EXECUTIVE SUMMARY

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447

ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM

WESTERN GULF OF ALASKA PETROLEUM DEVELOPMENT SCENARIOS: ECONOMIC AND DEMOGRAPHIC IMPACTS

PREPARED FOR

BUREAU OF LAND MANAGEMENT
ALASKA OUTER CONTINENTAL SHELF OFFICE

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SCENARIOS: ECONOMIC AND DEMOGRAPHIC IMPACTS

Prepared by
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August 1979

WESTERN GULF OF ALASKA
PETROLEUM DEVELOPMENT SCENARIOS: ECONOMIC AND DEMOGRAPHIC IMPACTS

EXECUTIVE SUMMARY

This study examines the impact of potential Outer Continental Shelf petroleum development in the Western Gulf of Alaska. Development of these resources is assumed to begin with a lease sale held in 1980. The study focuses on the economic and demographic effects of OCS development on the State of Alaska and its Gulf of Alaska region.

The impact of OCS development is defined as the change resulting from this development. In examining Western Gulf impacts, a process of economic impact assessment was developed. While rapid growth associated with OCS development will affect most economic variables, a much smaller number of variables is important. Information on these dimensions of impact will describe the effect of rapid growth on the state and regional economies.

OCS development may affect the magnitude and the process of growth. This study emphasizes the effect on 1) the aggregate indicators of economic activity--employment, population, and personal income, 2) the state's fiscal position measured by its effect on fund balances, 3) individuals' earnings as measured by real per capita income, and 4) the average level of state services as measured by real per capita state expenditures. The study examines the effect of OCS development on the process of growth by examining its effect on 1) the components of population growth, 2) the proportion of the population which is working (the dependency ratio), 3) the structure of employment, and 4) the regional distribution of growth.

The economic and demographic change is examined against two points of comparison. First, the effect on OCS development is compared to growth in the historical period. Examining growth in the historical period provides an understanding of how the economy works. Secondly, the growth with Western Gulf OCS development is compared to the projected growth of the economy without Western Gulf OCS development.

The Alaska Economy, 1965-1976

The period between 1965 and 1976 was one in which the Alaska economy experienced tremendous growth. Three significant economic events occurred during this period: the major Upper Cook Inlet oil development in the late 1960s, the Prudhoe Bay lease sale in 1969, and the construction of the trans-Alaska oil pipeline beginning in 1974.

Economic growth is a multidimensional process for which there is no single summary measure; however, the general trend of the economy can be described by examining three aggregate indicators of economic activity: population, employment, and personal income. Over the historical period, each of these indicators grew rapidly. Growth was not uniform throughout the period; growth was more rapid after 1970. Employment grew at an annual average rate of 8.4 percent over the period, reaching 171,714 by 1976; the growth rate after 1970 averages 10.9 percent per year. Population was 413,289 in 1976; it grew at an annual average rate of 4.1 percent between 1965 and 1976 and 5.4 percent between 1970 and 1976. The growth in personal income reflects both the growth of the economy and the increase in prices. Personal income increased at a rate of 15.4 percent per year between 1965 and 1976; the rate of growth after 1970 was slightly higher, averaging 19.6 percent per year.

The major cause of growth during this period was the expansion of the basic sector. The industry primarily responsible for this growth was petroleum. The traditionally important Alaskan basic industries of federal government and fisheries did not expand during this period. While employment in the total basic sector expanded at an average annual rate of about 3 percent, mining employment expanded at an average rate equal to 13 percent per year. Construction employment expanded at a rate equal to 15 percent per year; the growth of this industry was importantly affected by the construction of the trans-Alaska oil pipeline.

Overall growth in the economy was greater than in the basic sector. Two factors were responsible for this. First, state government acted as a growth-initiating sector. The rapid growth in state government in the early 1970s was funded by revenues which were exogenous to the Alaskan economy. An important source of these revenues was the Prudhoe Bay lease sale held in 1969. The second factor was the changing relationship between the basic and support sectors of the economy. As the economy grew, more goods and services were provided locally. The growth of employment in the basic sectors stimulated a greater-than-proportional response in the remainder of the economy. The ratio of total employment to basic sector employment increased from 2.3 in 1965 to 3.0 prior to pipeline construction in 1973. This changing ratio illustrates the qualitative change which occurred in the economy during the historical period.

The level of population is influenced by the level of economic activity; like employment, population also experienced rapid growth during the historical period. Migration was the most important component of population change throughout the period. Between 1970 and 1976, migration accounted for almost 70 percent of the total change in population. Population did not grow so rapidly as employment; this resulted in a declining dependency ratio throughout the period. This ratio fell from 3.8 in 1965 to 2.4 in 1976. Much of the direct Trans-Alaska Pipeline Service (TAPS) employment was located in remote camps, which meant that workers often did not bring their families, thus lowering the dependency ratio of in-migrants. This trend emerged even prior to TAPS construction; by 1973, the dependency ratio had fallen by 22 percent. This falling dependency ratio resulted from an increase in the proportion of the population of working age and an increase in the labor force participation of this group.

Rapid growth had a mixed effect on two measures of individual welfare: the unemployment rate and real per capita income. The unemployment rate measures the probability that an average resident is unemployed. Rapid growth did not reduce the unemployment rate. The rate fell only in 1974 and 1975 and was above 10 percent in every year except 1975. The seasonal pattern of unemployment did change over the historical period. The seasonality of employment, which measures the peak summer employment, decreased. One reason for this reduction was the increased importance of the less seasonal support sector. A second measure of individual welfare is real per capita income, which measures the command of the average resident over goods and services. The Alaskan real per capita income increased by 78 percent between 1965 and 1976. In all but one year after 1970, real per capita income in Alaska increased faster than in the United States. Real per capita income is importantly affected by prices. Alaskan price level increased slower than U.S. prices for most of the period. This reflected the growth in the scale of the economy. The rapid growth connected with TAPS construction reversed this trend.

The Alaska Economy Base Case Growth, 1978-2000

Petroleum development in the Western Gulf of Alaska may affect both the structure and the size of the Alaskan economy. The impact of this OCS development can only be described as changes from a certain pattern of economic growth which would have occurred without OCS development. The base case describes the projected growth of the economy without OCS development in the Western Gulf. This study develops three base cases which differ in their assumed level of OCS activity in the Lower Cook Inlet, the Beaufort Sea, and the Northern Gulf of Alaska.

The non-OCS assumptions are consistent across all base cases. Assumptions about industry growth, state revenues, and state expenditures determine the projected growth of the economy. In this case, non-OCS growth was assumed to include:

- Prudhoe Bay petroleum activity with expansion to the Lisburne and Kuparak formations.
- Shutdown of Upper Cook Inlet oil fields in 1990.
- Construction of the ALCAN gasline between 1981 and 1984 and Pacific LNG plant between 1980 and 1983.
- Constant federal government employment.
- Agriculture-forestry-fisheries employment increasing by 3 percent per year.
- Manufacturing output increasing at 4 percent per year.
- State exogenous petroleum revenues consisting of royalties, production taxes, property taxes, and corporate income taxes determined by existing state laws and assumed oil and gas production.
- Growth in real per capita state expenditures equal to one-half the rate of growth in real per capita income.

The base cases differ in their assumptions about OCS development in the Lower Cook Inlet, the Beaufort Sea, and the Northern Gulf of Alaska. The three alternative scenarios describe low, moderate, and high levels of activity in each area. Developing these alternative scenarios allows the assessment of the effects of the level of previous OCS activity on the impacts of the Western Gulf lease sale. The general pattern of projected future economic growth can be ascertained by examining the moderate base case growth since these cases differ only by magnitude.

Overall, substantial growth is projected, although it will not be so rapid as that experienced between 1965 and 1976. Population is projected to grow to approximately 805,700 by 2000, which is 3.2 percent average annual rate of growth. Employment grows at an average annual rate of 3.4 percent. Since wages and salaries are the major component of personal income in Alaska, the growth of personal income is related to employment growth. Personal income grows at an annual average rate of 10.8 percent. The growth over the projection period is not uniform throughout the projection period. The most rapid period of growth is prior to 1983. The major cause of this projected rapid growth is the construction of the ALCAN gas pipeline which reaches peak employment in 1983.

Three major structural changes were projected to occur in the base case; these changes support trends found in the historical period. The sectors of the Alaska economy do not grow at equal rates. Employment in the support sector grows more rapidly than in the remainder of the economy; the share of employment in the support sector is projected to increase from 37 percent in 1978 to 53 percent in 2000. Another historical trend projected to continue in the future is the increased participation of the population in the economy. This participation is measured by the dependency ratio (population/employment) which decreases from 2.24 in 1980 to 2.17 in 2000. The major reasons for this change are the aging of the population and the increased labor force participation of the adult population. The final structural change concerns the regional distribution of population. The population is projected to continue concentrating in Anchorage; by 2000, over 50 percent of the state's population is projected to be in Anchorage.

Over the projection period, the State of Alaska will receive revenues which exceed current levels of expenditure. The state's decision on the expenditure of these revenues will influence the growth of the Alaskan economy. The overall fiscal position of the state is affected by the interaction of both revenues and expenditures. Total yearly revenues are projected to grow by over $7.0 billion during the projection period. The fastest period of growth occurs prior to 1985, when revenues from Prudhoe Bay oil and gas production peak. Total petroleum revenues from Upper Cook Inlet, Prudhoe Bay, and the Beaufort Sea are projected to fall by almost 8 percent by 2000 from the 1989 peak.

State government expenditures increase in response to growth in the economy and in response to the accumulation of unspent revenues. Expenditures grow at an average annual rate of 9.9 percent over the projection period, slowing slightly after 1989 when the increase in revenues slows. The level of real per capita expenditures also increases. The level of real per capita expenditures is a proxy for the level of services provided by the state.

The increase in revenues which are projected to result from the production of oil and gas places the State of Alaska in a unique position by allowing the state to build a fund balance. Excess revenues accumulate in two funds, the Permanent and General Funds. For most of the projection period, the General Fund is larger than the Permanent Fund. The amount in the General Fund increases until 1996. After 1996, the fund balances must be drawn down to meet increasing state expenditures. The cyclical nature of petroleum revenues and their importance as a part of state revenues mean that when expenditure policies are tied to increases in revenues, they will eventually lead to expenditures in excess of revenues. Once petroleum revenues decline, service levels cannot be supported out of current revenues, and the fund balance must be drawn on.

The Impact of OCS Development in the Western Gulf of Alaska on the Alaska Economy

To capture the important dimensions of uncertainty surrounding oil and gas development in the Western Gulf of Alaska, this report examines the development pattern implied by three alternative resource discovery scenarios. The scenarios which were examined include the level of development which would occur if the mean, 95 percent, and 5 percent probability resource levels were discovered in the Western Gulf. The general nature of the impacts can be ascertained by examining the impact of the mean resource find on moderate base case growth.

The impact of direct OCS employment depends on the extent to which the incomes earned in OCS development are spent in Alaska. Two factors will limit the impact. First, the probable enclave nature of the development will limit the extent of interaction with the Alaska economy when workers are on the job. Secondly, the international character of OCS firms means that they have regular experienced crews dispatched around the world, which may limit their residence in Alaska. The first step in estimating the overall impact of Western Gulf OCS development is to estimate the share of direct employment which will reside in Alaska and interact with the economy. Adjustments were made to direct field employment to reflect the share of direct employment residing in Alaska. These adjustments were determined by the characteristics of each task and considerations of labor supply and demand. These adjusted employment estimates were used in the scenarios provided to the MAP model to generate impacts.

The mean scenario assumes a level of development consistent with the development of .16 billion barrels of oil. In this scenario, oil and gas discoveries are located in two basins although only one field is economic. Exploration activity begins in 1981 and lasts for three years. Field development begins in 1984, and production starts in 1987. Direct OCS employment is divided into mining, construction, and transportation. Construction employment peaks in 1984 with platform installation. As construction employment falls, mining employment rises to a peak of 275 in 1986; the permanent mining employment is only 64 after 1992. Production ends in 1999.

The changing task composition of industry employment results in the non-proportional relation between resident Alaska employment and direct OCS employment. Alaska resident construction employment peaks at 260, the same year as the peak occurs in total construction employment. By 1989, all mining employment is assumed to reside in Alaska.

Unlike production from state lands and waters, OCS development in the Western Gulf has no direct effect on state revenues. The state is assumed to receive only property tax revenues from this production, and there are no oil terminals and onshore pipelines connected with this scenario.

OCS development will lead to changes in those factors which have been isolated as important to economic growth: exogenous employment, personal income, and state expenditures. Changes in these factors may result in changes in population, the structure of employment, the state's fiscal position, and the regional distribution of growth. These changes are the economic impact of OCS development.

The Western Gulf mean scenario differs significantly from previous development scenarios we have examined (ISER, 1979). The most important difference for the results discussed in this report is the small size of production employment associated with the lease area. Long-term production employment in both mining employment and transportation averages only 88. Mining also drops significantly after development; Alaskan resident employment in mining falls from a peak of 118 in 1986 to 39 by 1990. The final major difference is that production ends in 1999, one year prior to the end of our normal projection period in 2000.

The differences, particularly the small size of long-term OCS employment, necessitate some caution in interpreting the model results. The small size of the direct employment associated with the project increases the relative importance of the state expenditure response to the overall impact. Western Gulf development according to the mean scenario is projected to have a negative impact on state expenditures. This projected reduction of state expenditures reduces state employment and dampens the impact of the direct OCS employment on the economy. We are not assuming that the reduction of state expenditures with increased population would be the state's response.

The negative expenditure impact is a result of the expenditure rule assumed in the model. This rule determines the growth in real per capita expenditures as a function of the growth in real per capita income. Expenditures are reduced in the OCS case because real per capita income grows slower after its peak than in the base case. This, combined with the small size of the direct employment, produces a decline in expenditures. In all cases, the level of expenditures in the OCS case cannot be considered significantly different from the level in the base case.

OCS development increases the level of employment in the Alaska economy both directly and indirectly because of the increased demand for local goods and services. By 1999, OCS development in the Western Gulf is projected to increase employment by approximately 15. The peak employment impact is projected to occur in 1984 when Alaska resident OCS employment is projected to peak. The increased importance of the support sector is supported by OCS development.

Population is another aggregate indicator of economic activity. OCS development is projected to increase population in the year 1999 by 376. The peak impact on population occurs in 1984 when population is 1,984. This is the same year that total employment peaks. As in the base case, population is not projected to increase so rapidly as employment, which results in a declining dependency ratio. OCS development does not significantly change the importance of migration as a component of population change. When OCS activity is building to its peak between 1981 and 1984, migration accounts for over 50 percent of the change.

The growth of personal income reflects the ability of the economy to generate increased returns to factors. The impact on personal income follows the pattern of the other indicators. By 1999, personal income is projected to be $1 million. Like employment, the personal income peak impact occurs in 1984. Personal income growth reflects both increases in employment and prices, so it is not the best measure of welfare. One measure of welfare is real per capita income which measures the command of the average individual over goods and services. OCS development has two differential periods of impact. OCS activity has a positive impact on real per capita incomes prior to 1986 and a small negative impact after that year. These differences are not significant.

OCS development affects both state revenues and expenditures. The changes affect both the fund balance and level of services provided by the state. The major cause of state revenue increases are increases in endogenous revenues such as personal and corporate income taxes and earnings on the fund balance. Total general fund revenues are $13 million greater in 1999 because of OCS development. State expenditures decrease because of OCS development. By 1999, expenditures are projected to be $22 million less than in the base case. The pattern of expenditure impact results from the assumed state expenditure rule. Sensitivity analysis showed that the impacts of OCS development were highly sensitive to the rule chosen to describe the growth of expenditures.

OCS development has an overall positive impact on the fund balance because expenditures decrease and revenues increase. By 1999, the fund balance is $204 million greater than in the base case. The overall impact of Western Gulf OCS development on the state fiscal position is impossible to determine. The fiscal position is a combination of the impact on state services as measured by real per capita expenditures and the fund balance. According to these projections, Western Gulf development causes these measures to move in opposite directions.

Summary and Conclusions

In this report, we assess the major impacts that offshore oil and gas development in the Western Gulf of Alaska will have on the process of Alaska economic growth. These projected impacts were assessed in terms of both an assumed base case growth without the project and the historical economic growth.

For all of the OCS scenarios, the qualitative nature of the influence of OCS development on the growth process is similar. Development generates direct employment activity in the construction, mining, manufacturing, and transportation industries which builds to a peak during the development phase, then declines to a stable, long-term level as production dominates the activity. Since a number of fields are developed in each scenario, the various phases of development occur simultaneously. This development activity generates both new private incomes and public revenues which induce impacts. Expenditure of wages and salaries earned in OCS activity generates further income and employment in the endogenous sector of the economy through the increased demand for the output of these sectors. The increased economic activity also increases public expenditures which affect economic activity by increasing government employment and construction expenditures.

The qualitative nature of the impacts is also similar across scenarios. Four major structural changes were observed in the base case and the historical period. First, as the scale of the economy increased, more goods and services were produced locally and the importance of the support sector increased. Secondly, the population aged and labor force participation increased over time; this led to an increase in the proportion of the population which is employed. Thirdly, the role of Anchorage as the administrative and distributive center of Alaska resulted in population growth continuing to center in Anchorage. Finally, state expenditures and revenues were projected to follow a pattern in which expenditures would increase faster than revenues after the major petroleum revenues peaked. This pattern of expenditure and revenue increase would necessitate drawing down the general fund balance. This results from the declining importance of the petroleum revenues throughout the period. All of the Western Gulf OCS development scenarios support these trends.

