734.63	617.09	25.0
1989	307	16.12	618.61	519.63	16.0
1990	240.6	17.30	520.3	437.05	10.0
1991	188.4	18.53	436.38	366.56	6.0
1992	147.6	19.83	365.86	307.32	4.0
1993	115.8	21.19	306.73	257.65	3.0
1994	90.6	22.62	256.17	215.18	2.0
1995	71.0	24.12	214.07	179.82	1.0
1996	55.6	25.70	178.62	150.04	0
1997	43.6	27.35	149.06	125.21	0
1998	34.2	29.09	124.36	104.46	0
1999	26.8	30.91	103.55	86.98	0
2000	21	32.83	86.18	72.39	0

C.II. Prudhoe Bay Gas

Production - Department of Revenue estimate through 1985, then author's estimate with 15 percent decline commencing in 1996.

Wellhead Value - Constant value of 25¢/mcf assumed by author.

Royalties - Calculated at 12.5 percent of wellhead value.

Production Tax - Calculated at 6¢/mcf.

TABLE C.2

Prudhoe Bay Gas Revenues

Year	Production Billion Cubic Feet	Wellhead Value Million $	Royalties Million $	Production Severance Tax Million $
1974	-	-	0	-
1975	-	-	0	-
1976	-	-	0	-
1977	2.8	.7	.09	.15
1978	3.9	1.0	.13	.21
1979	5.1	1.2	.15	.25
1980	5.9	1.3	.16	.27
1981	28.0	7.0	.88	1.47
1982	43.0	10.8	1.35	2.27
1983	777.4	194.4	24.3	40.82
1984	828.6	207.2	25.9	43.51
1985	868.7	217.2	27.2	45.61
1986	870	217.5	27.2	45.61
1987	870	217.5	27.2	45.61
1988	870	217.5	27.2	45.61
1989	870	217.5	27.2	45.61
1990	870	217.5	27.2	45.61
1991	870	217.5	27.2	45.61
1992	870	217.5	27.2	45.61
1993	870	217.5	27.2	45.61
1994	870	217.5	27.2	45.61
1995	870	217.5	27.2	45.61
1996	740	185	23.1	38.85
1997	629	157	19.6	32.97
1998	534	133	16.6	27.93
1999	454	113	14.1	23.73
2000	386	96	12.0	20.16

C.III. Cook Inlet Revenues

Oil Royalties -	Through 1985 from Legislative Affairs Agency memorandum of July 14, 1977. Subsequent figures assume an annual 6 percent decline rate in value of oil.
Oil Production Tax -	Through 1985 from Legislative Affairs Agency memorandum of July 14, 1977. Subsequent figures author's estimate based upon decline in productivity of average well below taxable rate in 1989.
Gas Royalties -	Based upon production estimate to 1985 from Department of Revenue, Revenue Journal, Vol 1, No. 2, October 1976. Thereafter, declining beginning in 1989 by 10 percent annually with cumulative production between 1977 and 2000 of 5,761 billion cubic feet. 1977 royalties is author's estimate and subsequent years bear same ratio to production.
Gas Production Tax -	Author's estimate for 1977 and, subsequently, the same ratio to production.

TABLE C.3

Cook Inlet Revenues

Year	Oil Royalties Million $	Oil Production Taxes Million $	Gas Royalties Million $	Gas Production Taxes Million $
1974	-	-	-	-
1975	-	-	2.1	-
1976	39.3	-	3.8	1.7
1977	36	-	4	2
1978	33.1	16.3	4.4	2.3
1979	31.3	14.4	5.4	2.8
1980	29.5	12.7	6.9	3.6
1981	27.9	10.9	8.3	4.4
1982	26.4	9.1	9.0	4.6
1983	24.6	7.3	9.1	4.7
1984	22.9	5.5	9.3	4.8
1985	21.2	3.7	9.4	4.9
1986	19.9	3	9.4	4.9
1987	18.7	2	9.4	4.9
1988	17.6	1	9.4	4.9
1989	16.5	0	8.5	4.4
1990	15.5	0	7.7	3.9
1991	14.6	0	6.9	3.5
1992	13.7	0	6.2	3.2
1993	12.9	0	5.6	2.9
1994	12.0	0	5.0	2.6
1995	11.4	0	4.5	2.3
1996	10.7	0	4.1	2.1
1997	10.0	0	3.7	1.9
1998	9.4	0	3.3	1.7
1999	8.9	0	3.0	1.5
2000	8.3	0	2.6	1.4

C.IV. Miscellaneous Variables

Pipeline Property Taxes - Through 1985 from Department of Revenue, Alaska's Oil and Gas Tax Structure, February 1977, page IV, 23, assuming construction of Alcan gas pipeline. Subsequently, taxes decline by 5 percent annually. This is based upon a maximum tax for Alyeska of $168 million and for Alcan of $185 million derived from Department of Revenue figures. The method of determination of pipeline value for tax purposes has not yet been agreed upon. During construction, value is based upon cost of capital in place (construction financing not included). Three methods with significantly different revenue implications are being considered for the valuation of pipelines during the operations phase--original cost, income, and market value.

State Bonuses - A Beaufort Sea lease sale in the fall of 1979 generates $100 million in state revenues in fiscal year 1980.

Reserves Tax - This is assumed to be repaid out of production tax receipts from Prudhoe Bay at a 50 percent rate until the entire $499 million is repaid.

Alaska Native Claims Settlement Act Payment - Calculated as 2 percent of Prudhoe Bay oil royalties until $500 million is paid.

Employment - This scenario assumes substantial construction and operating employment associated with the Alcan gas pipeline. In addition, exploratory petroleum activity occurs in the Gulf of Alaska, Lower Cook Inlet, and Beaufort Sea areas. There are no commercial discoveries.