The qualitative impact of OCS development on individual welfare was also similar across scenarios. In all scenarios, real per capita incomes increased significantly over the base case levels during the buildup to the peak employment. After this, increases in population and prices led to no real significant increases in real per capita income. The level of real per capita state expenditures is also reduced relative to the base case by OCS development. The reduction of real per capita state expenditures is one part of the negative fiscal impact of OCS development. The other part concerns the impact on the fund balance. In all cases, the combined effect of increased prices and expenditures from OCS development reduces the real value of the fund balance below its base case levels.

Quantitatively, the impacts across scenarios differ. The single most important determinant of impact is the size of the field. The 5 percent scenario has larger development activity and so has a larger impact. The 95 percent scenario contains only exploration and has only minimal impact on the major economic variables. Table 1 shows the relative year 2000 impacts across the five OCS scenarios.

The major dimensions of both base case growth and OCS development are uncertain. By examining the three alternate development scenarios, we get some feeling for the range of impacts possible from OCS development in the Western Gulf. Examination of the assumptions in the base case shows that the major assumptions concerning the base case, such as ALCAN, do have a significant effect on the impact of OCS development. The results are also affected importantly by the assumptions made about the expenditure policy followed by the state.

TABLE 1. SUMMARY OF THE LONG-RUN IMPACTS OF ALTERNATIVE DEVELOPMENT SENARIOS (IMPACTS IN THE YEAR 2000)

	Population	Employment	State Expenditures (Millions of Nominal Dollars)	Fund Balance (Millions of Nominal Dollars)
Moderate Base Case				
Mean OCS Scenario (1999)	376	15	-19	204
5% OCS Scenario	8,025	2,363	-14	458
95% OCS Scenario	101	12	1	-28
High Base Case				
5% OCS Scenario	9,689	3,083	46	-119
Low Base Case				
95% OCS Scenario	96	10	1	-26

SOURCE: MAP Model

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I. INTRODUCTION

Background

The United States, because of the progressive depletion of U.S. petroleum reserves, has become increasingly reliant on foreign energy supplies. Concern over the reliability of these foreign supplies has led the federal government to establish policies aimed at increasing domestic energy supplies. Because of its high potential as a source of oil and gas, the U.S. Outer Continental Shelf (OCS) figures significantly in the future energy program of the United States.

Although Alaska has historically played a small role in the U.S. energy supply, production at Prudhoe Bay and future development of the Alaska OCS will increase its importance. It has been projected that by 1985 over 25 percent of total domestic crude oil production could be from Alaska (Federal Energy Administration, 1976). Through 1974, Alaska had produced only one percent of the total cumulative petroleum production in the United States (U.S. Geological Survey, 1975); however, the development of existing oil and gas reserves and the exploration for additional reserves will center importantly on Alaska. Alaska accounts for over one-fourth of the identified oil and gas reserves in the United States, and an estimated one-third of all undiscovered recoverable domestic oil reserves are in the state. Since over 60 percent of the estimated undiscovered OCS reserves in the United States are in Alaska, Alaska is particularly important to the OCS program (U.S. Geological Survey, 1975).

The development of Alaska's petroleum reserves is also important to the Alaskan economy. Changes produced by past petroleum development in the state have been major. The rapid changes in the Alaska economy and population associated with the development in Upper Cook Inlet and Prudhoe Bay created strains on the Alaskan society and environment. At the same time, these developments generated the most prosperous economic period in the state's history as well as prospects of continued prosperity through the next decade. The development of petroleum reserves in Alaska's OCS will also affect the population and economy of Alaska.

The Purpose of the Study

The nature of the changes which result from Alaskan OCS development will not necessarily resemble those caused by past petroleum development. One objective of the current study being undertaken by the Institute of Social and Economic Research (ISER) for the Bureau of Land Management's OCS Studies Program is to provide the information needed to anticipate the major dimensions of the economic and social impacts of the proposed oil and gas developments in the Western Gulf of Alaska. To achieve this objective, ISER will provide a series of economic and population forecasts through 2000 under several alternative scenarios for petroleum development in the Western Gulf. By contrasting these forecasts with a base case forecast which does not include the proposed development, it is possible to assess the major dimensions of the impacts of OCS development on population, employment, income, and the state's fiscal position.

This study is part of the Bureau of Land Management's Alaska OCS Socio-economic Studies Program. The objective of this program is to assess the potential impacts of proposed lease sales in the federal offshore areas of Alaska. The study of the impacts of OCS development in the Western Gulf of Alaska is one of a series of studies describing lease sale impacts. Already completed is a study of the impact of the joint federal-state sale in the Beaufort Sea (ISER, 1978) and the federal sale in the Northern Gulf (ISER, 1979); future studies will be conducted for lease sales in the Lower Cook Inlet and the Bering Sea-Norton Sound. The studies program is concerned with many aspects of OCS impact on many different levels. The major objective of this study is to examine only a portion of OCS impact, the statewide and regional economic and demographic impacts.

In order to assess the impact of the proposed Western Gulf OCS development, the study must accomplish two additional objectives. First, an understanding of the existing state and regional economies must be developed. The important economic relationships need to be understood in order to say anything about future growth and the effect of OCS development on the economy. Secondly, the study will develop a process for economic impact assessment. Rapid growth associated with OCS development will affect most economic variables; a much smaller number is important, and information on these dimensions of impact will describe the effect of rapid growth on the state and regional economies. The process of economic impact assessment will consist of the selection of the major variables to analyze and the appropriate questions to ask about each of these.

Study Design

This study consists of three major parts: a baseline study of the economies of the state and its Gulf of Alaska region, a base case projection describing the future economy without Western Gulf development, and an examination of the impact of Western Gulf development. This section describes the relationship of each of these parts to the impact assessment and the methodology chosen to make the necessary projections.

EXAMINATION OF PAST ECONOMIC GROWTH

Examining the past growth of the Alaska economy and the economy of the Gulf of Alaska region provides an understanding of the way the economy works. This type of examination is implicit in the development of economic models. Making this analysis explicit will emphasize those aspects of economic growth which are important. The two aspects of the economy which will be emphasized in such a process are the important causes of growth and the economic relationships which transfer growth between sectors of the economy. An examination of the historical period will provide an indication of the types of response we can expect to OCS petroleum development. In addition, the historical growth and development of these economies provide a point of comparison for future economic growth, both OCS and non-OCS related.

THE BASE CASE

Petroleum development in the Western Gulf of Alaska will affect both the structure and size of the Alaska economy. Changes in the economy which result from the development of the OCS resources can be defined as the impact of this development. This impact can only be described as changes from a certain pattern of economic growth which would have occurred without OCS development. The non-OCS base case is developed to provide a reference point for the analysis of the impacts of OCS development. Comparing a projection of economic activity with OCS development to the base case will isolate the impacts of development.

THE ROLE OF SOCIOECONOMIC PROJECTIONS

The uncertainty of the future, though it may increase the problems associated with making projections, increases the importance of these projections. Decision makers in both the public and private sectors need information about the future in order to plan their actions. The more uncertain the future events, the more important is some projection of them. Projections serve two important purposes--they serve as a means of determining future demands and needs for services, and they allow policy makers to test the alternative effects of various policies.

Models are used to test the relative efficiency of alternative policy choices. When models explicitly include policy variables, such as tax rates, or variables directly affected by policy, such as the level of petroleum employment, they can be used to test the effects of policies described by these variables. By making separate projections under various assumptions about policy choices, the effects on important variables such as population or employment can be compared. Alternative policy choices can be compared in terms of their relative costs and benefits.

Projections increase the information available to decision makers for making policy choices. Many present policy choices have important future implications which must be considered by policy makers. For example, current policy decisions regarding Western Gulf OCS petroleum development will have their major effect in the middle of the next decade. By providing descriptions of the most probable future levels of important variables, socioeconomic projections serve as a framework for making policy choices.

METHODOLOGY

This section describes the methodology used to make the projections of Alaskan economic growth in both the base case and OCS development cases. Two econometric models, statewide and regional econometric models, are used to make the projection. This section will describe the models used and their strengths and weaknesses.

The Statewide Econometric Model

The basic model to be utilized in the analysis of the OCS development scenarios is the statewide econometric model of the Alaskan economy developed in the Man-in-the-Arctic Program (MAP) presently being conducted by the Institute of Social and Economic Research of the University of Alaska. There are three components of this model: an economic model, a fiscal model, and a demographic model. The basic structure of the model is shown in Figure 1.

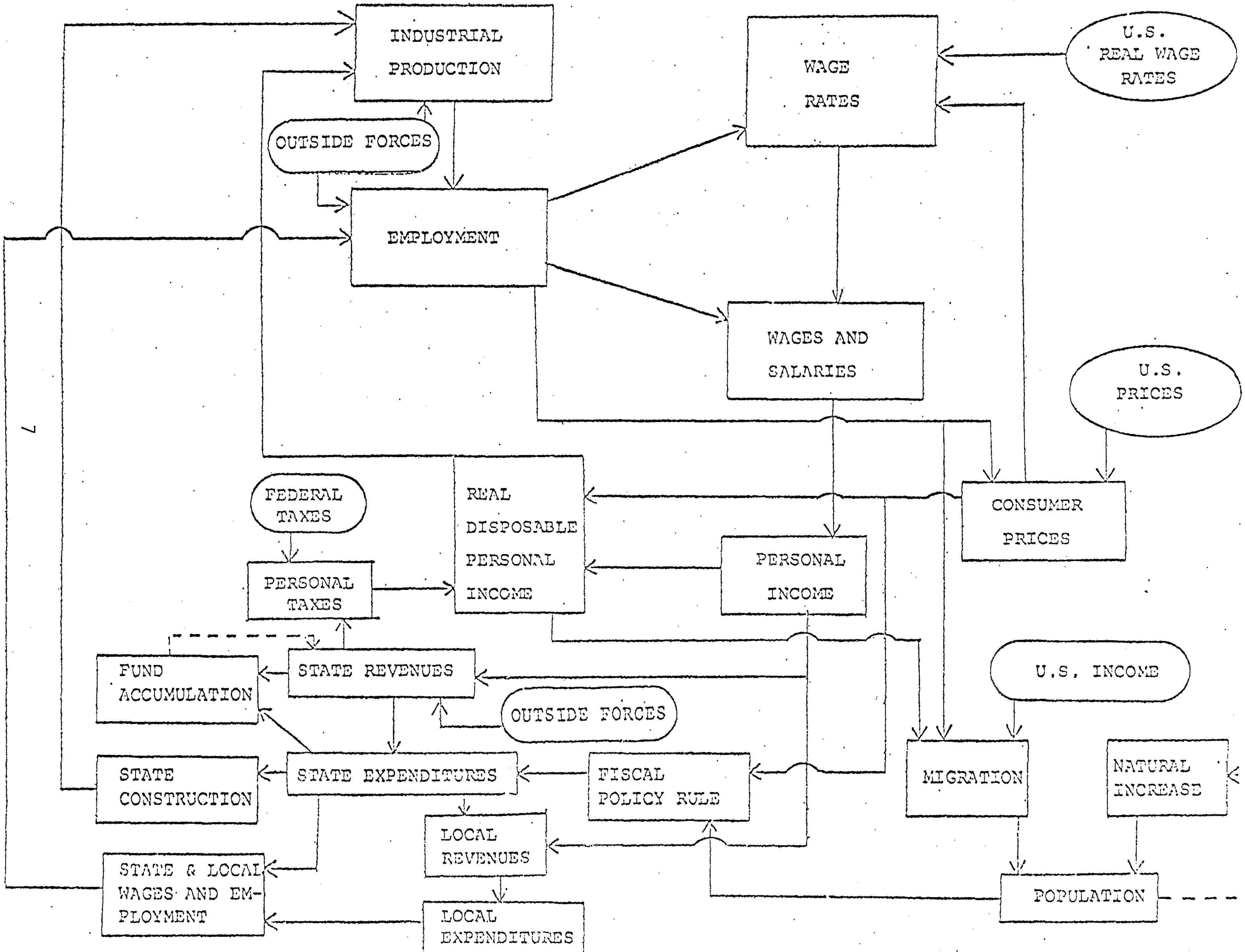

FIGURE 1. STRUCTURE OF THE BASIC MAP MODEL

The economic model is divided into exogenous or basic sectors and endogenous or nonbasic sectors. The level of output in the exogenous sectors is determined outside the state's economy. The primary reason for the nonbasic sector is to serve local Alaskan markets, so the level of output is determined within the Alaskan economy. The basic industries in the model are mining, agriculture-forestry-fisheries, manufacturing, federal government, and the exogenous components of construction and transportation. The model can accommodate exogenous sectors in other industries, such as a tourist sector in services. The nonbasic industries are transportation-communication-utilities, wholesale and retail trade, finance-insurance-real estate, services, and the remainder of construction.

In the model, industrial production determines the demand for labor and employment; employment is that level needed to produce the required output. Employment and the wage rate determine wages and salaries, the most important component of personal income. The Alaskan labor market is an open one with equilibrium achieved through migration of individuals. Because of this, the most important determinant of Alaskan wage rates are U.S. wage rates; wages are also affected by rapid growth of employment in Alaska. An estimate of disposable personal income is made by adding an estimate of nonwage income to wages and salaries and adjusting this by deducting income taxes. The level of real disposable income is found by deflating disposable personal income by a relative price index; the major determinants of Alaskan prices are U.S. prices, the size of the economy, and the growth rate of the economy. Incomes determine the demand for local production; incomes and output are simultaneously determined.

Population is determined based upon a projection of each of its components--births, deaths, and migration. The model uses age-sex-race specific survival rates and age-race specific fertility rates to project births and deaths for the civilian population. Total civilian population is found by adding civilian net migration to the natural increase. Net migration is determined by the relative economic opportunities in Alaska. In the model, these are described by employment changes and the Alaskan real per capita income relative to the real per capita income of the United States. An exogenous estimate of military population is added to determine total population.

The fiscal model, which provides important pieces of information for the economic model, also provides a framework for analyzing the effects of alternate fiscal policies. The fiscal model calculates personal tax payments in order to derive disposable personal income. The fiscal model, based on an assumed state spending rule, also calculates personnel expenditures, state government employment, and the amount spent on capital improvements which determines a portion of employment in the construction industry. All three submodels are linked through their requirement for information produced by the other submodels.

The Regional Econometric Model

The regional model provides an allocation of employment, income, and population in the state to seven regions of the state. These regions are shown in Figure 2. The economic component is similar in each region to that of the state model. The major difference is that some regional

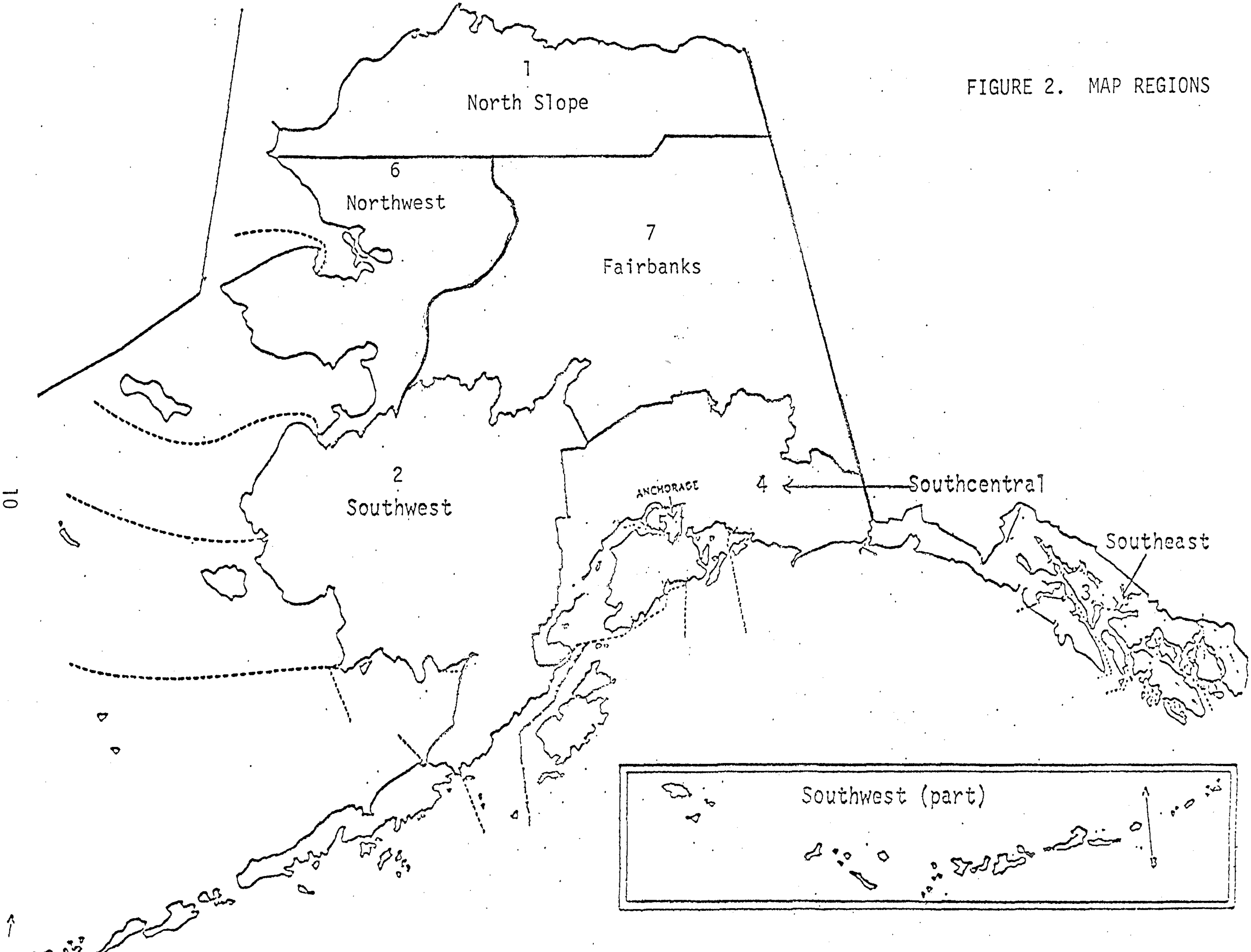

FIGURE 2. MAP REGIONS

economies are influenced by economic activity in other regions; the most notable of these is Anchorage. The demographic component of the regional model is much simpler than that component of the state model. Regional population is estimated as a function of employment. Regional population is estimated in two components--enclave and nonenclave population. A weighted average of the nonenclave population to nonenclave employment ratio for the state and the lagged value in the region is multiplied by the nonenclave employment to estimate nonenclave population in the current year. The weights used to determine regional population in this study equal the proportion of state population for the lagged regional population to employment ratio and one minus this proportion for the state ratio. Enclave employment is added to nonenclave population to determine total regional population. Enclave employment includes the military and major construction projects such as the trans-Alaska pipeline. The regional model has no fiscal component and must accept an exogenous pattern of wage and salary payments to state and local government workers. Usually the pattern of wage and salary payments used is taken from a similar state model projection. Estimates of regional employment, population, and income in the regional model are constrained to total to equivalent variables from the state model results.