Table C.4

Miscellaneous Variables

Year	Pipeline Property Taxes Million $	State Bonuses Million $	Reserves Tax Million $	ANCSA Payments Million $
1974	0	0	-	-
1975	6.6	0	-	-
1976	83.4	0	223.1	-
1977	122	0	276	-
1978	168.3	0	(85.44)	(50.4)
1979	170.6	0	(191.43)	(72.8)
1980	193.2	100	(222.23)	(84.8)
1981	226.7	0	0	(93.6)
1982	251.8	0	0	(107.2)
1983	257.0	0	0	(84.3)
1984	261.4	0	0	0
1985	295.5	0	0	0
1986	277.9	0	0	0
1987	260.3	0	0	0
1988	242.7	0	0	0
1989	225.1	0	0	0
1990	207.5	0	0	0
1991	189.9	0	0	0
1992	172.3	0	0	0
1993	154.7	0	0	0
1994	137.1	0	0	0
1995	119.5	0	0	0
1996	101.9	0	0	0
1997	84.3	0	0	0
1998	66.7	0	0	0
1999	49.1	0	0	0
2000	31.5	0	0	0

APPENDIX D

METHODOLOGY EMPLOYED IN ALASKA INC. ANALYSIS

D.I. Eligibility

Calculation of eligibility for the Alaska Inc. program is based upon House Bill 525 (HB 525) of the first session of the tenth legislature. According to that bill, an "eligible" resident is anyone who has lived in Alaska for at least a "five-year period" commencing January 1, 1974. A person need not reside in the state continuously over a five-year period but must accrue five years of residence to be eligible. An individual must be at least 18 years of age to be eligible.

There is no data available on length of residency in Alaska by which one may directly calculate the number of individuals eligible for an Alaska Inc. program as outlined in HB 525. The 1970 Census provides the only recent reliable information regarding prior place of residence of individuals resident in Alaska in 1970.

Table D.1. shows the age-sex distribution of persons in Alaska in 1970 who were also resident in Alaska in 1965. For the total population five years of age and over (268,289), 54 percent have been estimated to have been resident in the state in 1965. Of the total civilian population in 1970 (268,957), 54.5 percent were estimated as residents in 1965. Of the 146,594 estimated to be resident in both 1965 and 1970, 94,188 were aged 18 or more in 1970. This results in a ratio to civilian population of 35.0 percent.

Table D.1.

Age-Sex Distribution of 1970 Alaska Residents
5 Years and Above and Estimated 5 Year Residents

Sex and Age Group	1970 Population	Estimated 1965 Alaska Resident	Estimated Percentage Alaska Resident
FEMALE			
Total	121,668	70,239	.577
5-9	18,417	10,745	.58
10-14	16,288	10,419	.63
15-19	12,603	8,180	.64
20-24	13,438	4,757	.35
25-29	12,591	4,646	.36
30-34	10,446	4,842	.46
35-39	9,048	4,625	.51
40-44	7,861	5,496	.69
45-49	6,768	4,921	.72
50-54	5,312	4,086	.76
55-59	3,796	3,142	.82
60-64	2,211	1,861	.84
65+	2,889	2,523	.87
MALE			
Total	146,621	76,423	.521
5-9	18,858	10,601	.56
10-14	17,348	10,613	.61
15-19	13,856	8,082	.58
20-24	22,658	4,332	.19
25-29	14,637	4,693	.32
30-34	12,046	5,505	.45
35-39	10,927	5,197	.47
40-44	9,853	6,168	.62
45-49	8,131	5,854	.71
50-54	6,452	5,129	.79
55-59	5,083	4,252	.83
60-64	2,946	2,580	.87
65+	3,826	3,500	.91
TOTAL	268,289	146,594	.546
CIVILIAN	236,864	–	–
MILITARY	31,425	–	–

[1]Calculated as the total of 1) same house in 1965, 2) same county and state in 1976, and 3) moved but residence not reported *(movers reporting Alaska moves/ total movers reporting location of move). SOURCE: U.S. Census 1970.

Thus, if Alaska Inc. payments were to commence with an April 1, 1970, eligibility, approximately 94,188 individuals would be eligible based upon the fact that they were in the state in both 1965 and 1970 and were 18 years of age or more. The actual number eligible would differ from the figure because some individuals would be eligible in spite of not having been resident in Alaska in both 1965 and 1970, and some would be ineligible in spite of being resident in Alaska in both 1965 and 1970. This is because the residency need not be continuous. It may reasonably be assumed that these two groups cancel one another out.

The calculated ratio of 35 percent of 1970 population having been resident in 1965 should not be directly applied to the population base in any other year to obtain an estimate of eligible individuals because of potentially unrelated variation in both the numerator and denominator of the ratio. As will be discussed in more detail in the following sections, the numerator of the ratio is dependent upon the individual decisions of those people resident in the state in 1965, while the deonominator is a function of the overall growth rate in population over the interval 1965 to 1970. As a result, in spite of an assumption of constancy over time in the migratory response of classes of individuals, the ratio may change over time as a result of a difference in the rate of growth of the population.

This type of variation actually occurred between the period covered by the 1970 Census and the following five-year period when population growth was much more rapid. The result would be to reduce the ratio if it could be calculated for the interval 1970 to 1975.

To correct for this when projecting eligibility, the ratio between individuals who reported an Alaska residence in both 1965 and 1970 and the 1965 population can be taken. The weakness of this approach is that it must then be based upon a denominator which is an estimate. This estimate, the 1965 Alaska civilian population, is 232,192. Using this figure a ratio of 40.6 results.