STRENGTHS AND LIMITATIONS

The models used in this analysis have several strengths and weaknesses which must be considered when examining the reported results. The principal strength of the MAP models is that they capture the essence of the Alaska growth process. Export base industries and government create growth directly through hiring and indirectly through the demand generated by their employees for locally produced goods and services. Incomes earned by these export base workers and the workers who supply the goods and services provide the base of the economy.

Compared to two alternative forms, the economic base and input-output models, the econometric specification of the MAP model type is preferred since it captures the dynamics of industry growth. The economic base model is useful for projecting marginal changes but assumes that changes in the support sector are proportional to changes in basic sector employment. This misses both the feedback effect of the growth of the support sector incomes and the change in the responsiveness of the support industries over time. While input-output models more precisely define the inter-industry flows of purchases of goods and services, they represent the economy only at a particular point in time. The econometric approach can capture some of the changing relationships over time, as these are described by historic changes or incorporated by the modeler.

The limits on the econometric method define the limits on the acceptance of the resulting projections. No model is able to capture revolutionary changes which violate the assumptions upon which the model is built, unless structural change has been foreseen and incorporated by the modeler. The limitations of the model increase the more the model is extended into the future and the more locationally precise the model is expected to be. In other words, more confidence should be placed in the 1985 results than in those for 1995, and statewide projections are more likely to be "correct" than regional results.

Another important limitation of this model is that the projections should be considered contingent. The accuracy of the projections depends on the continued relevance of the model's historical structure and the accuracy of the assumptions about the level, timing, and distribution of the exogenous variables. One result of this contingency is that the projections may not necessarily agree with the actual levels of the projected variables for any given year. Projections are based on the average historical relationships between the projected variables and important exogenous variables. This leads to two reasons why projections in any year may differ from the actual levels of projected variables. First, estimates of the level of important exogenous variables may differ from the actual levels. Secondly, in any given year, the relation between projected and exogenous variables may differ from the historical average. Cyclical effects may cause yearly divergence from the general trend of economic growth. The relationships described by the model, while they may not predict actual levels in any particular year, describe the general trend of future Alaskan economic growth.

The final limitation of the results concerns the projection of the regional distribution of state growth. These results are merely allocations of the projected statewide totals to the regions. This should not be assumed to be a detailed analysis of the regional economies and should not replace such analysis.

ASSUMPTIONS

Once the model is given, the base case is defined by the assumptions about the future levels of the exogenous variables. There are four major types of assumptions required to define a development scenario. First, there are assumptions about the growth of exogenous industries in both the petroleum and nonpetroleum sectors. Secondly, assumptions about the level of state petroleum revenues are needed. Thirdly, assumptions about the change in certain national variables are needed. Finally, an assumption must be made about the way state expenditures grow in the future.

GENERAL METHODOLOGY FOR ANALYSIS

The general approach to be pursued in the analysis of the impacts of Western Gulf OCS development will be as follows: A set of scenarios will be developed which contain no Western Gulf OCS development. These scenarios will be run using the MAP model and will serve as points of comparison for each alternate Western Gulf scenario. Each of the Western Gulf development scenarios will then be run. Each of these runs will then be compared to the appropriate base run to examine the impact of this hypothetical development on the major dimensions of the Alaskan economy.

Overview

The remainder of this report will analyze the historical growth of the state and regional economies and the projections of future growth, both with and without OCS activity in the Western Gulf. The effect of alternative Western Gulf development scenarios will be examined. Part II describes the historical growth in Alaska and its Gulf of Alaska region. Part III presents the projection of economic activity in a base case which contains no offshore activity in the Western Gulf. Parts IV-VI then describe the impacts of alternative Western Gulf development scenarios. Part VII attempts to capture the uncertainty attached to these estimated impacts by examining the sensitivity of the results to several of the uncertain elements of the scenario. Finally, Part VIII summarizes our major findings.

II. THE ALSAKAN ECONOMY, 1965-1976

Introduction

The historical period serves as a point of reference for discussing potential future growth. Examining past economic changes provides us with information not only on what happened, but also on how things happened. By understanding how things happened in the past, we can acquire an understanding of the process of growth in the Alaskan economy. Without some specific assumption about how this process would change in the future, we would not expect the future growth to be qualitatively different. Knowledge of the changes in the levels of and the relationships between economic variables in the past allows us to assess the possible future economic effects of potential changes.

In this section, we will examine the Alaskan economy between 1965 and 1976. This was a period associated with tremendous growth and was chosen to provide a long-term look at the changes in the economy. The period contains three significant events: the major Upper Cook Inlet oil development, the Prudhoe lease sale, and the construction of the trans-Alaska oil pipeline. We are interested in the comparative activity in three separate periods: before 1970, after 1970, and 1973-1975 (the peak years of Trans-Alaska Pipeline System (TAPS) construction). The Prudhoe Bay lease sale in 1969 marked the beginning of Alaska as a major petroleum economy. Comparing the economy before and after this date will illustrate the effects of this change. The years 1973 to 1975 are the years of most rapid expansion of TAPS construction. Examining this period in comparison with the entire post-1970 period will allow us to assess the short-run response of the economy to this rapid expansion.

This section has three objectives. The first objective will be to describe what happened during this period in terms of major economic variables. The second objective of this section will be to describe the Alaskan economy's growth process. The growth process includes both the factors causing growth and the response of the economy to these changes. Finally, we will attempt to describe the effects of the past growth on indicators of economic welfare such as unemployment and per capita income. Gaining an understanding of the economy during this period will allow us to understand better the probable effects of future potential OCS activity.

Growth of Aggregate Indicators

Economic growth is a multidimensional process for which there is no single summary measure of either the level of growth or the welfare associated with that growth. Economic growth is usually defined in terms of the change in the level of certain economic indicators. This is only one aspect of growth; the effects of growth on the process of change and the level of economic welfare are also important. This section will describe the change in some major economic variables, while the other aspects of growth will be discussed later. Table 1 describes the change in the level of three aggregate indicators of economic activity: employment, population, and personal income. These do not exhaust all of the possible indicators of economic activity, but they do describe the general economic trends during the period.

TABLE 1. GROWTH OF EMPLOYMENT, POPULATION AND PERSONAL INCOME, ALASKA 1965-1976

	Population[1]	Employment[2]	Personal Income[3] ($ Million)
1965	265,192	70,530	858
1970	302,361	92,476	1,412
1971	312,930	97,584	1,557
1972	324,281	104,243	1,698
1973	330,365	109,851	2,008
1974	351,159	128,178	2,436
1975	404,634	161,313	3,514
1976	413,289	171,714	4,133
Annual Average Percent Change			
1965-1976	4.12	8.43	15.36
1970-1976	5.35	10.87	19.60

[1] All estimates State of Alaska Department of Labor, Research and Analysis Section, Population Estimates by Census Division, except 1970 which is April 1970 Census of Population.

[2] Alaska Department of Labor, Statistical Quarterly, various years.

[3] U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, July 1978 printout.

Population grew at an annual average rate[1] of 4.1 percent throughout the period. The state experienced over a one percent greater growth rate in population after 1970. Of the growth in population between 1965 and 1976, over 75 percent occurred after 1970. The most rapid increase occurred during the period of trans-Alaska pipeline construction when total population increased by 15.2 percent between 1974 and 1975.

Growth in population is determined by the growth in employment. Total nonagricultural wage and salary employment grew by almost 150 percent between 1965 and 1976. Employment growth averaged a rate of 8.43 percent per year during the period. After 1970 employment grew at a faster average rate of 10.9 percent per year. More than 78 percent of the growth in employment occurred after 1970.

Personal income is the final measure of aggregate economic growth. Personal income is shown in Table 1 in nominal dollars. Its growth reflects both real economic growth and the increases in prices. Nominal personal income increased at an average rate of 15.4 percent per year throughout the period. As in population and employment, the major growth in personal income occurred after 1970.

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[1]The average annual percent change or average annual rate of growth is used extensively throughout this paper as an indicator of the functioning of the economy. This term is equal to that yearly percentage change which would have to occur to obtain the year-end projection. This indicator is calculated as follows: Let $B = A(1+r)^t$ where A and B are the start and end values of some variable; t is equal to the duration of the period of interest; and r is the average annual percent change. Given A, B, and t, solve for r.

Overall, these aggregate indicators illustrate a rapidly growing economy. The major growth in the period occurred after 1970 when the economy was influenced significantly by the construction of the trans-Alaska pipeline. Growth in the population occurred at a rate which was slower than the growth of either employment or personal income.

The Causes of Growth

Three major events shaped the growth of the state during this period. The first was the development of the Upper Cook Inlet oil and gas fields during the late sixties. The second major event was the Prudhoe Bay lease sale in 1969, which produced a major source of revenue for the state and began an era when the state became a major oil producer. Finally, the construction of TAPS beginning in 1974 led to the most rapid growth during the period. This section will examine the Alaskan growth process in an attempt to relate these events and other factors to the growth of the Alaskan economy.

Traditionally, the growth of regional economies is described by economic base theory; the practical application of this theory is widely used in regional analysis. Economic base theory states that a region grows primarily as a result of increased export activity to other regions. The demand for these exports is not influenced by activity within the region, so the level of economic activity is fixed by external factors. The local support sector exists to serve the basic sector and the population associated with it. Growth occurs as a two-part process; the expansion of the export sector leads to an expansion of the local support sector.

One of the strongest statements in support of this theory was made by North. He argued that the growth of exports was the most important reason for growth in a region; he presented economic base theory as a long-run theory of economic growth (North, 1955). In response, Tiebout argued this theory was not a theory of economic development and it was only valid in the short run. Tiebout pointed out that nonexport sectors such as government and local investment may generate growth even in the short run. Tiebout argued that the importance of exports as a determinant of regional income is inversely related to the size of the region (Tiebout, 1956). Anything which increases regional income would lead to economic growth through the expansion of the support sector. Tiebout expanded the explanation of the causes of growth. Regional growth may result not only from an expansion of the export base but also from improved technology, an increase in trade within the local economy, and the expansion of nonexport sectors. This section will attempt to assess the role of each of these factors in the growth of the Alaska economy.

BASIC SECTOR GROWTH

The growth of the export base or basic sector is one of the major causes of economic growth. The basic sector was still a major force determining the growth of the Alaskan economy during the period between 1965 and 1976. This section will examine the growth of the various industries which make up the Alaskan basic sector. By examining the growth in each industry, we can see the relative importance of the basic sector to Alaskan economic growth.

A major problem in examining the relation between the economy's basic sector and its growth is determining which industries in a region are basic industries. Traditional multiplier analysis is importantly dependent on this, since the size of the multiplier is determined by this disaggregation. The problem arises because every industry has both basic and nonbasic sectors. An Alaskan example is the construction industry which includes a basic component such as pipeline and federal government-sponsored construction, a nonbasic component such as housing construction, and an investment component which is exogenous in the short run while it is endogenous in the long run. Even an important support sector industry such as services has a relatively large basic component in hotel and motel service which serves the tourist industry.

Many methods exist for defining industries as either basic or nonbasic. Leven suggested that, other than conducting a survey, most traditional methods for separating these sectors incorrectly estimate the importance of the basic sector (Leven, 1964). In this section, we will determine the basic sector by definition. Those industries where the level of activity is affected most significantly by external factors will be considered basic industries. Mining, agriculture-forestry-fisheries, manufacturing, federal government, and construction are basic industries. The demand for the products of both mining and agriculture-forestry-fisheries is determined in national and international markets not within the Alaskan economy. The most important components of manufacturing are food processing and petrochemicals which are extensions of the fishing and mining industries. The level of federal government activity in Alaska is determined by decisions made outside the state. Construction has both basic and non-basic components; however, major changes in construction activity are determined by outside agencies and firms. The most important recent example of this is the construction of the trans-Alaska pipeline.

Table 2 illustrates the growth of the Alaskan economy by sector. Industry growth is described by the growth of employment and wages and salaries. Growth of employment illustrates the direct effect of the industry on the growth in the number of jobs. Wages and salaries are an important component of both personal income and industrial output. This measure allows us to estimate the broader effect of the industry on the economy. The growth in wages and salaries can differ from employment growth for three reasons. First, the growth of wage rates can differ between industries. Wage rates are determined by the industrial productivity, as well as differential demand. Secondly, the hours worked in different industries could differ. During the construction of the TAPS, the hours worked increased considerably in construction, raising average wages because of overtime. Finally, wages and salaries can increase at a different rate than employment because the composition of industrial employment changes.

The distinction between employment and wage and salary growth is important when examining the relative growth of the basic sector. Overall employment in the basic sector grew much less rapidly than the remainder of the economy in all but the pipeline years, 1973-1975. Between 1965 and 1976, basic sector employment increased at an average annual rate of only 2.9 percent per year, compared to 6 percent for the entire economy and 10.2 percent

TABLE 2. ALASKA ECONOMIC GROWTH BY SECTOR
1965-1976

	Average Annual Rate of Change					
	1965 - 1976		1970 - 1976		1973 - 1975	
	Employment	Wages & Salaries	Employment	Wages & Salaries	Employment	Wages & Salaries
Basic Sector[1]	2.9	16.7	4.7	23.6	13.8	54.2
Mining	12.5	23.1	4.9	16.3	37.8	68.8
Construction	15.2	29.1	27.9	50.6	82.2	157.8
Manufacturing	4.6	11.1	4.7	13.0	1.1	15.5
Federal Civilian	.3	7.6	.8	8.0	3.5	12.7
Federal Military	-2.7	5.7	-4.1	4.3	-4.1	2.5
Support Sector	10.2	18.6	12.3	24.1	23.7	52.5
Transportation-Comm.-Utilities	7.4	16.9	9.6	22.8	26.0	58.7
Trade	9.7	16.4	10.2	19.3	19.7	38.9
Finance-Insurance-Real Estate	11.2	18.5	14.8	24.4	18.1	30.3
Services	12.6	24.3	16.0	30.9	28.5	68.1
Other						
State Government	6.6	15.7	5.4	15.8	6.0	23.0
Local Government	10.1	18.8	11.1	21.7	11.9	20.5
Total Nonagricultural Wages and Salaries[2]	6.0	17.5	7.8	23.4	16.5	47.5

[1] Agriculture-forestry-fisheries is left out of this table. During the period, changes in the coverage of fisheries employment distorts the real growth in this industry.

[2] Includes military wages and salaries from U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, July 1978 printout.

SOURCES: Alaska Department of Labor, Alaska Labor Force Estimates, Estimates of Total Population, various years.

Alaska Department of Commerce and Economic Development, The Alaska Economy: Year End Performance Report 1977.

for the support sector. After 1970 industrial growth rates were much closer; basic sector employment grew at a rate of 4.7 percent, compared to 7.8 percent for the entire economy. The growth rates are much closer when wages and salaries are considered. Between 1965 and 1976, the wages and salaries earned in the basic sector grew only .8 percent less than the economy-wide average of 17.5 percent. After 1970 basic sector wages and salaries grew slightly faster than the economy as a whole.

The effect of pipeline construction on the growth of the economy can be seen in the period 1973 to 1975. Employment in the basic sector grew at 13.8 percent annually, while the economy grew at 16.5 percent. Wages and salaries increased more rapidly, increasing at a rate of 54.2 percent annually in the basic sector, compared to 47.5 percent for the economy as a whole.

One of the major reasons for the overall character of the basic sector was the declining role of the federal government in the state economy. The federal government has played a major role in the economy of Alaska. Between 1965 and 1976, federal government civilian employment increased from 17,400 to 17,900. Employment grew faster between 1973 and 1975 in response to TAPS construction's reaching a peak of 18,300 in 1975. The average growth rate of federal civilian employment was less than one percent per year over the entire period. Military employment actually declined throughout the period with an average growth rate of -2.7 percent per year. Wages and salaries in this sector increased, but at rates much less than the growth of the economy in general. Federal government employment continued to supply a stable base for the economy but was not responsible for the tremendous growth in the economy throughout the period.

The most rapidly growing basic industry was construction. Employment grew at an average rate of more than 15 percent throughout the period; this was more than twice the growth rate of the economy. The obvious reason for this growth was the construction of the trans-Alaska pipeline beginning in 1974. The most rapid increase in construction employment came between the period 1973 and 1975 when construction employment increased at a rate of 82.2 percent per year. The state has estimated that in 1976 construction employment connected with the Alyeska project was approximately 15,000, or 50 percent of the total state construction employment (Alaska Department of Labor, 1977). Wages and salaries mirrored the growth in employment, increasing at an average annual rate of 50.6 percent after 1970.

Mining employment also increased at a rapid rate throughout the period; its average annual rate was 12.5 percent. Unlike construction, mining experienced cyclical growth during the period. Mining employment increased between 1965 and 1970 to 3,000, then fell to 2,000 in 1973 before increasing to 4,000 in 1976. The early growth in mining resulted from discovery, development, and production of oil and gas from the Kenai Peninsula and Cook Inlet fields. Oil was discovered in 1957 at the Swanson River; production increased from one million barrels per month in 1966 to a peak in 1970 of 7.5 million barrels per month. Employment associated with these fields grew at an annual rate of approximately 40 percent in the late sixties, causing mining employment to triple between 1965 and 1969 in the Cook Inlet Region (Anchorage, Kenai, Matanuska-Susitna, Seward) (Scott, 1978). Employment associated with this development dropped after this peak production. During the 1970s, the development of the Prudhoe Bay fields resulted in the expansion of the mining industry. This development led to growth in both exploration and production employment and headquarters employment in Anchorage. The most rapid expansion of the mining industry came between 1973 and 1975 when both employment and wages and salaries increased at rates more than three times as great as the economy.

Manufacturing in Alaska has traditionally been associated with the fishing industry because of the large component of food processing employment. The composition of manufacturing changed over the period with food processing becoming less important; this change in composition accounts for the differential growth in employment and wages and salaries since food processing is a traditionally low-paying sector. Between 1970 and 1976, employment in manufacturing grew at a rate of 4.6 percent annually, while wages and salaries grew at 11.1 percent. Food manufacturing, because of its relation to the fishing industry, showed cyclical growth; employment fell between 1973 and 1974 and did not rise again until 1976. The fastest growing sector of manufacturing was "other" manufacturing which consists principally of petroleum refining, petrochemical, and printing and publishing. Between 1965 and 1976, employment in "other" manufacturing increased at an average annual rate of 6.5 percent, which meant that this sector was increasing its share of manufacturing employment.

Agriculture-forestry-fisheries depends on the development of the state's renewable natural resources. The growth of these industries depends to some extent upon the natural resource cycles. State Labor Department estimates do not include all of the employment in this industry since a large proportion of the workers are self-employed. Independent estimates of employment in these industries suggest little growth. Forestry employs only about 22 people statewide; most of the logging employment is accounted for in lumber and wood products manufacturing (Scott, 1979). One indicator of agricultural activity is employment reported in a yearly agricultural survey. This survey reports a decline in total agricultural employment from 900 in 1965 to 750 in 1975 (USDA). The fishing industry has traditionally been important to Alaska. Based on estimates from Fish and Game fish ticket data, employment was estimated to have increased from about 4,340 in 1970 to about 5,720 in 1976. This is an annual growth rate of 1.3 percent (Rogers and Listowski, 1978). Table 3 shows some additional indicators of the growth of the fisheries industry. The catch and value statistics shown in this table illustrate the cyclical nature of the fishing industry. The real value of fisheries catch peaked in 1973 at $117,842 (in 1967 dollars).

TABLE 3. ALASKA FISHERIES ACTIVITY, 1970-1975

	1970	1971	1972	1973	1974	1975
Catch (million lbs)	533.6	471.0	422.5	513.1	454.2	442.4
Value ($.000)	97,497	85,585	92,431	142,353	144,809	129,402
Real Value ($.000)	88,957	75,735	79,751	117,842	108,147	84,965

SOURCE: Alaska Department of Commerce and Economic Development, The Alaska Economy, 1977, 1978.

The major growth in the basic sector was in mining and construction. The traditionally important fishing industry did not keep up with growth in other basic sectors. Federal government employment, while it provided a stable base for the economy, actually declined. Overall, employment in the basic industries grew rapidly but not as rapidly as the total economy. The differential growth in average wages led to increases in basic sector wages and salaries at rates close to state averages.

THE GROWTH OF STATE GOVERNMENT

The growth of nonexport sectors may also be responsible for the growth of a regional economy. An important sector contributing to the growth of Alaska between 1965 and 1976 was the expansion of state government. There are two reasons for selecting state government as a growth-initiating sector. First, state government experienced rapid growth in the early 1970s. Secondly, this growth was funded by the growth in revenues which were exogenous to the economy. The lease bonus from the Prudhoe Bay lease sale in 1969 resulted in the increased state revenues. This placed state government in a position equivalent to the basic sector. Growth in exogenous revenues led to increased expenditures which caused growth in the economy. Because of this, state and local government could be a possible source of economic growth. The growth of state government expenditures will influence the economy in two ways. First, increased state expenditures will lead to increased employment in state and local government. Secondly, state capital expenditures will increase employment in the construction industry. State expenditures on construction of highways and ports provide increased activity in the construction industry. Examining the growth of state expenditures during the period will provide an indication of the state government's contribution to growth.

Since statehood, total state expenditures have increased at an average annual rate of 21 percent (Goldsmith, 1977). Examination of expenditures shows there are three distinct periods of expenditure growth: prior to the 1969 Prudhoe Bay lease sale, between 1970 and 1972 when the initial adjustment to these revenues occurred, and after 1972. The primary interest is in the period after the state received the lease bonus in 1970. In examining expenditures in this period, Scott (1978) found:

1. The constant dollar increase was 62 percent of the nominal dollar increase.

2. The rate of increase was more rapid between 1970 and 1972 than between 1972 and 1977.

3. Operating expenditures have grown more rapidly over the whole period, while capital expenditures grew more rapidly between 1970 and 1972. These suggest that each type of expenditure may be sensitive to different factors, with operating expenditures responding to increases in demand and capital expenditures responding more to available revenues.

The question of whether state expenditures responded to growth or were growth inducing can be examined in Table 4 (from Scott, 1978), which shows the growth of real per capita state expenditures. If expenditures increased but real per capita expenditures remained constant, the growth of expenditures, in the absence of significant economies of scale, could be assumed to be simply keeping up with the growth in demand. If real expenditures grew faster than population, state government could be contributing to growth. Both real per capita operating and capital expenditures increased between 1970 and 1972. Real per capita operating expenses increased at an average rate of 19.9 percent in this period, while capital expenditures increased at a rate of 32.3 percent per year. After 1972 and the initial response to the Prudhoe Bay lease sale revenues, operating expenditures increased at a rate of 3.4 percent and capital expenditures actually decreased at a rate of -6 percent.

Between 1970 and 1972, state government expenditures expanded much more rapidly than either population or prices. After 1972, expenditures have grown more in line with population and prices. The expansion of real per capita expenditures between 1970 and 1972 is an indication that state government was a contributing factor to the growth during this period. The growth of real per capita expenditures reflected the initial response to the large increase in revenues from the Prudhoe Bay lease sale. State government contributed to growth since it distributed exogenous revenues to the economy. This extra demand resulted in economic growth. The long-term consequences result from the change in the relationship between state expenditures and economic growth as defined by real per capita expenditures.

TABLE 4. STATE REAL PER CAPITA OPERATING AND CAPITAL EXPENDITURES 1970-1977

(Constant 1967 Dollars)

Fiscal Year	Resident Population[1]	Operating Expenditures Per Capita	Capital Expenditures Per Capita	Total Expenditures Per Capita
1970	294,560	$ 722.20	$317.02	$1,039.22
1971	302,361	990.64	374.77	1,365,41
1972	312,930	1,038.74	555.11	1,593.85
1973	324,800	1,108.15	497.07	1,605.22
1974	330,600	1,168.14	475.66	1,643.80
1975	351,159	1,199.92	548.54	1,748.46
1976	404,635	1,156.97	486.57	1,634.54
1977	413,289	1,224.88	409.17	1,634.05
		Average Annual Rate of Increase		
1970-1977	5.0%	7.8%	3.7%	6.7%
1972-1977	5.7%	3.4%	- 6.0%	0.5%
1970-1972	3.1%	19.9%	32.3%	23.8%

[1]State's estimate from Research and Analysis Section, Employment Security Division, Alaska Department of Labor, State of Alaska Current Population Estimates by Census Divisions, July 1 (year). The population as of the beginning of the fiscal year was used.

This historical period illustrates the state's unique financial position. The revenues associated with Prudhoe Bay production will be available to the state to increase economic growth. However, Prudhoe revenues are a fixed flow of resources which will not be affected by economic growth. Since they are fixed, growth will reduce the share of these revenues available to existing residents. This relation makes the ability of the economy to generate revenues to replace Prudhoe revenues an important future consideration.

SUMMARY

Two major factors have been responsible for the growth of the Alaskan economy since 1965. The expansion of basic industries and the growth of state government were the most important growth-initiating factors. Unlike most states, the Alaskan government had an exogenous source of revenues in the early 1970s which it could use to expand government spending in more than a proportionate response to the growth of the economy. The rapid increase in government spending was important as a source of growth in the early 1970s. The most important basic sectors during this period were mining and construction. These industries experienced particularly rapid growth after 1973 with the construction of TAPS and development of Prudhoe Bay. The traditionally important basic sectors of federal government and agriculture-forestry-fisheries expanded at a much less rapid pace.

The expansion of state government and the basic sector was important to growth of the economy, because this expansion led to an increase in incomes. Factors which cause incomes to increase independently of expansion of either the basic sector or state government can also result in the expansion of the economy. Income can increase because of an increase in the productivity of labor or increased demand for labor not associated with an increase in the basic sector. One factor that is important for Alaska incomes is the influence of overall U.S. wage rates. Since Alaska is an open economy, Alaska is part of the U.S. labor market. Growth is transmitted from its initiating source through the economy by increased demand for local goods and services. As incomes increase, a portion of this income is spent on goods and services in the local economy. This additional expenditure leads to increasing employment in the support sector. This growth in employment leads to increased incomes which generate new increases in demand. The simultaneous nature of this process can be seen as growth in income leads to increases in demand and further income growth.

Structural Change in the Alaskan Economy

The relation between the growth-initiating sectors and the remainder of the economy is an important part of the economic growth process. In our analysis of Alaskan growth, one thing was evident: the growth of employment in the basic sectors stimulated a greater-than-proportional response in the remainder of the economy. One measure of this response is the ratio of total-to-basic sector employment; the larger this ratio, the more important is the economy's response to basic sector growth. In 1965, the ratio of total-to-basic employment was 2.25; it had risen to 2.95 by 1973 prior to the trans-Alaska pipeline construction. Even in 1976 with the tremendous amount of basic construction employment, the ratio was 2.69. The change in this ratio shows that along with the rapid growth in the levels of economic activity, there has been a qualitative change in the relationships in the economy. This qualitative change is a change in the structure of the economy which will be described in this section.

STRUCTURAL CHANGE

The economic relationships which determine the flow of income, goods, and services are determined by the structure of the economy. The structure of the economy's productive sector can be defined by the distribution of employment or gross product among industries. The economy's structure influences its overall level of activity, the level of prices, and seasonal and cyclical stability. The structure both affects and is affected by growth.

The growth of the economy leads to changes in its structure. Structural change can result from a change in the structure of demand as changes in incomes and prices affect the structure of consumption. However, changes in demand may only change the distribution of imports unless supply conditions lead to the production of goods locally. If economies of scale are obtained in production, regional growth will alter the production costs. As economies grow and achieve economies of scale, they will substitute local production for imports of goods or services. When the economic change is large relative to the local economy, structural change may result.

The structure of the economy also affects growth. Chinitz suggested that the structure of the export sector influences important determinants of growth such as bank lending patterns and entrepreneurship (Chinitz, 1961). The structure of the export sector may also influence growth through its propensity for backward and forward linkages. The Alpetco project is a recent example of a forward linkage from the Alaska petroleum sector. The structure will influence the economy's response to major exogenous changes. The region's industrial structure will determine how much of the incomes generated by export activity will be spent locally.

ALASKA STRUCTURAL CHANGE

The ratio of total-to-basic employment has steadily increased from the early fifties (Goldsmith and Huskey, 1978B). This growth in the nonbasic or support sector of the Alaskan economy means that equivalent increases in basic employment will lead to greater growth. Table 5 illustrates the effect of structural change on growth. The last two columns show what growth would have been with the given basic sector growth and the maintenance of 1965 and 1970 total-to-basic ratios. In all cases, these ratios underestimate the economy's real growth.

Table 6 provides a detailed description of the structure of Alaska industry in 1965, 1970, and two pipeline years--1975 and 1976. The support industries as a group expanded. Trade and transportation-communication-utilities remained constant after 1970. The service industry grew significantly in this period, increasing from 10.7 percent to 16.1 percent of total employment. Business services increased from 1.97 percent to

TABLE 5. THE EFFECT OF STRUCTURAL CHANGE, ALASKA, 1965-1976

Year	Total Non-Agricultural Employment	Civilian Total Basic Employment	Ratio of Total/ Basic	Total Employment When Using 1965 Ratio	Total Employment When Using 1970 Ratio
1965	70,530	31,393	2.25	-	82,879
1970	92,476	35,028	2.64	78,697	-
1971	97,584	35,447	2.75	79,638	93,582
1972	104,243	36,137	2.88	81,188	95,404
1973	109,851	35,849	3.06	80,541	94,643
1974	128,178	45,698	2.80	102,668	120,645
1975	161,313	58,592	2.75	131,637	154,686
1976	171,714	63,732	2.69	143,185	168,256

Basic Employment includes: Mining, Contract Construction, Manufacturing, Agriculture-Forestry-Fisheries, Federal Government, and Military.

SOURCE: Alaska Department of Labor, Statistical Quarterly, various quarters (primarily third), 1966-1977.

TABLE 6. DISTRIBUTION OF EMPLOYMENT, ALASKA
1965, 1970, 1975, and 1976

Industry	1965 % of Total Employment	1970 % of Total Employment	1975 % of Total Employment	1976 % of Total Employment
Total Wage and Salary Employment	100.00	100.00	100.00	100.00
Mining	1.54	3.24	2.35	2.31
Contract Construction	9.15	7.45	16.04	17.61
Manufacturing	8.90	8.48	5.98	6.02
Food	4.26	4.04	2.68	2.98
Logging Lumber and Pulp	3.27	2.98	2.09	1.89
Other Manufacturing	1.36	1.45	1.20	1.14
Transportation, Communication, and Public Utilities	10.30	9.85	10.21	9.18
Trucking and Warehousing	1.72	1.79	2.45	1.89
Water Transportation	1.47	.90	.86	.78
Air Transportation	2.72	3.32	2.96	2.70
Other Transportation	.76	.95	1.13	1.08
Communications and Public Utilities	3.63	2.89	2.69	2.73
Trade	14.11	16.61	16.25	16.05
Wholesale	2.63	3.51	3.66	3.55
Retail	11.48	13.10	12.58	12.50
General Mdse. and Apparel	2.69	3.63	2.55	2.48
Food Stores	1.65	1.85	1.62	1.74
Automotive & Service Stations	NA	1.81	1.77	1.68
Eating/Drinking Establishments	2.77	3.02	3.88	3.76
Other Retail	4.36	2.78	2.76	2.84
Finance, Insurance, and Real Estate	3.08	3.35	3.74	4.14
Services	10.65	12.37	15.58	16.11
Hotels, Motels, and Lodges	1.46	1.57	1.96	1.87
Personal	.96	.92	.57	.54
Business	1.97	2.16	4.54	5.04
Medical	2.03	2.35	2.68	2.92
Other	4.22	5.37	5.83	5.75
Government	42.06	38.45	29.22	27.89
Federal	24.72	18.50	11.34	10.45
State	9.87	11.21	9.59	8.22
Local	7.47	8.73	8.30	9.21
Agriculture, Forestry, and Fisheries	.20	.21	.63	.70

SOURCE: Statistical Quarterly, Alaska Department of Labor, various issues.

5.04 percent and were the major component of service sector change. Finance-insurance-real estate also increased as a proportion of total employment. (The employment levels are found in Appendix A.)

The Extent of Future Structural Change

The Alaska support sector has increased its share of employment since 1965, which is part of a much longer trend. An important question when examining potential future growth is what the extent of future structural change will be. If the support sector were to continue to expand its share of employment at its past rate of about 2.5 percent per year, the support sector would account for 85 percent of employment in 2000 and almost 100 percent six years later. This, of course, cannot happen; however, there are reasons to expect future growth in the support sector. The most important reason is that economic growth will increase market size, which will allow more local production of goods and services.