Given this figure and the assumption that the poulation distribution with respect to relevant characteristics is constant, as well as that migratory response patterns are constant over time, one can project Alaska Inc. eligibility based upon the population five years before. The equation is simply:

ELIGIBLE INDIVIDUALS = 40.6 * CIVILIAN POPULATION FIVE YEARS PREVIOUS

D.II. Total Shares

As envisioned by HR 525, the number of shares of Alaska Inc. would be identical to the number of eligible individuals during the first five years of the program until January 1, 1984. At that time, people who had been residents continuously over the preceding ten years would become eligible for two shares in Alaska Inc. In later years, more people would become eligible for two shares as they maintained Alaska residence over a ten-year period commencing on January 1, 1974.

Every fifth year after January 1, 1984, individuals who had resided in the state for the preceding five years would become eligible for an additional share. In 2000, for example, an individual who had been a continuous resident of Alaska since January 1974 would be eligible to receive five shares of Alaska Inc.

In order to determine the number of individuals at any point in time who would be eligible to receive a number of shares larger than one, it would be desirable to have the same kind of information provided by the 1970 Census with respect to 1965 residency, but for longer intervals of 10, 15, 20, and 25 years. Unfortunately, this information is not available and, thus, the only data which can be used to draw inferences about long-run residency is the 1970 Census data summarized in Table D.1.[1]

To determine what inference is best to make from the availabe information, a simple mathematical model may be employed. The probability of an individual who lives in Alaska at time t remaining in Alaska at t + 1 year can be hypothesized to be a function of age, sex, and previous length of residence, in addition to a variety of other socioeconomic factors. Table D.1. clearly shows that residency is related to age and sex. One could then divide that population into age, sex, and length of residence categories for analysis purposes. All individuals of age i, sex j,

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[1]The Alaska sample from the Continuous Work History Sample of the U.S. Department of Commerce was analyzed toward addressing the question, but problems of sample size and data errors cast serious doubt on its reliability and potential value. Eligibility would be much lower if the Work History Sample Tapes data were used.

and length of residence k would have a probability P_{ijk} of remaining in Alaska in t + 1.

Consider an individual in the category ijk. The probability in 1965 that he will remain in Alaska to 1966 is P_{ijk}. By extension, the probability in 1965 that he will be in Alaska in 1967 is

$$P_{ijk} * P_{i+1,j,k+1} \qquad \text{D.1}$$

which is the probability that he will remain for the interval 1965 to 1966 multiplied by the probability that he will remain from 1966 to 1967.

By extension, the probability in 1965 that he will still be in Alaska in 1970 is D.2

$$(P_{ijk} * P_{i+1,j,k+1} * P_{i+2,j,k+2} * P_{i+3,j,k+3} * P_{i+4,j,k+4}) = {}^{65}P^{70}_{ijk}$$

If the number of individuals in 1965 with characteristics ijk is n_{ijk}, then the number of individuals remaining in 1970 will be

$$n_{ijk} * {}^{65}P^{70}_{ijk} \qquad \text{D.3}$$

and the number remaining after m years would be

$$n_{ijk} * {}^{65}P^{m}_{ijk} \qquad \text{D.4}$$

Finally, by summing over all population groups, the total number of individuals remaining after m years could be determined.

$$\sum_i\sum_j\sum_k n_{ijk} * {}^{65}P^{m}_{ijk} \qquad \text{D.5}$$

To use this summation equation requires not only that one know the population distribution (all n_{ijk}) in the base year and all succeeding years if continuing estimates are desired, but also that all P_{ijk} are known and are constant over time and not influenced by other factors which might vary over the period for which the estimates are to be made.

Obviously, none of the data necessary to solve equation D.5 for a single year is available. However, from Table D.1. it is possible to estimate the percentage of 1970 civilian residents who were also residents in 1965. This was calcuated to be 61.9.

From this information, the following equation can be constructed

$$\sum_{ijk}\sum\sum n_{ijk} * {}^{65}P^{70}_{ijk} = 236{,}864 * .619 \qquad \text{D.6}$$

which equates the number of 1965-1970 residents calculated on a 1965 base with the number calculated on the known 1970 base of the 1970 civilian population over five years. Since $\sum_{ijk}\sum\sum n_{ijk} = 232{,}192$, the equation can be solved. If a_{ijk} is the proportion of the population in category ijk, then the solution is

$$\sum_{ijk}\sum\sum a_{ijk} * {}^{65}P^{70}_{ijk} = .631 \qquad \text{D.7}$$

Thus, the weighted average of all probabilities in the initial year multiplied by the respective succeeding probabilities for the next four years equals .631.

Now at the initial point in time, there will be represented in the population all subsets ijk and all probabilities P_{ijk} which will result in some overall average probability for the first interval from 1965 to 1966. The overall probability for the second interval 1966 to 1967 will not equal the first because not all probabilities P_{ijk} will be represented, and the percentage distribution of the population will weight the new set of probabilities somewhat differently.

One can calculate an average annual probability for the five-year interval, however, which is $.631^{1/5} = .912$.

This annual average probability can be applied over any inteval. It will not be totally accurate because the population against which it is applied is aging and as is shown in Table D.1, the percentage of five-year residents is positively correlated with age beyond the 20-24 year category. Thus, one might reasonably expect average P to increase as age and length of residence increased. Absent actual information on the values of P_{ijk} and their interrelationships one with another, the average value must suffice.

For various intervals, the probability at time t used to calculate residents remaining would be

interval in years	probability of residents remaining from the initial group
5 y	.631
10 y	.398
15 y	.251
20 y	.158
25 y	.100

These probabilities are for the total population, rather than that of the population which would be eligible for Alaska Inc. given the age restriction.

Since the age groups under thirteen years of age appear to have a higher than average probability of remaining in Alaska based on Table D.1, some bias will be introduced by using the average probability for the total population on a subgroup which eliminates a particular age group. The probabilities are slightly reduced by this, but the bias of the population aging tends to offset this. This situation cannot be avoided because since there is no age distribution data for 1965, it is impossible to calculate the following probability for people under 13 years of age.

$$\sum_{ijk}\sum\sum {}^{65}P^{70}_{ijk} \qquad \text{for } i < 13 \qquad \text{D.8}$$

Using this information, the number of individuals eligible for more than one share of Alaska Inc. is calculated based on the following set of equations

NUMBER OF INDIVIDUALS ELIGIBLE FOR 2 (3,4,5) SHARES =

IF YEAR GT 1984 (1989,1994,1999) THEN

$$\left[\frac{\text{POPULATION OVER 12 YEARS OF AGE IN YEAR } (-10\ (-15,-20,-25)\ )}{\text{TOTAL POPULATION IN YEAR } (-10\ (-15,-20,-25)\ )}\right] *$$

TOTAL POPULATION IN YEAR (-10 (-15,-20,-25)) * .398 (.251,.158,.100).

D.III. Migratory Response Pattern

Under the assumption of moderate petroleum development in the state, 25 percent contribution rate to the fund, reinvestment of none of the interest generated and 50 percent of interest paid out as Alaska Inc. dividends, the average annual payment value of Alaska Inc. would average about $200 over the twenty-year period from 1981 to 2000.

The actual value, of course, depends upon all these variables. The rate of petroleum development and associated state revenues is largely beyond state control, but the contribution rate to the fund and the reinvestment rate are subject to legislative approval. Finally, under HB 525, 50 percent is the minimum percentage of earnings transferred from the permanent to the general fund which must be distributed as Alaska Inc. Given this level of control over the annual share value of Alaska

Inc. by the legislature, it would potentially be possible to use Alaska Inc. as an active policy tool.

In any event, the level of annual share value is subject to a large degree of variability and much uncertainty from year to year. This is more a function of uncertainty regarding policy than uncertainty regarding the number of eligible Alaskans, even though the latter can be only roughly estimated.

Given these initial parameters, however, one can analyze the potential impact on the Alaskan population of Alaska Inc. share payments. Since the rate of natural increase would be unaffected, the potential areas of response would be inmigration and outmigration. In this section, only direct impacts are discussed. A direct impact is a migratory response because of a perceived difference in personal income as a direct result of an Alaska Inc. payment. An indirect response would be a migratory response generated by an increase in employment or personal income as a result of increased spending on goods and services of individuals who have received Alaksa Inc. share payments. The two components of migration are separated because the response of the two to a given change in Alaska Inc. may not be the same.

Consider first inmigration response. The distribution of inmigrants to the state is weighted heavily toward the young. A rational individual would choose to migrate if the present value of benefits from migration discounted to account for risk, outweighed the present value of the costs of migration. This abstracts from periods of "booms," when normal conditions may not prevail, and severe and extended depressions in the lower 48 states.

For a hypothetical individual who is otherwise indifferent between migrating to Alaska and remaining at a location outside the state, the possibility of becoming eligible for an Alaska Inc. share would theoretically result in an increase in the perceived benefit stream from a move to Alaska. However, the incremental benefits and the relative increase in income associated with it is quite small.

Consider the two situations of an individual and a family, both of which have one income earner of 30 years who can look forward to 35 years of productive labor. In 1975, the median income of all unrelated individuals was $4,882 and of families, $13,719. Over the previous 20-year period, the median family income grew 2 percent annually, while that of unrelated individuals increased 3 percent annually. Applying these growth rates to the median incomes yields total lifetime incomes for these typical income earners of $295,000 and $686,000, respectively.

Over the same period, Alaska Inc. shares, at $200 per share, incremented by one share each five years, would result in total payments of $21,000 to the individual and $42,000 to a family of two adults. This is 7 percent of total expected future income for the individual and 6 percent for the family.

However, it must be recognized that income received in future years has less value in the present than income received in the present. If a 10 percent discount rate is assumed for future income, then the present value of the incomes and the Alaska Inc. shares are as follows:

Present Value of Future Incomes

	Alaska Inc.	Regular Income	Ratio
Individual	2,462	64,149	3.8%
Family	4,924	162,296	3.0%

In present value terms, the Alaska Inc. payment represents a smaller portion of basic income, because payments are deferred until the fifth year of residence and thus have less value than if received in the present.

The ratio is further reduced by several other factors. First, the Alaskan cost of living is much higher than that experienced by the individual or family with a median income for the U.S. This cost of living adjustment is a necessary component of the calculation used to determine whether a move to Alaska would be a net benefit to the individual. If the cost of living in Alaska exceeds that of the lower 48 by 40 percent, then the median income against which to weigh the Alaska Inc. payment must also be increased by that amount. This reduces the ratios for the individual and family to 2.6 percent and 2.1 percent, respectively.

Second, the ratios must be further reduced to account for the uncertainty involved when a person tries to predict how long he will live in a certain location. The previous analysis indicates that about 63 percent of the people in Alaska in 1965 were still in the state in 1970. Of the group remaining, as well as the group which moved, a large number if interviewed in 1965 would not have been able to accurately predict their residence in 1970.

Thus, when valuing future Alaska Inc. payments, they should be further discounted by the uncertainty of the flow because of the real possibility that the payment stream will be terminated by a move from the state. If the Alaska Inc. payments are discounted 50 percent to account for this uncertainty, the present values are reduced to $1,231 for the individual and $2,462 to the family, which correspond to 1.3 percent and 1.1 percent, respectively, of present value of future income. This is equivalent to $100 out of an annual income of $10,000.