Tables 7 and 8 give some insight into the limits to the growth of the support sector. Table 7 compares the Alaskan distribution of employment to the United States and some other states. Only in finance-insurance-real estate and transportation does Alaska come close to the employment shares of other states. The shares of trade and services are well below those of other states. If the only thing determining industrial production were scale economies, the structure of a region could be assumed to grow toward the structure of similar regions. The average of other states is similar to the U.S. distribution and supports this hypothesis.

Table 7. THE ECONOMIC STRUCTURE OF SMALL STATES

	Total Employment (thousands)	Percent in Services	Percent in Trade	Percent in Finance-Insurance-Real Estate	Percent in Transportation-Communication-Public Utilities	Percent in Government
Alaska	151.7	15.2	17.5	5.1	9.0	34.5
Wyoming	168.7	13.9	21.9	3.4	7.8	22.7
Vermont	179.5	23.4	20.7	4.0	4.7	18.2
North Dakota	227.8	19.3	29.0	4.5	6.1	26.8
South Dakota	227.0	21.1	27.5	4.4	5.4	24.9
Delaware	234.3	16.9	22.0	4.8	5.2	17.8
Montana	263.7	18.4	25.2	4.4	7.8	27.8
Idaho	305.5	17.5	25.1	5.3	6.0	21.8
Nevada	323.7	40.8	19.8	4.2	6.0	16.1
New Hampshire	348.1	18.3	21.5	4.9	3.6	16.1
Hawaii	362.2	24.0	25.4	6.9	7.8	24.2
Rhode Island	383.0	18.8	19.9	5.0	3.5	15.7
Maine	384.3	17.0	21.1	3.9	4.5	21.3
New Mexico	430.9	19.5	22.9	4.4	6.0	26.9
Utah	500.2	17.4	24.0	4.6	6.1	23.8
Nebraska	583.6	17.4	26.5	6.6	7.2	22.2
West Virginia	549.2	15.8	22.1	3.6	6.6	20.9
Arkansas	714.5	14.0	21.3	4.2	5.4	19.0
Mississippi	778.1	14.3	19.7	3.9	4.7	21.2
Arizona	829.8	18.2	24.4	5.6	5.2	23.2
Kansas	878.5	17.5	23.8	4.9	6.6	20.9
Oregon	962.7	17.5	23.7	6.2	5.7	20.3
Oklahoma	1,001.6	16.6	23.4	5.0	6.0	22.4
Colorado	1,008.1	19.4	23.4	6.1	6.5	22.2
Washington	1,405.6	18.4	23.7	5.6	5.7	20.7
Average (excluding Alaska)		19.0	23.3	4.8	5.8	21.5
U.S. Average		18.8	22.1	5.1	5.5	15.9

Source: U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, June 1978.

TABLE 8. ECONOMIC STRUCTURE OF SMALL STATES
1977

	Total Employment Support Industry[1] (Thousands)	Personal Income (Million $)	Support/ Personal Income	Regional Index of Costs (U.S.=1)	Support Employment/ Regionally Deflated Personal Income
Alaska	71,100	4,311	16.5	1.42	23.4
Wyoming	79,100	3,073	25.7	.90	23.1
Vermont	94,700	2,814	33.7	1.02	34.4
North Dakota	136,600	4,044	33.8	.92	31.1
South Dakota	132,700	4,104	32.3	.92	29.7
Delaware	114,700	4,477	25.6	1.02	26.1
Montana	147,300	4,661	31.6	.90	28.4
Idaho	164,600	5,128	32.1	.90	28.9
Nevada	228,800	5,059	45.2	.99	44.7
New Hampshire	168,400	5,547	30.4	1.02	31.0
Hawaii	234,600	6,773	34.6	1.21	41.8
Rhode Island	181,000	6,332	28.6	1.02	29.2
Maine	178,300	6,221	28.7	1.02	29.3
New Mexico	227,400	6,970	32.6	.88	28.7
Utah	256,300	7,510	34.1	.98	33.4
Nebraska	336,500	10,491	32.1	.93	29.9
West Virginia	264,000	11,129	23.7	.85	20.1
Arkansas	321,100	11,878	27.0	.89	24.0
Mississippi	331,800	12,019	27.0	.89	24.0
Arizona	446,600	14,943	29.9	.99	29.6
Kansas	464,700	19,802	23.5	.93	21.9
Oregon	511,500	16,651	30.7	.998	30.6
Oklahoma	510,400	17,839	28.6	.98	28.0
Colorada	558,900	18,752	29.8	.98	29.2
Washington	755,900	27,534	27.5	.998	27.4

[1]Support sector includes: Services, Trade, Finance-Insurance-Real Estate, and Transportation-Communication-Public Utilities.

SOURCES: U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, June 1978.

U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, April 1978.

Examining Table 7 shows that the variation around the U.S. average cannot be explained simply by scale. Table 8 shows that real personal income may explain some of the differences; when personal income is adjusted to reflect regional cost differences, there is a similarity among states. The ratio of support employment to personal income is close to 30.00 for most states independent of their size, although the ratio is lower for some states larger than Alaska. Alaska's ratio is less than this. Both Tables 7 and 8 indicate that the support sector in Alaska has room for expansion.

What explains the support sector's relative underrepresentation in the Alaska economy? One explanation might be a certain threshold size which Alaska has not yet reached after which the support sectors grow somewhat proportionately. A second explanation could be the composition of the export sector. Large petroleum and mining operations and government provide much of the support activity internally leading to an underdeveloped support sector. A third reason could be the high cost of doing business in Alaska which dampens the effects of scale and reduces the competitiveness of Alaska production. The extent of the state could be another reason for Alaska's underdevelopment of the support sector. The distribution of population may make it more profitable to serve some areas such as Southeastern and Western Alaska from outside the state. The most optimistic reason would be that it is merely an information problem. If outside investors do not know the Alaska market, they will underinvest. That, coupled with the slow reaction of investment in the support sector to the recent rapid growth, would mean that Alaska could expect future growth in these sectors merely to catch up with the existing growth in the basic industry.

SUMMARY

This section has described the second part of the process of economic growth, the response of the economy to changes in those sectors which initiate growth. This response has changed in the Alaska economy since 1965; an important indicator of this is the increased share of the support sector. Relative to other states, Alaska is underserved by the support sector. Because of this, there is some reason to believe the support sector will continue to expand as a portion of total employment. This understanding of structural change and its relation to economic growth increases our awareness of the effects of the scale and the timing of future economic activity.

Population

Industrial growth and the change in the structure of the economy are not the only aspects of economic growth. Population growth is another component. The level of population is influenced by the level of economic activity. Migration is a major component of population change, and the relative economic opportunities within Alaska determine levels of in- and out-migration. The population of a region also influences the economic activity. The characteristics and size of the population determine the region's local demand for goods and services and its labor force composition. This section will discuss the growth and composition of the Alaska population.

Table 9 shows the growth in population between 1965 and 1976. As would be expected, population increased most rapidly with the construction of TAPS; between 1973 and 1974, population increased 6.29 percent, while it increased by 15.23 percent between 1974 and 1975. Population increased by 148,100, or 55.8 percent, between 1965 and 1976.

The age and sex distribution of the population determines the demand that population places on both public and private services. A population with a large school-age component will have a higher demand for schools than the same population with a different distribution. The age-sex distribution will also influence the size of the labor force produced by a given population. Table 10 describes the age-sex distribution in 1970 and 1976. Comparing the age-sex distribution between 1970 and 1976 shows two observable trends. First, the proportion of males in the population has declined. The second trend is the increase in working-age population relative to the remainder of the population. The surprising observation is that the age-sex distribution has maintained relative stability. The tremendous growth in the population between 1970 and 1976 seems to have affected the distribution only slightly.

Population has grown rapidly since 1965, although the growth has been less rapid than the growth in employment. This differential growth has resulted in a fall in the dependency ratio (population/employment). The ratio of population-to-employment has fallen from 3.76 in 1965 to 2.41 by 1976. TAPS construction may be largely responsible for the low ratio in 1975 and 1976, since the pipeline has attracted single workers. The

TABLE 9. POPULATION GROWTH, ALASKA
1965, 1970-1976

	Number of Births	Number of Deaths	Natural Increase	Estimated Net Migration[1]	Population as of July 1	% Increase over Previous Year
1965	7,063	1,400	5,663	4,538	265,192	3.84
1970	7,560	1,431	6,129	1,672	302,361[2]	2.66[3]
1971	7,312	1,455	5,857	4,712	312,930	3.50
1972	6,948	1,467	5,481	5,870	324,281	3.60
1973	6,611	1,464	5,147	937	330,365	1.88
1974	7,006	1,468	5,538	15,256	351,159	6.29
1975	7,470	1,522	5,948	47,527	404,634	15.23
1976	7,834	1,713	6,121	2,534	413,289	2.14

[1] Difference between change in population and natural increase.

[2] April 1970.

[3] Average annual percent increase between 1965 and 1970.

SOURCE: Alaska Department of Labor and the Division of Economic Enterprise, Department of Commerce and Economic Development, as reported in The Alaskan Economy, Year-end Performance Report, 1977, except 1970 population which is from U.S. Department of Commerce, Bureau of Census, 1970 Census of Population.

TABLE 10. ALASKA POPULATION
AGE-SEX DISTRIBUTION
1970, 1976

	1970			1976		
Age	Males	Females	Total	Males	Females	Total
All ages	54.2	45.7		51.6	48.4	
0-13	16.5	15.7	32.2	14.1	13.2	27.3
14-19	5.7	5.2	10.9	6.6	6.0	12.6
20-29	12.4	8.7	21.1	11.2	10.4	21.6
30-39	7.7	6.5	14.2	7.8	7.8	15.6
40-54	8.1	6.6	14.7	7.7	7.2	14.9
55-64	2.5	2.0	4.5	3.1	2.6	5.7
64 +	1.3	1.0	2.3	1.1	1.2	2.3

SOURCES: U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population.

U.S. Department of Commerce, Bureau of the Census, 1976 Survey of Income and Education Microdata Tape.

dependency ratio had fallen substantially before construction on the pipeline began; in 1973 the ratio was 3.01. The dependency ratio has fallen as the proportion of the population which is working has increased. This increase results from a change in the proportion of the population which is of working age; the proportion of the population between 14 and 64 has increased from 65.4 percent in 1970 to 70.4 percent in 1976. The increased labor force participation of this population is also responsible.

Population growth results from the net effect of births, deaths, and in- and out-migration. As would be expected in a region with a small population which is experiencing rapid economic growth, migration was the most important component of population change throughout the period. Migration accounted for 69 percent of the total change in population between 1970 and 1976. In 1975, it accounted for 89 percent of the increase in population.

Unemployment

Unemployment has always been an important problem for the Alaska economy. Table 11 shows the dimensions of the problem. Since 1970, the unemployment rate has remained close to 10 percent; only in 1975 did it fall below 10 percent. The unemployment rate remained constant even though employment was increasing throughout the period. This illustrates a particular Alaska dillema. Increases in employment lead to increases in migration, which increase the labor force and leave the unemployment rate high. This has important welfare effects when skill levels are considered. If migrants are more qualified and take the new jobs, employment growth may do little to increase the welfare of original residents. The other factor which

TABLE 11. UNEMPLOYMENT, ALASKA
1965-1976

Year	Total Unemployed	Unemployment Rate (%)	Labor Force Participation Rate (%)
1965	7,700	8.6	38.16
1970	9,700	9.0	39.94
1971	12,100	10.4	40.97
1972	12,900	10.5	41.27
1973	13,900	10.8	42.78
1974	14,900	10.0	46.00
1975	14,900	8.3	47.40
1976	21,000	10.5	52.65

SOURCES: Alaska Department of Labor, Labor Force Estimates, and Alaska Department of Labor, Estimates of Total Resident Population, various years.

maintained the high unemployment rate was the increase in labor force participation. The labor force participation rate responds, like migration, to economic opportunities. As the employment opportunities expand, more people enter the labor force. The labor force participation rate increased from about 40 percent in 1970 to 53 percent in 1976.

One factor influencing unemployment in Alaska is the seasonality of employment. Economies which are dependent on natural resource production often have seasonal cycles. This has been accentuated in Alaska by the severe winters which limit activity. Since the seasonal decline usually occurs in the winter months, one measure of seasonality is defined by the ratio of the fourth-quarter employment to the third-quarter employment. The closer this index is to one, the less seasonal is the industry. Table 12 shows the seasonality of Alaska industries. Seasonality has decreased in importance throughout the historical period. In 1960, the overall seasonality index was .8313. In 1975 the seasonality index for total employment was .9402; the increase in seasonality in 1976 was due to the pipeline construction employment in the summer of 1976. The decrease in seasonality since 1960 has been a result of three factors. First, the increased importance of support sector industries with smaller seasonal components resulted in lowering the average seasonality. The seasonality index of services, trade, and F.I.R.E. has always been close to one. Secondly, the technology became available to work through the winter in construction. Finally, market forces made it profitable to employ these technologies in Alaska.

TABLE 12. SEASONALITY OF EMPLOYMENT, ALASKA
1950, 1960, 1965, 1970, 1975, and 1976

	1950	1960	1965	1970	1975	1976
Mining	.6267	.7143	.7949	.8556	.9009	.9690
Construction	.7900	.5862	.6460	.7279	.8374	.6906
Manufacturing	.2440	.5137	.6531	.5457	.6886	.6714
Transportation, Communication, and Public Utilities	.8248	.9683	.9125	.8851	.9887	.8871
Trade	.9226	.9718	.9905	.9733	1.0048	.9120
Finance, Insurance, and Real Estate	1.0000	1.0000	.9706	.8942	1.0000	.9270
Services	.9583	.9123	.9664	.9716	.9812	.9387
Government	.9632	.9815	.9617	.9810	1.0049	.9689
Total	.7505	.8313	.8718	.8800	.9402	.8733

SOURCE: State of Alaska, Alaska Labor Force Estimates, various years.

Personal Income

Growth of personal income increases the demand for goods and services and is an important determinant of the growth of the Alaska economy. Growth in personal incomes is also a measure of the benefits received from economic growth. Personal income has grown at an average rate of more than 15 percent throughout the period. The best measure of the welfare effects of personal income is real per capita income. Increasing incomes will only increase welfare if it is increasing faster than prices and population. Real per capita personal income measures the command of the average individual over goods and services.

Table 13 shows the effect of price increases in Alaska as measured by the Anchorage CPI. By comparing the growth in the Anchorage index to the United States, we can assess one impact of rapid development. Prior to 1974, the Anchorage CPI was increasing at a slower rate than the U.S. CPI, which meant the price differential between Alaska and the United States was falling. With the TAPS boom, this trend was reversed. Prices rose relatively faster in Alaska after 1975 because of bottlenecks and the rapid increase in demand. Bottlenecks resulted when the rapid increase in demand was met by the relatively fixed supply system.

Table 14 shows the growth in real per capita personal income. The maximum increases came in 1973 and in 1975 when real per capita income in Alaska increased by over 10 percent. In all but 1972, the growth of real per capita income was greater in Alaska than in the United States. This shows that an average Alaskan's command over goods and services has increased at a rate much greater than in the United States as a whole.

TABLE 13. ANCHORAGE CONSUMER PRICE INDEX
(1967 = 100)

Year	Anchorage Index	% Change Over Previous Years	United States Index	% Change Over Previous Years
1965	94.2	--	94.5	--
1970	109.6	3.07[1]	116.3	4.23[1]
1971	112.9	3.01	121.3	4.30
1972	115.9	2.66	125.3	3.30
1973	120.8	4.23	133.1	6.23
1974	133.9	10.84	147.7	10.97
1975	152.3	13.74	161.2	9.14
1976	163.3	7.22	170.2	5.58

[1] Average annual rate of price increase 1965-1970.

SOURCE: Alaska Department of Commerce and Economic Development, The Alaska Economy Year End Performance Report, 1978.

TABLE 14. ALASKA GROWTH OF REAL PER CAPITA INCOME
1965, 1970-1976

	Real Per Capita Income in Millions			
	Alaska		United States	
Year	Total	% Increase Over Previous Year	Total	% Increase Over Previous Year
1965	3,435	--	2,895	--
1970	4,260	4.40[1]	3,348	2.95[1]
1971	4,407	3.45	3,406	1.73
1972	4,518	2.52	3,585	5.26
1973	5,031	11.35	3,742	4.38
1974	5,180	2.96	3,675	- 1.79
1975	5,701	10.06	3,636	- 1.06
1976	6,124	7.24	3,755	3.27

[1]Average annual percent increase between 1965 and 1970

SOURCES: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information Center, July 1977 printouts.

U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1966 and 1967.

U.S. Department of Labor, Handbook of Labor Statistics, 1972 and 1977.

Summary: The Effects of Economic Growth

During the period between 1965 and 1976, the Alaska economy experienced rapid growth. The expansion of the economy during this period is symbolized by the growth in three aggregate indicators of economic activity: personal income, employment, and population. Personal income, which measures the command of residents over goods and services, expanded by 382 percent during the period from $858 million to $4,133 million. Employment expanded by 144 percent from 70,530 to 171,714 between 1965 and 1976. Population grew from 265,192 in 1965 to 413,289 in 1976, an increase of 56 percent.

Growth did not occur evenly during the period; the most rapid growth occurred after 1970. For each of the aggregate indicators, the growth rate was more rapid after 1970. Population grew at an average annual rate of 5.4 percent after 1970 compared to 2.7 percent between 1965 and 1970. Employment grew at an average rate of 10.9 percent per year between 1970 and 1976, compared to 5.6 percent prior to 1970. Personal income grew at almost twice its pre-1970 rate between 1970 and 1976.