To further reduce the value of the Alaska Inc. payment to the potential inmigrant, the implications of taxation must be added. Alaska Inc. payments are marginal income and would be taxed at the marginal tax rate, which is higher than the average rate at which total income is taxed. Thus, a reduction of the total basic income and Alaska Inc. income to account for the tax liability on personal income would further reduce the percentage of lifetime income represented by Alaska Inc. share payment.

In summary, based upon this analysis of hypothetical potential inmigrants, it seems unlikely that the existence of Alaska Inc. payments would,other things being equal, have any significant effect on the rate of inmigration into the state. For individuals or families with incomes well below the median, the percentage increment which Alaska Inc. could provide would naturally be larger, but against this must be weighed both a relatively higher cost of living (higher than lower 48) for lower income families because of the relatively higher cost in Alaska of necessities, as well as the larger degree of uncertainty regarding future residence which a lower income individual or family might reasonably be expected to have.

With respect to outmigration, the response to Alaksa Inc. shares availability would be somewhat different. To continue the analysis of the two situations considered above, recall that for young persons the additional lifetime income would be marginal because of a large number of factors which discount the apparent Alaska Inc. value. All of those factors--future timing of payments, cost of living differential, uncertainty, and taxation--would be involved here also but to a different degree.

To a new arrival in Alaska, the present value of an initial Alaska Inc. payment of $200 would be $131 if his rate of time preference were 10 percent. All subsequent payments also have a reduced present value relative to the present value of a payment perceived by a five-year resident who is presently receiving Alaska Inc. payments. Therefore, the longer an individual has been in Alaska, the more relatively important as a portion of income Alaska Inc. will become.

The importance of uncertainty regarding receipt of the income stream from Alaska Inc. would be a function of prior residence length in the state. According to the Census, about 37 percent of those in the state in 1965 had departed by 1970, while an estimated 9 percent who were in the state in 1969 had departed in 1970. Since the probability of outmigration probably declines as a function of residency, one could reasonably expect that for new migrants to the state, the probability of ever receiving an Alaska Inc. payment to be less than 60 percent, with probability increasing with residency time. This would operate to reduce the probability of receiving Alaska Inc. shares for life as long as there is some propensity to migrate.

The taxation factor works to the disadvantage of Alaskans, because the progressive personal tax schedules tend to increase the difference between the average and marginal tax rates. This reduces the increment to disposable income of Alaska Inc.

Finally, the higher cost of living in Alaska has the same effect on the potential outmigrant as the potential inmigrant. However, the median income figures for the individual and family somewhat understate the actual income situation in Alaska where, in 1976 for the first time in any state, personal income per capita passed the $10,000 mark. For the average Alaskan then, a single share Alaska Inc. payment received today would represent 2 percent of gross income. For the average non-dependent, the percentage would be correspondingly less. Also, between the present and 1985, personal income will likely increase, while the Alaska Inc. share would remain constant.

It seems that for the average Alaskan, in terms of income and age, the possibility of receiving Alaska Inc. shares would have little effect on a decision to outmigrate because of the small increment to income they would provide.

The impact on the decision to migrate would, however, be an increasing function of age, length of residence in the state, and an inverse function of income. For the component of the population in that category, the disincentive to outmigrate because of the receipt of Alaska Inc. payments could be substantial. Referring back to Table D.1, however, it is clear that the propensity to outmigrate declines with age and since there is a correlation between age and length of residence in Alaska, there is an implied reduction in the propensity to outmigrate as a function of length of residence. Finally, a reasonable case could be made,in normal times in Alaska, for the propensity to outmigrate being an increasing function of income, although no studies exist which either support or refute this assertion for Alaska.

These factors imply that it is precisely in that segment of the population where the impact of Alaska Inc. on income would be the greatest where the propensity to outmigrate is the weakest. Therefore, the actual impact on individual decisions to outmigrate would be small and any aggregate impact would be quite small. For this reason, any direct impact on outmigration is ignored in this study.

To provide a partial example in support of this argument, reference is again made to Table D.1. Looking at the subset of the population 50 years old and above, which in 1970 numbered 32,515, the table indicates that 27,073 had been resident in Alaska in 1965. If the ratio of the population 45 and above was equivalent in 1965 and 1970, there were 40,000 people 45 and over in 1965. About 67 percent of these people remained in the state in 1970; 13,527 either left the state or died in the interim. If the crude death rate for this group was 5 percent, then 31,415 of the original group would remain in 1970 as potential outmigrants. 4,342 actually did outmigrate. If Alaska Inc. share payments affected 10 percent of those decisions, the number of outmigrants in that group would have been reduced by 434 individuals who would, by their presence, increase the present population by .1 percent.

D.IV. Consumption Response Patterns

Alaska Inc. payments constitute an increment to the incomes of those individuals receiving them. It is interesting to investigate the effect of these increments to income on the expenditure patterns of Alaska Inc. recipients.

The permanent income hypothesis is often used as a model framework within which to analyze the consumption and saving behavior of individuals and family groups. In its simplest form, consumption is determined by the following relationship:

$$C = C(Y, YE, A, T, S)$$

Where C = Consumption
Y = Income in present time period
YE = Expected future income
A = Assets
T = Age of individual
S = Sociological characteristics

Consumption in this model depends only partially upon the level of present income. The individual rather tries to maximize the present value of consumption from income over his entire lifetime, and for this reason expected future income of its levelized component "permanent income" is important.

For example, a young family may experience net dissaving (marginal propensity to consume greater than one) by incurring debt to purchase durable goods when establishing a home. The rationale for this is an expected future income sufficient to recover the debt plus interest. In the same way, consumption out of assets will vary with age. A retired couple may consume almost exclusively out of assets accumulated during working years.

The impact of an increase in income given this model of behavior will be a function of whether the income increase is perceived as a transitory, occurring once only; or permanent, shifting the income stream in each future period upward by the amount of change in the initial period. A transitory change would need to be "allocated" among all future periods to maximize the utility from the consumption resulting from that income. Since a permanent change is perceived to be an income increase in each future period, a large portion of the increase in the initial period could be used for consumption immediately.

Empirical studies tend to confirm this hypothesis and they examine the response of different types of expenditures to income gains. Consumption can be categorized into durable goods, which are items with a usable lifetime in excess of one year; non-durable goods; and services. Income increases can also be saved in the form of either liquid saving or contractual saving or can lead to dissaving in the form of increased debt. The responses of these different components of household portfolios to income increases may differ considerably.

For example, discretionary spending consisting primarily of durable goods and vacation expenditures as well as liquid saving in the form of bank deposits, stocks, and bonds, etc., account for a large portion of the income increases resulting from the federal tax cut in 1964.[2] The response of both non-durable and service expenditures was much smaller. The increase in contractual saving including life insurance policies, early mortgage payoffs, etc., was highly correlated with a perception

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[2] George Katona and Eva Muller, Consumer Response to Income Increases. (Wash., D.C.: Brookings, 1968).

of the income change as being permanent. Also, the more transitory the income was perceived to be, the larger the proportion which went into liquid saving relative to discretionary spending.

This particular study also found that the impact of the income change was dependent upon underlying long-run expectations of total income for the individual, and also upon the absolute size of the change in income. Thus, a small income increase from one source might be swamped in an individual's perceptions by the normal year-to-year variability in income. This implies a threshold level of income change only beyond which the change has a perceived impact on behavior.

Both the model and empirical studies support the notion that liquid saving is not a residual component after an income change has been allocated to other categories of expenditures and savings. In addition, increases in everyday type expenditures of a non-durable and service nature tend to increase only with a lag.

The relationship of this analysis to the Alaska Inc. payments is dependent upon how the payments are perceived by recipients. Given the assumption that the share payment would be in the range of $200 annually, it can be assumed the income increase would be perceived as permanent, but small. The perception of size is, of course, dependent upon the form of the payment. A government check would probably be more obviously an increment to income than a reduction in taxes at year end. The uncertainty concerning the receipt of future payments because of migrations, change in state policy, or reduced fund earnings would strengthen the perception of the payment as being transitory.

From this, it seems likely the impact of income increases resulting from Alaska Inc. payments would in the short run be concentrated on increases in discretionary spending (consumer durables, housing, vacations) and liquid saving and to a lesser extent on contractual saving. Some people might reduce their contractual saving by incurring more debt. Increases in everyday expenditures would be slight and would appear with a lag.

In order to investigate the long-run implications on consumer behavior of increases in income, it is valuable to use the concept of the Engel curve. An Engel curve describes the proportion of additional income spent on consumption of a particular good or category of good as income rises. Consumption expenditures for some goods rise more rapidly than income and are known as superior goods, while the reverse is true for inferior goods. Over the long run, one would expect a slight aggregate increase in the consumption of those goods which are superior as a result of Alaska Inc. This is because in the long run the Alaska Inc. payments will not be viewed as marginal increments to income, but rather as a normal part of annual income to be distributed between consumption and saving as all other income.

Table D.2 shows in very aggregate terms how the percentage of expenditures on various items by families changes as income increased

Table D.2

Selected Expenditures (and Percent of Total Income) of Families by Income Level, 1973

Income Group	$5,000-5,999		$10,000-11,999		$25,000 +	
(Average Income for Group)	($5,443)		($10,934)		($40,494)	
Expenditures	$	%	$	%	$	%
Food Total	$1,111	20	$1,546	14	$2,433	6
Food at home	1,007	19	1,354	12	1,969	5
Food away from home	85	2	181	2	443	1
Alcoholic Beverages	54	1	70	1	165	0
Tobacco	102	2	140	1	171	0
Housing Total	1,690	31	2,231	20	4,818	12
Shelter	971	18	1,164	11	2,684	7
Fuel & Utilities	310	6	413	4	639	2
House Furnishings	223	4	382	3	771	2
Clothing	353	6	632	6	1,550	4
Transportation	967	18	1,712	16	2,792	7
Health Care	363	7	470	4	853	2
Personal Care	67	1	101	1	207	1
Recreation	339	6	532	5	1,943	5
Vacation Trips	122	2	209	2	932	2
Reading Materials	31	1	45	0	114	0
Education	13	0	68	1	534	1
Miscellaneous	43	1	95	1	363	1
Personal Insurance and Pensions	327	6	756	7	2,265	6
Gifts and Contributions	235	4	327	3	1,748	4
Current Consumption Expenditures[1] Excluding Personal Insurance and Pensions and Gifts & Contributions	5,134	94	7,643	70	15,943	39

Source:

U.S. Department of Labor, Bureau of Labor Statistics; Consumer Expenditure Survey Series; Interview Survey 1972-73; Average Annual Expenditures for Commodity and Service Groups Classified by Nine Family Characteristics, 1972 and 1973.