Economic growth during the period examined in this section resulted from expansion of the basic sector. The industries which were most important in the basic sector growth were mining and construction. The expansion of these sectors was directly related to petroleum development in the state. Prior to 1970, development of oil fields on the Kenai Peninsula and in Upper Cook Inlet were primarily responsible for growth. The development of the Prudhoe Bay fields after the lease sale in 1969 resulted in mining employment growth both at Prudhoe Bay and in Anchorage. The construction of the trans-Alaska pipeline to transport the oil from Prudhoe Bay was responsible for a 158 percent increase in construction employment between 1973 and 1975. This major petroleum-related growth occurred after 1970, contributing to the more rapid growth in the latter part of the study period.

Two other factors contributed to state economic growth. First, the additional state revenues available after the Prudhoe lease sale in 1969 allowed the state to increase expenditures. The increase in state government employment and capital improvement expenditures were partially responsible for state growth in the early 1970s. Secondly, as the scale of the economy increased, the relation between the support sector and basic sector growth changed. Increased scale allowed more local production of goods and services, which meant that increased basic sector activity resulted in greater-than-proportional growth in the support sector.

Existing Economic Conditions

The existing economic conditions in Alaska reflect the end of work on the TAPS project. The project was completed in 1977, but the peak employment on the pipeline project occurred in 1976. The fall in construction employment between 1976 and 1977 illustrates the significance of this to the economy. Construction employment fell by 35.4 percent from 30,200 to 19,500 in 1977 (Alaska Department of Labor, 1978).

Although the economy experienced a fall in total employment, the drop was not so great as would have been expected given the response the economy experienced during the pipeline buildup. Nonconstruction employment actually rose between 1976 and 1977. Total nonagricultural wage and salary employment fell by only 7,000, or only 65 percent of the fall in construction employment; nonconstruction employment increased by 3,700. This increase was a result of the expansion of both the basic sector and the support sector. The major basic sector to increase was mining, which increased by 1,000 employees. This increase was a result of the continued development of the Prudhoe Bay fields and the preparation for further exploration activity. This included substantial expansion of headquarters employment in Anchorage. Trade and finance-insurance-real estate accounted for 1,500 of the increased employment. This was an unexpected response from the support sector, given decreasing basic sector employment. Local government added significantly to this growth, expanding employment by about 2,000.

Two delayed adjustments could be responsible for growth in the post-pipeline period. The first may have been a delayed response by the support sector to the larger economy. The full expansion of this sector may have been prevented during the pipeline period; the larger economy which existed even after the completion of the pipeline required a larger support sector. The expansion of this sector during the period may have been constrained by the tight labor market and high wages available in other sectors. Another factor which may have been responsible for the delayed response was the rapid growth of the economy; the 1977 response was the delayed investment response. The second delayed adjustment which prevented the proportional drop in the economy in the post-pipeline period was the spending of accumulated savings and capital gains. This dissaving lengthened impact of the pipeline beyond the period of direct employment impact.

The economy has adjusted to the end of the pipeline. Future growth can be expected to be at much lower rates than in the past. Future growth will depend on the expansion of the basic sector and whatever structural change may occur. One of the most important basic industries for the future will be mining. With the beginning of production at Prudhoe Bay, Alaska became the third largest oil producing state. Continued development at Prudhoe Bay and exploration in NPRA, as well as the OCS areas, will be responsible for the continued future growth of this industry. The 200 mile fisheries limit will increase the importance of the fishing industry. Alaska's current domestic catch accounts for only 7 percent of the fishery resource (Alaska Pacific Bank, 1979). The near-future growth may be limited because of the investment required to move into bottomfishery. In the near future, construction will be dependent on government projects. The next major project planned is the construction of the ALCAN natural gas pipeline in the early 1980s. If constructed, this project should have impacts similar to the TAPS project.

The Economies of the Gulf of Alaska Region, 1965-1976

OVERVIEW

The major impacts from OCS development in the Western Gulf of Alaska are projected to occur in the Gulf of Alaska region of the state. The Gulf of Alaska region contains two major subregions, Anchorage and Southcentral. The Anchorage region consists of the Anchorage Census Division. Southcentral includes six census divisions: Kenai, Seward, Matanuska-Susitna, Valdez-Chitina-Whittier, and Cordova-McCarthy. It also includes the Yakutat portion of the Skagway-Yakutat Division. (Figure 3 shows the Alaska Census Divisions.) The character of each of these subregions differs. Anchorage is the urban center of the state. The Southcentral region consists of a series of small, rural economies.

The Gulf of Alaska region is the most populous region of the state. It contains almost 60 percent of the state's population. Many of the events which have influenced the growth of the state occurred in the Gulf of Alaska region. The Cook Inlet oil and gas fields are located in that region, and the terminus of the trans-Alaska pipeline is also in the Gulf of Alaska region at Valdez. This region also contains one of the major fishing ports in the state at Kodiak. Anchorage, the state's major metropolitan center is in the region. The region and its subregional economies experienced rapid growth between 1965 and 1976. The Gulf of Alaska region grew faster than the state and increased its share of state employment from 53.6 percent to 56.5 percent. This section will examine the growth of the Gulf of Alaska's two subregions during the 1965-1976 period.

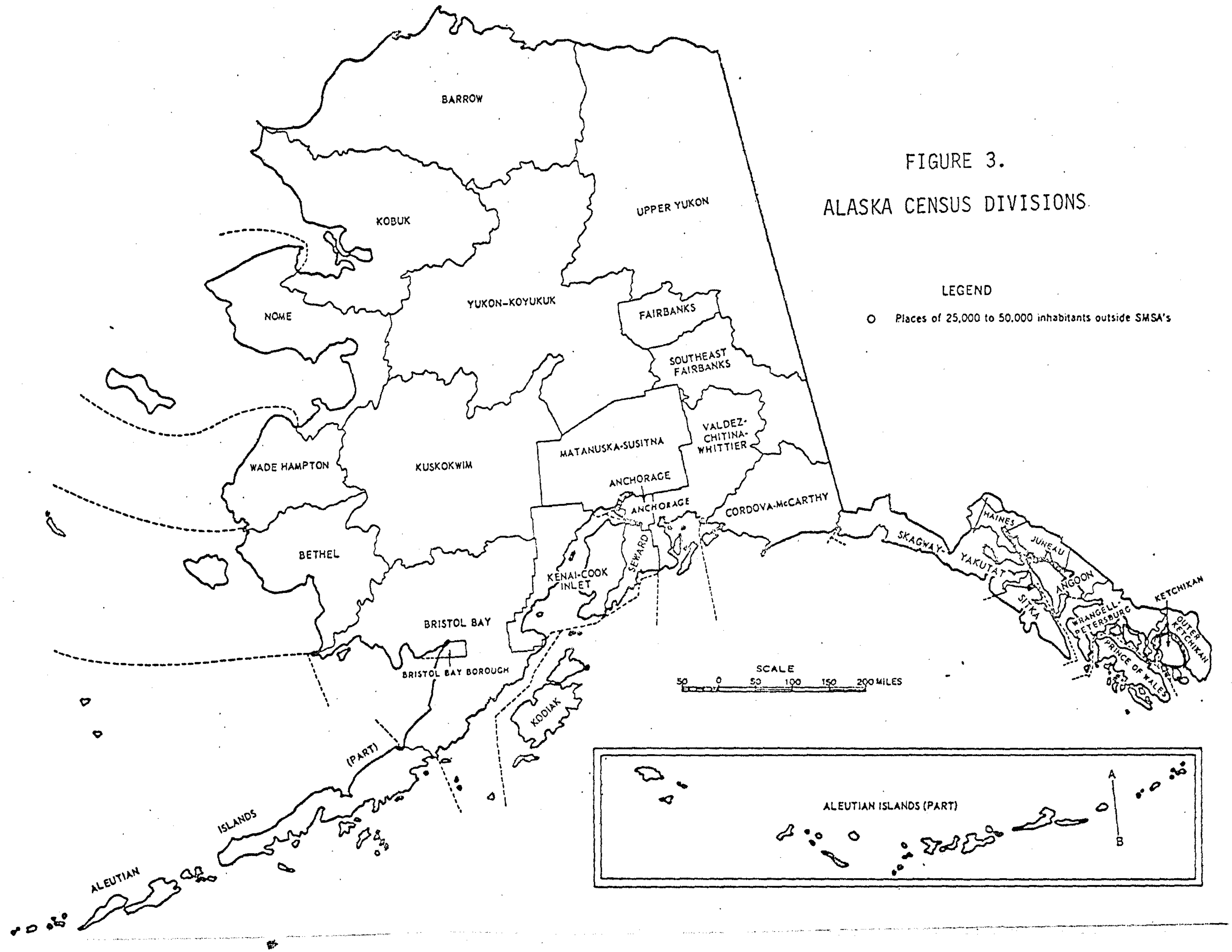

FIGURE 3.

ALASKA CENSUS DIVISIONS

ANCHORAGE

The position of Anchorage as the major metropolitan center of Alaska and the administration and distribution center for much of the state means that growth in Anchorage reflects the growth in the rest of the state. This factor explains why Anchorage, while having no actual pipeline construction, experienced rapid growth during the pipeline period. As an urban area, the past and future expected growth in Anchorage differs importantly in its causes and effects from the state as a whole. This section will describe the historical growth of Anchorage and will attempt to isolate the important causes of growth which are unique to Anchorage.

Growth of Aggregate Indicators

Table 15 shows the growth of three indicators of aggregate economic activity: employment, population, and personal income. Total employment increased by about 42,440 during the period; over 73 percent of this increase occurred after 1970. After 1970, the average growth rate of employment was 9.7 percent compared to the overall 8.2 percent rate. Between 1973 and 1975, the period of the most rapid TAPS growth, total employment increased by 38 percent.

Population followed the same path as employment, increasing more rapidly in the last six years of the period. Population grew at an average rate of 5.54 percent per year between 1965 and 1970; for the period after 1970, the rate was 6.58 percent. Unlike employment, population grew faster in Anchorage than in the state, which grew at 5.3 percent. This meant

TABLE 15. GROWTH OF EMPLOYMENT, POPULATION, AND PERSONAL INCOME, ANCHORAGE 1965-1976

	Population	Employment	Personal Income ($ Million)
1965	102,337	30,678	371.0
1970	126,333	41,995	634.9
1971	135,777	45,452	732.9
1972	144,215	48,252	800.2
1973	149,440	50,627	883.1
1974	153,112	58,713	1111.6
1975	177,817	69,645	1577.6
1976	185,179	73,113	1799.1
Average Annual Percent Change			
1965-1976	5.54	8.22	15.43
1970-1976	6.58	9.68	18.96

SOURCES: All estimates State of Alaska Department of Labor, Research and Analysis Section, Population Estimates by Census Division, except 1970 which is Census of Population.

Alaska Department of Labor, Statistical Quarterly, various years.

U.S. Department of Commerce, Bureau of Economic Analysis, July 1978.

that population was concentrating in Anchorage even though the pipeline construction had slowed the trend toward employment concentration.

Personal income experienced growth similar to state growth; personal income increased at close to 15 percent annually in Anchorage and the state. For the entire period, the annual rate of growth was slightly higher for Anchorage. After 1970 the higher incomes associated with the pipeline construction led to a slightly faster rate of growth in the state.

The Causes of Growth

The Anchorage economy expands for reasons similar to those causing expansion in the state economy. One cause of growth is the expansion of the basic industries of agriculture-forestry-fisheries, mining, manufacturing, construction, and federal government. For the local economy, state government growth can also be seen as a basic sector, since the factors determining its growth are political decisions external to the region. The growth of the basic industries is shown in Table 16 which describes the growth of all industrial sectors in Anchorage.

Over the period 1965-1976, the fastest growing basic sector was mining. Mining grew at an average annual rate of 12.91 percent over the period. Between 1965 and 1970, mining employment increased by an average rate of 20.9 percent per year. The growth of mining was the result of the development of regional headquarters and administrative staffs to support the

TABLE 16. CIVILIAN EMPLOYMENT GROWTH
ANCHORAGE, 1965-1976

Industry	Average Annual Percent Increase 1965-1976	Average Annual Percent Increase 1970-1976	Average Annual Percent Increase 1973-1975
Total	8.22	9.68	17.29
Agriculture, Forestry, and Fisheries	10.48	11.33	15.82
Mining	12.91	6.63	30.09
Contract Construction	8.39	13.69	29.94
Manufacturing	6.78	8.14	10.58
Transportation, Communication, and Public Utilities	9.92	11.26	26.01
Transportation	10.68	10.77	31.60
Air	11.93	10.29	19.28
Other	9.52	11.29	47.32
Communication	8.60	13.92	16.74
Public Utilities	7.75	8.77	5.22
Trade	10.58	10.82	18.32
Wholesale	11.94	11.39	28.33
Retail	10.13	10.61	15.12
Finance, Insurance, and Real Estate	11.42	13.61	13.56
Services	13.69	15.81	27.23
Hotels	10.96	11.41	28.77
Personal	3.81	2.12	4.97
Business	18.09	26.71	78.67
Medical	13.17	14.17	7.08
Other	13.53	13.51	19.99
Federal Government	.40	.53	3.41
State Government	8.38	8.97	5.61
Local Government	7.97	6.96	13.06

SOURCE: Department of Labor, Statistical Quarterly, various issues.

development of the Cook Inlet and Prudhoe Bay fields. The growth of mining employment in Anchorage, as in the state, was cyclical, falling after 1970 when peak development of Upper Cook Inlet was reached. After 1973 mining employment grew at an average rate of 22.3 percent per year. The growth during this period included headquarters growth necessary for the development of the Prudhoe Bay fields. Over the period, Anchorage averaged more than one-third of the statewide mining employment.

Construction was the second fastest growing major component of the basic sector.[1] Construction grew at an average annual rate of 8.39 percent between 1965 and 1976. Between 1973 and 1975 when the most rapid buildup resulting from the pipeline occurred, the growth rate averaged 29.94 percent. In Anchorage, the construction industry did not include major projects connected with resource development such as TAPS. Construction in Anchorage was largely an investment response to expected future growth and an expansion of the capacity of Anchorage housing and private sectors to meet the rapid growth in population.

The government component of the basic sector experienced minimal growth between 1965 and 1976. Federal government remained almost constant throughout the period, growing at an overall rate of less than one percent per year. State government employment grew at a rate slightly greater than growth in total employment, an annual average rate of

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[1]Agriculture-forestry-fisheries, while experiencing a very rapid rate of growth, had little impact on the Anchorage economy. In 1976, employment in this industry was only 100 people.

8.38 percent between 1965 and 1974. As on the state level, state government is partially responsive to local demands. However, since the determinants of its growth are outside the region and a large component of state government is administrative for programs outside of Anchorage, state government can be considered basic. The most rapid period of growth of state government in Anchorage was in the beginning of the 1970s. Between 1970 and 1972, state government employment grew at a rate of 20.2 percent per year. This reflects the rapid growth of total state government at the time.

The final basic sector is manufacturing which grew at an average annual rate of 6.78 percent between 1965 and 1976. When the period after 1970 is considered, the growth rate increases; but it is still less than the growth rate of total employment. Manufacturing experiences a steady increase throughout the period, not a cyclical increase as at the state level. This is because the manufacturing in Anchorage has only a small component of food manufacturing which reflects cycles of the fishing industry.

Anchorage: The Administration and Distribution Center for Alaska

Anchorage serves as the administration and distribution center for Alaska. Because of this, traditional service functions such as trade, services, transportation-communication-utilities, and finance-insurance-real estate have important basic components. These sectors are support sectors at the state levels since they respond primarily to growth in state incomes. The distinction arises because the location of support activities is not spread uniformly with basic activities; economies of scale are one primary reason activities would concentrate in one place. Because a portion of these sectors in Anchorage responds to demands from outside the region, they can be considered part of the Anchorage basic sector. This response of the Anchorage support sector provides a major link between the economies of Anchorage and the state.

There are many ways of distinguishing the basic and nonbasic components of an industry. The most accurate would be by survey. In a survey, a sample of firms in each industry would be asked the portion of their output sold inside and outside the region. Another method involves the use of location quotients. A location quotient for industry i is defined as the ratio of the percent of total employment in Anchorage in industry i to the percent of total employment in the state in industry i. The use of location quotients to measure the basic components of support industries requires the assumption that consumption in all parts of the state is similar and that this average consumption is reflected in the proportion of employment in these industries at the state level. This is an extreme assumption since consumption levels will most probably differ across regions because of income and environmental differences. Location quotients provide no more than an indication of the basic component of industries. Its major advantage is that it is inexpensive to use. Table 17 shows the Anchorage location quotients for the four support industries: transportation-communication-utilities, trade, finance-insurance-real estate, and services.

TABLE 17. LOCATION QUOTIENTS, ANCHORAGE
1965, 1970, 1975, 1976

	1965	1970	1975	1976
Transportation, Communication, and Public Utilities	.8284	.9485	1.0323	1.1039
Trade	1.2927	1.2354	1.3191	1.3548
Finance, Insurance, and Real Estate	1.3706	1.4074	1.3877	1.4058
Services	1.1531	1.2326	1.2407	1.3117

$$\text{Location Quotient} = \frac{\dfrac{\text{Total Anchorage Employment in Industry i}}{\text{Total Anchorage Employment}}}{\dfrac{\text{Total State Employment in Industry i}}{\text{Total State Employment}}}$$

SOURCE: Alaska Department of Labor, Statistical Quarterly, various issues.

Table 18 shows the Anchorage basic sector as estimated using location quotients to estimate the basic sector portion of the service, trade, finance, and transportation industries. The portion of support industry employment which is basic is equal to $\frac{LQ - 1}{LQ}$. The location quotient methodology does not provide an exact description of the basic component of these industries. This method may overestimate the basic component if the assumption of similar consumption is not true. The location quotient may underestimate the true amount of export component since it considers only the net difference in regional consumption and does not allow for interregional trade (Hoover, 1970). For example, the location quotient method estimates no basic component of transportation prior to 1975. This is surely an underestimate since the Port of Anchorage serves as the entrance source of supply for approximately 80 percent of the state's population (Municipality of Anchorage, 1978). This analysis is useful in pointing out the relationship of the Anchorage support sector to the state economy. Table 18 shows the trends in this component of the Anchorage basic sector. The component of the basic sector made up of transportation-communication-utilities, trade, finance-insurance-real estate, and services has been increasing. In 1965, this component accounted for 12 percent of the civilian basic sector; and by 1976, it accounted for 28 percent. Overall, the importance of the basic sector to the Anchorage economy decreased as it did at the state level. The civilian basic sector decreased from 57 percent of total employment in 1965 to 47 percent in 1976.

TABLE 18. ANCHORAGE BASIC SECTOR GROWTH
1965, 1970, 1973, 1975, and 1976

Industry	1965	1970	1973	1975	1976
Agriculture, Forestry, and Fisheries	33	52	82	110	100
Mining	371	958	769	1,301	1,409
Contract Construction	3,127	3,514	4,178	7,054	7,587
Manufacturing	791	1,018	1,286	1,573	1,629
Transportation, Communication, and Public Utilities	- 0 -	- 0 -	- 0 -	230	697
Trade	1,195	1,642	2,239	3,611	4,195
Finance, Insurance, and Real Estate	350	573	825	1,010	1,229
Services	500	1,208	1,323	2,612	3,510
Federal Government	9,395	9,509	9,558	10,222	9,813
State Government	1,672	2,421	3,667	4,056	4,053
Total Civilian Basic Employment	17,434	20,895	23,927	31,779	34,222
Total Military Employment	15,190	12,884	14,049	12,642	12,179
Total Basic Employment	32,624	33,779	37,976	44,421	46,409
Total Basic/ Total Employment	.7113	.6155	.5872	.5398	.5440
Civilian Basic/Total Civilian Employment	.5683	.4975	.4726	.4563	.4680

SOURCE: Alaska Department of Labor, Statistical Quarterly, various issues.

The Economic Structure

The growth of the Anchorage economy has resulted not only in a change in the levels of economic indicators but also in a change in the process by which growth is transmitted. This change is similar to that experienced in the state economy. The decreasing proportion of basic employment, as illustrated in Table 18, is one result of this change. Total basic employment fell from 71 percent to 54 percent of employment between 1965 and 1976. (This assumes the basic component of services, finance, transportation, and trade is found using the location quotient.) The increase in the support sector means the economy will have a greater response to growth in the basic sector. Table 19 details the change in the economy's structure as measured by employment distribution.

The changing structure of the Anchorage economy can easily be observed from this table. The traditional support sector industries of services, finance, trade, and transportation increased their share of total employment from 42.2 percent in 1965 to 58.9 percent in 1976. This is a result of the increased importance of the support sector in both the state and Anchorage economies. The share of government has decreased. This is primarily because of the limited growth of federal government. The share of federal government fell from 30.6 percent in 1965 to 13.4 percent in 1976. Total government's share fell from 43.7 percent in 1965 to 26.4 percent in 1976. The share of employment in construction increased between 1970 and 1976, reversing the trend between 1965 and 1970. This reversal may be a short-run phenomenon reflecting only the increased activity connected with TAPS construction.

TABLE 19. ANCHORAGE DISTRIBUTION OF EMPLOYMENT
1965, 1970, AND 1976

Industry	% of Total Non-Agricultural Wage & Salary Employment 1965	1970	1976
Agriculture, Forestry, and Fisheries	.11	.12	.14
Mining	1.21	2.28	1.93
Contract Construction	10.19	8.37	10.38
Manufacturing	2.58	2.42	2.23
Food	.59	.47	.46
Lumber	.06	.11	.19
Paper	.01	.01	.03
Other	1.92	1.83	1.56
Transportation, Communication, and Public Utilities	8.53	9.30	10.13
Transportation	5.52	6.67	7.07
Communication	2.20	1.82	2.28
Public Utilities	.81	.82	.78
Trade	17.21	20.52	21.83
Wholesale	4.00	5.29	5.80
Retail	13.21	15.23	16.03
Finance, Insurance, and Real Estate	4.22	4.71	5.82
Services	12.28	15.25	21.13
Hotels	1.50	1.80	1.97
Personal	1.31	1.27	.83
Business	2.57	2.83	6.72
Medical	2.22	2.85	3.63
Other	4.71	6.49	7.97
Federal Government	30.62	22.64	13.42
State Government	5.45	5.77	5.54
Local Government	7.59	8.61	7.40

SOURCE: Alaska Department of Labor, Statistical Quarterly, various issues.

Anchorage, like the state, has been experiencing and should continue to experience an increased importance of the support sector. This structural change is a result of the increased size of the economy which allows the production of more goods and services for local consumption. This process affects Anchorage in a twofold manner since it provides support sector goods and services for the state as well as the region.

Population

Table 20 shows the growth of population in the Anchorage region. Anchorage experienced major population growth since 1965. Of the 82,842 population increase since 1965, 71 percent occurred after 1970. Migration accounted for 70.6 percent of the increase between 1970 and 1976. The major migration increase occurred in 1975 at the height of pipeline activity when the state estimated migration of 22,222 to Anchorage. As in the state, migration was the most important component of population growth.

The dependency ratio in Anchorage fell during this period, although the fall was not so great as at the state level. The dependency ratio in Anchorage fell from 3.01 in 1970 to 2.53 in 1976, a drop of 16 percent, compared to a 36 percent drop at the state level. The reason for the fall was the same as at the state level, an increased proportion of the population in the labor force. Since Anchorage serves as home to many workers in other areas of the state, the ratio will be higher.

Anchorage does have comparative age distributions of the population in 1970 and 1975. These illustrate one reason why the population-to-

TABLE 20. ANCHORAGE POPULATION GROWTH
1965, 1970-1976

	Number of Births	Number of Deaths	Natural Increase	Estimated Net Migration	Population as of July 1	% Increase over Previous Year
1965					102,337	
1970	3,285	489	2,796		126,333[1]	4.30[2]
1971	3,192	473	2,719	6,725	135,777	7.48
1972	3,119	490	2,629	5,809	144,215	6.21
1973	4,247	424	3,823	1,402	149,440	3.62
1974	3,123	481	2,642	1,030	153,112	2.46
1975	2,990	507	2,483	22,222	177,817	16.14
1976	3,472	519	2,953	4,409	185,179	4.14

[1] U.S. Department of Commerce, Bureau of the Census, 1970 Census of Population, April 1970 estimate.

[2] Percent average annual increase.

SOURCES: Alaska Department of Labor, Estimates of Total Resident Population and Estimates of Civilian Population, various years.

Alaska Department of Health and Social Statistics, in communication with the Municipality of Anchorage.

employment ratio has fallen. Comparing these figures shows a relatively stable age distribution when the major growth which took place is considered. However, the proportion of nonworking-age population has fallen. The population under fifteen accounted for 33.9 percent of the population in 1970 and for 29.3 percent in 1975. This reflects a relative decrease in family size and a decreased demand for services such as schools. The percentage of the population available for the labor force, ages 15-64, increased from 64.6 percent in 1970 to 68.6 percent in 1975. This is one reason for the decreased dependency ratio. Table 21 compares the age distribution in the two periods.

Unemployment

Anchorage, like the state, has a serious unemployment problem, although the unemployment rate is less than the state. The unemployment rate has remained less than 10 percent through the period. The unemployment rate rose to a high of 9.7 percent in 1973 prior to the construction of the pipeline; the rate then fell to a low of 6.7 percent in 1975 and rose again in 1976 as pipeline construction came to an end. Except for 1975, the total number of unemployed increased throughout the period. Increases in employment opportunities encourage increases in the labor force in a corresponding manner. The increased labor force results from two forces: increases in the population from migration and increases in the proportion of the population in the labor force. Table 22 shows the increased labor force participation throughout the period. This increased labor force participation rate is partially an effect of the increase in the age group available for work.

TABLE 21. ANCHORAGE AGE DISTRIBUTION OF NONMILITARY BASE POPULATION

Age	% of 1970 Population	% of 1975 Population
0 - 4	10.40	9.50
5 - 14	23.50	19.80
15 - 30	28.10	34.10
30 - 40	15.50	15.30
40 - 50	12.40	11.90
50 - 64	8.60	7.30
65 +	1.50	2.10

SOURCE: Patricia L. Dolezal and Richard L. Ender, 1976 Population Profile, Municipality of Anchorage, September 1976. 1970 Census of the Population PC(1)-B3 Table 35.

TABLE 22. ANCHORAGE UNEMPLOYMENT AND SEASONALITY
1965, 1970-1976

Year	Total Unemployment	Unemployment Rate (%)	Labor Force Participation Rate (%)	Seasonality Index
1965	2,249	6.2	41.44	.9406
1970	3,267	6.7	43.21	.9526
1971	4,418	8.2	44.43	.9680
1972	5,140	8.9	44.68	.9738
1973	5,818	9.7	44.40	.9281
1974	5,980	8.6	49.66	.9914
1975	5,279	6.7	47.85	.9818
1976	7,372	8.4	50.56	.9920

SOURCE: Alaska Department of Labor, Alaska, Labor Force Estimates.

Seasonality has not been a major factor in the Anchorage economy. Anchorage is less dependent on traditionally seasonal industries and has a larger proportion of the less seasonal support sector employment. Only in 1973 is the seasonality index less than .95, which may reflect more cyclical than seasonal problems. Since the beginning of pipeline construction, the seasonality index has remained above .98 which reflects the technology and profit factors on Anchorage's most highly seasonal industry, construction.

Personal Income

Personal income increased at an average annual rate of approximately 15.4 percent between 1965 and 1976. The growth of personal income is only one determinant of the command over goods and services. In order to increase the command over goods and services, personal income must increase faster than both population and prices. Real per capita income reflects the effects of population and prices on incomes.

Table 23 shows the growth of real per capita income over time. The growth has been about 4 percent per year over the entire period. At the height of pipeline activity between 1973 and 1975, real per capita personal income increased at a rate of 9.12 percent per year.

Summary

Anchorage experienced rapid growth between 1965 and 1976. During this period, the proportion of state population in Anchorage increased. Employment grew more rapidly outside of Anchorage. The differential

TABLE 23. ANCHORAGE GROWTH OF REAL PER CAPITA INCOME
1965, 1970-1976

Year	Personal Income ($ Thousands)	Real Personal Income ($ Thousands)	Real Per Capita Personal Income (1967 $)
1965	371,037	393,882	3,849
1970	634,884	579,274	4,585
1971	732,881	649,142	4,781
1972	800,201	690,424	4,788
1973	883,144	731,079	4,892
1974	1,111,635	830,197	5,422
1975	1,577,614	1,035,859	5,825
1976	1,799,125	1,110,173	5,950
% Annual Average Increase			
1965 - 1976	15.43	9.88	4.04
1970 - 1976	18.96	11.45	4.44
1973 - 1975	33.65	19.03	9.12

SOURCES: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, July 1978 printouts.

Alaska Department of Labor, Estimates of Total Resident Population.

growth was a result of the rapid employment growth associated with TAPS construction outside of Anchorage. Expansion of the traditional basic sector was an important cause of the growth of the Anchorage economy. However, the support sector in Anchorage also has an important basic component. The support sector industries in Anchorage have a basic component responding to growth outside of Anchorage. This relationship, along with the increased scale of the economy, was responsible for the change in the structure of the economy which took place.

The population of Anchorage expanded rapidly during this period. The major component of growth was migration which was induced by increased economic opportunities. As at the state level, the increased economic activity had little effect on the Anchorage unemployment problem; only in the peak TAPS year did the unemployment rate fall below 8 percent. Real per capita did expand during this period as a result of the increased activity.

SOUTHCENTRAL

Anchorage, because of its link to the rest of the state through the support function, is indirectly affected by resource development; the remainder of the Gulf of Alaska region is directly affected by resource development. The Southcentral region contains both the historically important natural resource industries and the new natural resource industries. Fisheries of Southcentral are some of the most important in the state, accounting for close to half the catch of the state's fishing industry. The Upper Cook Inlet region was the state's first major oil producing region and contributed to the development of the petrochemical industry in Kenai.

The oil port built as the terminus of the trans-Alaska pipeline at Valdez contributed to the economic growth of the Southcentral region during construction and will contribute to its growth in the future. This section will examine the historical growth of the region.

Growth of the Aggregate Indicators

The aggregate indicators of economic growth illustrate the importance of TAPS construction to the economy of this region. (See Table 24.) Between 1973 and 1976, the population of the region increased by almost 20,000; employment, by more than 10,000; and personal income, by $330 million.

Population grew at an overall average rate of 6.34 percent per year between 1965 and 1976. Population in the region grew by almost 29,196 between 1965 and 1976. Over 67.5 percent of this growth occurred after the beginning of the pipeline construction in 1974.

Population growth followed a pattern established by employment growth. Employment grew at an annual average rate of 11.26 percent during the period; in the post-1970 period, the rate increased to 15.7 percent. The employment growth rates are greater than the population growth rates. This reflects the type of employment growth in the region at this time. Employment connected with mining and construction is more transient than employment in other sectors and does not bring dependents to the area. This pattern also results from shift schedules which allow workers, particularly in mining, to live in other regions. The short-term enclave

TABLE 24. GROWTH OF EMPLOYMENT, POPULATION, AND PERSONAL INCOME, SOUTHCENTRAL REGION 1965-1976

	Population	Employment	Personal Income ($ Million)
1965	30,235	7,124	90.1
1970	37,809	9,582	157.3
1971	39,227	10,127	165.1
1972	39,148	10,735	172.9
1973	39,716	12,131	210.2
1974	41,986	13,645	264.4
1975	51,923	18,300	414.0
1976	59,431	23,030	548.7
Annual Average Percent Change			
1965-1976	6.34	11.26	17.85
1970-1976	7.83	15.74	23.15

SOURCES: All estimates State of Alaska Department of Labor, Research and Analysis Section, Population Estimates by Census Division, except 1970 which is Census of Population.

Alaska Department of Labor, Statistical Quarterly, various years.

U.S. Department of Commerce, Bureau of Economic Analysis, July 1978.

nature of the employment, such as construction of the TAPS line, was another reason for the decreased dependency ratio in the region.

Personal income grew at an average annual rate of 17.9 percent between 1965 and 1976. Most of this growth came after 1973 with pipeline construction. Personal income increased at an annual rate of 37.7 percent after 1973. There are two reasons the economies of Southcentral did not feel the full impact of this growth in income. First, the transient and enclave nature of pipeline construction and mining employment means that less of the income is spent in the region. Secondly, because they are smaller economies, the leakages from the economy are greater and there is less induced response to growth in incomes.

Causes of Growth

The major cause of growth in the Southcentral region was the expansion of the traditional basic industries. Table 25 provides information on employment growth by industry and on the basic sector.

The three major industries affecting the growth of Southcentral Alaska are mining, construction, and fisheries. The fisheries industry includes both actual harvesting and food processing. The growth rate of mining averaged 8.27 percent over the entire period. Mining experienced cyclical growth, declining after 1970 and rising again after 1973. The recent growth of the industry is a result of exploratory activity and increased petrochemical activity (Kenai Borough, 1977).

TABLE 25. EMPLOYMENT BY INDUSTRY
SOUTHCENTRAL ALASKA

Industry	Annual Average Percent Increase 1965 - 1976	1970 - 1976	1973 - 1975
Agriculture, Forestry, and Fisheries	38.44	37.87	5.16
Mining	8.27	1.37	18.59
Contract Construction	20.71	85.19	131.70
Manufacturing	9.53	11.90	.55
Food	6.30	8.65	.20
Transportation, Communication, and Public Utilities	9.51	2.09	32.62
Transportation	9.15	34.50	49.33
Communications	22.71	19.69	2.86
Public Utilities	5.90	8.38	12.66
Trade	10.88	11.22	31.72
Wholesale	11.95	10.59	60.82
Retail	10.47	11.46	23.95
Finance, Insurance, and Real Estate	10.57	14.68	25.86
Services	12.12	16.72	21.56
Hotel	11.61	20.09	24.77
Personal	3.37	4.28	-1.01
Business	18.49	37.07	78.12
Medical	11.60	9.15	-6.89
Other	9.64	11.54	24.90
Government			
Federal	-3.80	-4.28	5.65
State and Local	8.49	7.50	6.33
Total	11.26	15.74	22.82

SOURCES: Estimated from Alaska Department of Labor, Research and Analysis Section worksheets.
Alaska State Housing Authority, Alaska, Yakutat, Comprehensive Development Plan, Anchorage 1971.
Alaska Consultants, Inc., Anchorage, Alaska, Yakutat, Comprehensive Development Plan, December 1976.