1 Individual categories will not add to total because of exclusions.

in 1973. The most striking observation from the table is the decline in the category "current consumption expenditures" as family income increases. This category includes all purchases of durable and non-durable goods and services except for a few small items including housekeeping supplies, non-prescription drugs, and payment of mortgage principal. For the average family in the lower income category, 94 percent of income was spent on current consumption. This percentage fell to 70 percent for the middle income family and to 39 percent for the open-ended category of highest income families. For the population as a whole, the percentage was 69 percent. The implication of this is that savings of various kinds increase with income of the family.

The declining share of current consumption expenditures in the budget is accompanied by a changing mix of expenditures. Food consumption falls dramatically as a percentage of income both consumed at home and away from home. Transportation follows the same pattern, although the decline is less rapid. The shelter component of housing falls off identically with transportation, but the total housing decline is lessened by smaller drops in other components of the housing total such as home furnishings.

In this aggregated summary, no consumption items appear to take an increasing percentage of income as income rises except education. Those items which appear to take a proportionate share of income as income rises include vacation trips, personal care, personal insurance and pensions, gifts and contributions, and miscellaneous. Clothing expenditures are proportional in the middle of the income range, but decline as a proportion of the top end.

Table D.2 must be interpreted with the understanding that it does not control for differences in size of family, age of head of household, location, race, education, family composition, or housing tenure. All of these affect the expenditure pattern. And being based upon a national sample, it is not necessarily representative of Alaskan consumption patterns at various income levels.

The broad implications of the table are, however, clear. As income rises, expenditures on the basic necessities such as food, clothing, shelter, and transportation rise, but more slowly than income. Expenditures in other broad categories hold fairly constant as a percentage of income and savings grows as a percentage of income. From this, it is clear that the expenditure pattern for marginal income differs from the average patterns but also that the marginal pattern is a function of the level of income.

Any change in the marginal propensity to consume and to save as a result of Alaska Inc. payments would be quite small because of the small relative size of Alaska Inc. payments. They would, thus, have a minimal effect on the average propensity to consume different goods. This would be particularly true in the case where the various responses of a whole population to income change are being aggregated. For example, if a $200 Alaska Inc. payment supplements a $10,000 income, that is a 2 percent increase. If the average propensity to consume of that individual were .70 and all the Alaska Inc. increment were saved, the average propensity to consume would be reduced by 1 percent to .69.

The small size of this change eliminates the necessity of attempting to trace through the Alaskan economy the impact of expenditures and savings of particular types on economic activity defined by industrial sector. This task would have been impossible given a lack of data with which to relate levels of industrial activity to levels of types of expenditures as well as lack of information on Alaskan expenditures patterns.

Rather, increments to income derived from Alaska Inc. can be treated just like other small increments to income in analyzing their impact on consumption, because the change they introduce in the marginal propensity to consume various types of goods will be quite small.

APPENDIX E

ASSUMPTIONS TO RUN REGIONAL IMPACT CASES

Two cases were run through the Man-in-the-Arctic Program regional model--one which demonstrated the effects on the Alaskan economy of the introduction of a petrochemical refinery project and (alternatively) one which demonstrated the effects on the Alaskan economy of the expansion of fisheries enhancement in the form of non-profit private salmon hatcheries. Exogenous data series were developed for both cases as follows:

Petrochemicals (Table E.1)

The assumptions for petrochemicals were drawn from the proposals of the four finalists in the competition to use the state's royalty oil from Prudhoe Bay. The four proposals were quite different from each other, and the data was incomplete, so our data series reflect judgmental selection of data from the four proposals, which, it is hoped, fairly represent a world scale petrochemical plant and refinery in Alaska. Impacts occur both through impact on the state treasury and through direct employment.

Since the petrochemical plant is not subject to the state property tax on petroleum production and transportation equipment, and since we are assuming that the state receives a price at the wellhead which is the same as if the royalty oil were sold by oil companies as agents for the state, out of state, the major fiscal impact to the state of the petrochemical refinery was assumed to occur through the state taxes

Table E.1

Statewide Exogenous Impacts of Petrochemical Facility

	Direct State Tax Receipts From Facility Operations (Million $)	Local Property Tax (Million $)	Construction Employment (Thousands)	Operating Employment (Thousands)
1974	0	0	0	0
1975	0	0	0	0
1976	0	0	0	0
1977	0	0	0	0
1978	46	0	0	0
1979	51	0	.050	0
1980	54	2	1.050	0
1981	55	3.5	2.550	0
1982	56	6	2.550	.050
1983	58	10	2.550	.050
1984	62	17	1.550	.460
1985	66	30	0	.460
1986	67	30	0	.460
1987	65	30	0	.460
1988	55	30	0	.460
1989	50	30	0	.460
1990	47	30	0	.460

on corporate incomes, gross receipts, and individual incomes. Local impact was through the property tax. Some information was available in the four proposals concerning projected direct employment for building and running the refinery, which was also incorporated into the model runs as exogenous data.

The refinery-petrochemical plant is assumed to be a world scale plant utilizing 150,000 barrels of oil per day at full capacity. The construction period extends from 1979 through 1984, and the company purchases and sells the state's royalty oil on the international market at competitive rates throughout the construction period. Construction of the plant occurs near Kenai, with about 2,000 persons working on site during the peak construction years, and 550 in the Anchorage area. Operations and maintenance employment was estimated at 460 persons, of which 410 were line production workers, divided 210-200 as residents of the Kenai and Anchorage areas, and 50 management workers, all located in Anchorage. The operations workers were assigned to the petroleum sector, rather than "other manufacturing," where they would ordinarily fit in the Department of Commerce Standard Industrial Classifications as grouped for the purpose of constructing the MAP regional model. This was done for two reasons. The first was that historically, the "other manufacturing" category has a low-value of output per employee, compared with national ratio for either chemicals or petroleum refining. Even the national figures for value added per employee are probably too low for an Alaskan state-of-the-art, world scale plant using capital-intensive techniques, so the expedient of using the petroleum industry was adopted for estimating gross state product. The second reason was that wage rates in refining are nearly equal to those paid in oil and gas extraction, but are substantially greater than those paid in industries such as printing and publishing which make up the bulk of "other manufacturing."

To get the fiscal impact of the Business License Tax, we estimated sales of products (based on an average of the revenue estimates of two of the finalists) at 900 million 1977 dollars in the first year of operations, 1984, and at 1500 million 1977 dollars thereafter. The real price of petrochemicals was assumed to remain at 1977 levels to the end of the period, with the nominal price rising at 5 percent per year, the assumed rate of inflation. Business License Tax receipts were then estimated at one-fourth of one percent of gross sales. To get the corporate income tax estimate, we took the estimate of one of the four competing firms, which assumed the 9.4 percent maximum corporate tax rate and reduced it by 50 percent to be more in line with state experience concerning taxation of interstate firms, since it is not necessarily true that the corporate entity would be a firm doing business only in Alaska. Individual income taxes were estimated by the model and did not have to be assumed.

The local property tax was calculated on the basis of an initial value for the facility of $1.5 billion and a tax rate of 20 mills. This value is gradually attained as the facility is built and remains through the simulation period.

Fisheries Enhancement (Table E.2)

The impact of fisheries enhancement appears in the Alaskan economy through several processes, the most important of which are identified in the assumptions used to run the regional model. The primary impacts occur through construction and operations employment in fish hatcheries, increased production labor hours in the fish canneries as a result of increased catch, increased output in fishing and fish processing, together with increases in incomes of fishermen and cannery workers, and, finally, increases in the yield of raw fish taxes.

In order to discuss investments approaching the orders of magnitude involved in the petrochemical case ($1-2 billion, 1977 dollars), we assumed a private nonprofit hatchery program with 30 additional hatcheries of 25 million eggs capacity, at an investment of $2-4 million, 1977 dollars, per hatchery. The numbers used in the simulations were based on F.L. Orth, The Economic Feasibility of Private Nonprofit Salmon Hatcheries, Alaska Sea Grant Report 77-4, June 1977, together with discussions with Orth, Armin Koernig of Prince William Sound Aquaculture Association, Ken Rumchildt of North Pacific Processors in Cordova, and judgment on the part of the investigators.

Table E.2

Statewide Exogenous Impacts of Fisheries Enhancement

	Direct State Tax Receipts From Operations (Million $)	Construction Employment (Thousands)	Hatchery Employment (Thousands)	Value Added in Canneries (Constant Million $)	Additional Income in Fisheries (Million $)	Value Added in Hatcheries (Constant Million $)
1974	0	0	0	0	0	0
1975	0	0	0	0	0	0
1976	0	0	0	0	0	0
1977	0	0	0	0	0	0
1978	0	0	0	0	0	0
1979	0	.210	0	0	0	0
1980	0	.360	.056	0	0	0
1981	0	.420	.096	0	0	0
1982	.144	.540	.168	2.327	4.756	.298
1983	.260	.210	.240	4.132	8.562	.512
1984	.478	0	.240	7.503	15.731	.898
1985	.716	0	.240	11.122	23.596	1.281
1986	.752	0	.240	11.515	24.777	1.281
1987	.790	0	.240	11.973	26.013	1.281
1988	.829	0	.240	12.422	27.315	1.281
1989	.871	0	.240	12.883	28.680	1.281
1990	.914	0	.240	13.359	30.115	1.281

The following assumptions were made concerning the hatcheries: combined survival rate of eggs and fry, 2 percent; hatchery escapement rate, 40 percent, brood stock requirement, .00083. We assumed that the income from hatchery operations would not be taxable and that sales of fish and fish products by the hatchery would not be subject to the raw fish tax. Landed values to fishermen were assumed to be based on pink salmon weighing 3.8 pounds apiece at a 1976 average landed price of 45 cents per pound, which escalates at the general rate of inflation in the economy. Based on the assumption that the eventual increase in output of about 9 million fish per year can be handled by the existing fleet, by catching fish incidental to fish which would otherwise be caught, a catching cost of two cents per fish (1976 costs) was assigned.

The hatcheries were assumed to be built between 1979 and 1983, each taking 30 workers about two construction seasons. Peak construction employment was assumed to be about 540 workers, in 1982. The hatcheries were allocated geographically as follows: Southwest and Southeast, eight hatcheries apiece; Southcentral and Interior (except Fairbanks area), six hatcheries apiece; Fairbanks area, two hatcheries. First returns of fish were assumed to occur two years after hatchery completion. Operations employment in hatcheries was assumed to be four full-time personnel and four full-time equivalent seasonal workers (about 12 workers for about one-third of the year). All were assigned to the fishing sector.

In fishing, limited entry laws were assumed to keep increases in employment of Alaskans to a minimum. However, because of increased catch, the output added to the economy by the fishing sector, fisherman net income (equal to the increase in value of catch, less additional catching costs), and the three percent raw fish tax all increase. Catch was assumed to be delivered in the Southwest Region for hatcheries in the Southwest, Interior, and Fairbanks; to be delivered in the Southcentral Region for increments to production caused by Southcentral hatcheries; and to be delivered in Southeast ports if caused by Southeast hatcheries.

Processor gross product effects were estimated by computing the historical ratio of Gross Product/Value to Fishermen from the methodology in the April 1974 and March 1975 issues of Alaska Review of Business and Economic Conditions for Food Manufacturing, applying the ratio to the estimated value of catch, and deflating by the estimated gross product deflator from the same source. Processor employment was estimated directly by the model.

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