The major mining development occurred early in the period with the development of the Kenai-Upper Cook Inlet fields. Petroleum activity in the Kenai fields can be described in two periods: Field development occurred between 1961 and 1968; this phase included the development of both onshore and offshore fields. During this phase, mining employment increased by over 600 percent. Major construction of petrochemical facilities also took place during this period. Three petrochemical plants and seven pipelines were completed between 1961 and 1968. The second major phase was production. By 1970, all the major components of the petroleum industry had begun production (Math Sciences, 1976). The oil production phase is less employment intensive than the development phase. The beginning of production resulted in a fall in mining employment to approximately 600 in 1971. Employment in mining remained at approximately 600 until 1975 when employment increased rapidly to 900. This increase came as a result of OCS exploratory activity, the construction of TAPS, and expansion of refinery and petrochemical capacity in Kenai (Scott, 1979).

Construction employment increased at an annual average rate of 20.7 percent throughout the period. The major increase occurred between 1973 and 1975 when construction employment increased at an annual rate of 131.7 percent. This increase was a result of the construction of the trans-Alaska pipeline and the Valdez Port facility. Construction activity in Valdez accounted for almost 70 percent of total regional employment in 1975 and 78 percent in 1976. Although this is not all TAPS-connected employment, it shows the magnitude of the effect of this project on the region. Regional construction employment prior to 1970 was influenced importantly by petrochemical development in Kenai. Construction of five petrochemical facilities and seven pipelines increased Kenai's construction employment to a peak of 1,209 in 1968 (Math Sciences, 1976). By 1970, construction employment had decreased until its regional total was 583.

The final basic industry in the Southcentral region is the fisheries industry. This industry consists of fish harvesting employment and fish processing employment. Fish processing is a major component of manufacturing. The full impact of fisheries cannot be observed from employment data. Employment reported in nonagricultural wage and salary employment excludes self-employed which is a major component of fishery employment. (The rapid growth in agriculture-forestry-fisheries employment is primarily a result of a redefinition of the employment category in 1972.) Employment itself may not be a good indicator of the industry's health; in most industries, employment may be a good indicator of income, but fisheries' incomes depend upon the catch and its market value.

Independent estimates of fishery employment have been made based on catch and gear statistics. The totals for three regions--Prince William Sound, Cook Inlet, and Southwest--are shown in Table 26.

These regions include more than Southcentral; however, the figures provide an indication of the probable pattern of industry growth in the Southcentral region. Employment in 1976 was only 9 percent higher than in 1970. These figures show the cyclical behavior of fishery employment. Employment fell until 1972. After that, it peaked at 2,235 in 1973.

TABLE 26. ESTIMATED FISH HARVESTING EMPLOYMENT

	1970	1971	1972	1973	1974	1975	1976
Employment[1]	2,193	2,052	1,853	2,235	1,998	2,031	2,388
Catch[2] (million lbs.)	269.3	256.6	233.8	362.6	254.5	256.8	245.4
Value[2] (thousand $)	40,681	36,658	44,773	73,496	65,912	60,971	93,668
Real Value (thousand $)	37,117	32,469	38,631	60,841	49,225	40,033	57,080

[1] Rogers and Listowski, 1978.

[2] Alaska Department of Commerce and Economic Development, 1977. Value is deflated by the Anchorage CPI.

After falling slightly, employment then rose to its present level of 2,388. Information on the value and catch show a similar cyclical growth. Since 1970, catch in the Central region peaked at 362.6 million pounds in 1973 and fell to 256.8 million pounds in 1975. Except for the bonanza year in 1973, catch has varied relatively little from an average of 253 million pounds. The real value of this catch was only 7.8 percent higher in 1975 than in 1970; its peak was $60.8 million in 1973. The catch statistics provide an indication of the importance of the region to Alaska fisheries.

The manufacturing sector, because of the large fish processing component, was affected by the fish harvesting activity in the region. Manufacturing increased at an average annual rate of 9.5 percent per year. This was well over the average rate of increase in the state. Manufacturing has experienced cycles similar to fisheries, but they have not been as pronounced. The main reason for this is that manufacturing includes components of the petrochemical industry in Kenai. The petrochemical industry is not cyclical, so it stabilizes the Southcentral manufacturing industry.

The final basic sector is federal government employment. Federal government employment actually fell during the period from 975 in 1965 to 637 in 1976. The lowest point was in 1974 when employment was 595. Military employment in the region also followed the same pattern. Military employment in 1976 was 1,660 less than in 1965. The primary reason for this was the closure of the Kodiak Naval Station.

Table 27 summarizes the basic sector in the Southcentral region. The basic sector more than doubled between 1965 and 1976. (The year 1973 has been included in order to observe the non-TAPS trend.) While the total basic sector (including the military) remained constant between 1965 and 1973, the civilian basic sector grew by approximately 1,600 employees. The growth of the civilian basic sector replaced the lost military and federal government employment.

TABLE 27. BASIC SECTOR GROWTH, SOUTHCENTRAL ALASKA
1965, 1970, 1973, 1975, and 1976

Industry	1965	1970	1973	1975	1976
Agriculture, Forestry, and Fisheries	19	99	491	543	680
Mining	345	762	640	900	827
Contract Construction	880	583	681	3,656	6,978
Manufacturing	1,188	1,647	2,627	2,656	3,234
Federal Government	975	828	602	672	637
Total Civilian Basic Employment	3,407	3,919	5,041	8,427	12,356
Total Military Employment	2,651	2,110	1,039	747	991
Total Basic Employment	6,058	6,029	6,080	9,174	13,347
Total Basic/ Total Employment	.6197	.5157	.4617	.4817	.5556
Civilian Basic/Total Civilian Employment	.4782	.4090	.4155	.4605	.5365

SOURCES: Estimated from Alaska Department of Labor, Research and Analysis Section worksheets.

Alaska Department of Labor, Estimates of the Population.

Alaska State Housing Authority, Alaska, Yakutat, Comprehensive Development Plan, Anchorage, 1971.

Alaska Consultants, Inc., Yakutat, Comprehensive Development Plan, Anchorage, Alaska, 1971.

The Economic Structure

Table 27 shows the basic-to-total employment ratios; between 1965 and 1973, this ratio fell. During this period, the support sector increased its importance relative to the basic sector. With the construction of TAPS, the support sector did not expand as rapidly as the basic sector. The enclave nature of pipeline employment meant that the suport services were mostly provided by the enclave sector. This limited the necessary expansion of the support sector to accommodate pipeline employment and reversed the trend of decreased basic sector importance.

Table 28 illustrates the structure of the Southcentral economy as defined by its employment distribution. The non-TAPS trend can be seen by examining the change between 1965 and 1970. Between these periods, the support sectors either increased their share of employment or remained constant; the overall change was not so great as in the state or Anchorage. Only trade expanded its share significantly from 11.4 percent to 14 percent. One interesting trend is the reduction of importance of food manufacturing. The 1976 figures are skewed because of the pipeline construction; in 1976, construction accounts for over 30 percent of the total civilian employment.

Population

Population in the Southcentral region increased by over 28,000 between 1965 and 1976; over half of this increase came after 1973. The major growth in the Southcentral region was a direct result of the construction of the trans-Alaska pipeline beginning in 1974. Such rapid growth in the

TABLE 28. EMPLOYMENT DISTRIBUTION BY INDUSTRY
SOUTHCENTRAL ALASKA
1965, 1970, AND 1976

Industry	Percent of Total Employment 1965	1970	1976
Agriculture, Forestry, and Fisheries	.27	1.03	2.95
Mining	4.84	7.95	3.59
Contract Construction	12.35	6.08	30.30
Manufacturing	16.68	17.19	14.04
Food	15.24	13.49	9.24
Transportation, Communication, and Public Utilities	7.61	7.93	6.39
Transportation	5.24	5.44	4.24
Communication	.36	.89	1.07
Public Utilities	1.85	1.61	1.08
Trade	11.41	13.96	11.00
Wholesale	1.43	2.01	1.53
Retail	9.99	11.95	9.47
Finance, Insurance, and Real Estate	2.23	2.20	2.08
Services	10.36	10.72	11.28
Hotel	1.94	1.61	2.01
Personal	.35	.29	.16
Business	1.64	1.19	3.28
Medical	1.95	2.87	2.02
Other	4.48	4.76	3.81
Federal Government	13.69	8.64	2.77
State and Local Government	20.56	24.29	15.60

SOURCES: Estimated from Alaska Department of Labor, Research and Analysis Section worksheets.
Alaska State Housing Authority, Alaska, Yakutat Comprehensive Development Plan, Anchorage 1971.
Alaska Consultants Inc., Anchorage, Alaska, Yakutat Comprehensive Development Plan, December 1976.

relatively small region meant that migration was the most important component of growth. Between 1973 and 1974, migration accounted for 90 percent of the increase in population. Table 29 shows the employment growth in Southcentral.

The dependency ratio in Southcentral fell dramatically from 1965 to 1976. The ratio dropped from 4.24 in 1965 to 2.58 in 1976, a 40 percent decrease. The enclave nature of the TAPS construction affected this significantly; the ratio fell 22 percent after 1973. The nature of pipeline construction meant that workers in the region would not be accompanied by their families. The trend had been established prior to this. Increased labor force participation is primarily responsible for this change. An increase in the proportion of employment covered in these employment statistics was also responsible for the decrease in this ratio as fishing became less important.

Unemployment

The unemployment rates were high even during the period of rapid employment growth in connection with TAPS. Unemployment was highest in 1972 when the unemployment rate reached 15.0 percent. With the beginning of pipeline construction, the unemployment rate began to fall, reaching its lowest point in 1975 at 12.4 percent. Even though the percentage of unemployed fell throughout the period, the number of unemployed grew.

As in the state, the seemingly contradictory growth in employment and unemployment is a result of two factors. First, the increased employment

TABLE 29. POPULATION GROWTH, SOUTHCENTRAL ALASKA, 1965, 1970-1976

	Number of Births	Number of Deaths	Natural Increase	Estimated Net Migration	Population as of July 1	% Increase over Previous Year
1965					30,235	
1970	863	215	648		37,540[1]	4.4[2]
1971	505	139	366	926	38,832	3.4
1972	505	138	367	-406	38,739	-0.2
1973	718	173	545	- 31	39,253	1.3
1974	768	231	537	1,667	41,457	5.6
1975	634	244	390	9,828	51,675	24.6
1976	993	227	766	6,436	58,877	13.9

[1] April 1970 population estimate.

[2] Annual average increase from 1965 to 1970.

SOURCE: State of Alaska, Department of Health and Social Services, Health Information System Section.

opportunities led to increased migration. Secondly, the increased employment opportunities were responsible for increased labor force participation. As can be seen from Table 30, the labor force participation rate increased from 38.2 percent in 1970 to 54.8 percent in 1976. This increase resulted from an increased participation among existing population and a high rate of participation among migrants.

The seasonality index remained close to .80 throughout the period. Only during 1974 and 1975, did the index rise, indicating a fall in seasonality. The fall in the seasonality index in 1976 is a result of peak employment on the pipeline being reached in the summer of 1976.

Personal Income

Personal income is an important economic indicator since it influences demand and growth of the support sector. It is also a measure of the growth of residents' economic welfare. The effect of price increases (measured by the Anchorage CPI) and population increases on the real per capita income of residents is shown in Table 31. The real per capita incomes of the Southcentral region increased at an overall average yearly rate of 5.42 percent; this is less than one-third the rate of increase of personal income. The most rapid growth occurred between 1973 and 1975, the period of peak TAPS construction.

Summary

The construction of the trans-Alaska pipeline was the most important factor determining the economic growth of the Southcentral region. The

TABLE 30. UNEMPLOYMENT AND SEASONALITY
SOUTHCENTRAL ALASKA
1965, 1970-1976

Year	Total Unemployment	Unemployment Rate (%)	Labor Force Participation Rate (%)	Seasonality Index
1965	1,172	10.30	41.38	.8322
1970	1,835	13.44	38.24	.7959
1971	2,135	14.66	38.90	.8375
1972	2,257	15.03	39.17	.7815
1973	2,336	14.07	42.94	.8242
1974	2,744	14.80	45.09	.9481
1975	3,094	12.42	48.68	.9971
1976	4,502	13.83	54.78	.7722

SOURCES: Alaska Department of Labor, Labor Force Estimates, various years.

Alaska Department of Labor, Estimates of the Population.

Alaska State Housing Authority, Yakutat, Alaska Comprehensive Development Plan, Anchorage 1971.

Alaska Consultants Inc., Anchorage, Alaska, Yakutat Comprehensive Development Plan, December 1976.

TABLE 31. GROWTH OF REAL PER CAPITA INCOME
SOUTHCENTRAL ALASKA
1965, 1970-1976

Year	Personal Income ($ Thousands)	Real Personal Income ($ Thousands)	Real Per Capita Personal Income (1967 $)
1965	90,128	95,677	3,164
1970	157,316	146,234	3,796
1971	165,099	143,536	3,728
1972	172,916	149,194	3,811
1973	210,235	174,036	4,382
1974	264,428	197,482	4,704
1975	414,045	271,861	5,236
1976	548,661	335,983	5,653
Annual Average Percent Increase			
1965 - 1976	17.85	12.10	5.42
1970 - 1976	23.15	14.87	6.86
1973 - 1975	40.34	24.98	9.31

SOURCES: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, July 1978 printouts.

Alaska Department of Labor, Labor Force Estimates, various years.

Alaska Consultants, Inc., City of Yakutat, Comprehensive Development Plan, December 1976,

U.S. Department of Labor, Bureau of Labor Statistics.

Alaska State Housing Authority, Alaska, Yakutat, Comprehensive Development Plan, Anchorage, 1971.

majority of the growth in employment, population, and personal income occurred after 1973. Prior to the construction of the pipeline, Southcentral was experiencing a structural change similar to the state. The basic sector was playing a less important role in the Southcentral economy. The magnitude of pipeline employment and its enclave nature reversed this trend. The growth of employment was much greater than population, indicating an increased labor force participation of the population. Per capita incomes rose with growth. Growth in employment did not dramatically affect the Southcentral unemployment rate.

The Regional Economy in the Southcentral Alaska Region

Southcentral Alaska is made up of a number of local economies. These economies differ in their size and economic structure. The economies range from the largest, Valdez with a 1976 employment of 7,818, to the smallest, Yakutat with employment in 1976 equaling 241. The economies not only differ in size but also in the factors determining their growth. A question of some interest is whether the region can be treated as a single economy. This is important because in our projections Southcentral is treated as a single economy. In this section, we will examine the small economies which make up Southcentral and show why Southcentral can appropriately be treated as a single region.

In Alaska, the spatial order of the economy is that all local economies have a position in a regional structure. The link through transportation and support services in Anchorage makes a large portion of Alaska a region centered on Anchorage. Our aim in defining economic regions is to provide some spatial disaggregation of this major region. There are two approaches which have been taken to define regions. The first approach is based on the principle of functional integration. This notion would group economies which are interrelated and integrated. The second approach is based on the principle of homogeneity. This approach forms regions which are as much alike as possible and different from other regions (Nourse, 1968). This section will investigate the Southcentral subregions in terms of these principles.

The Local Economies

This section will describe the local economies in terms of their size and growth since 1970. Although each census division is not an individual economy, the analysis must concentrate on census divisions because of data limitations. Table 32 shows the employment, population, and personal income of each subregion in 1965, 1970, and 1976.

Table 32 shows that the growth in the region has been concentrated in three areas: the Kenai Census Division, the Matanuska-Susitna Census Division, and Valdez. Between 1965 and 1970, the major growth in the region was centered in Kenai with the petroleum development in Cook Inlet. Between 1965 and 1970, employment in Kenai grew at an annual average rate of 15.3 percent per year. Kenai increased its share of regional employment from 31.9 percent in 1965 to 36.6 percent in 1970.

After 1970, Valdez was the fastest growing region. Between 1970 and 1976, employment in Valdez increased by over eight times. The construction of

TABLE 32. GROWTH OF AGGREGATE INDICATORS
SMALL ECONOMIES
1965, 1970, AND 1976

	Population	Employment[1]	Personal Income (Million $)
Cordova-McCarthy			
1965	1,991	604	7.5
1970	1,857	702	9.8
1976	2,353	1,041	17.7
Valdez-Chitina-Whittier			
1965	2,396	452	6.1
1970	3,098	831	9.7
1976	13,000	7,818	163.0
Matanuska-Susitna			
1965	6,125	1,083	13.4
1970	6,509	1,145	24.3
1976	14,010	2,269	108.9
Seward			
1965	2,213	620	5.7
1970	2,336	692	8.4
1976	3,395	1,136	25.9
Kenai			
1965	8,446	1,753	26.7
1970	14,250	3,576	57.2
1976	16,753	6,465	156.0
Kodiak			
1965	9,064	2,310	30.6
1970	9,409	2,469	45.0
1976	9,366	4,153	72.9
Yakutat			
1965	--	--	--
1970	350	193	3.0
1976	550	241	4.2

[1] Civilian nonagricultural wage and salary employment.

SOURCES: Alaska Department of Labor. Population Estimates by Census Divisions, various years.

Alaska Department of Labor, Statistical Quarterly, various years.

U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System Printouts, July 1978.

TAPS was responsible for this growth. The fastest growing economy after Valdez was Matanuska-Susitna which increased employment at a 12.1 percent rate. Kenai grew at an average annual rate of 10.4 percent after 1970. During this period, Kodiak and Seward also experienced rapid average annual growth rates of close to 9.0 percent.

One noticeable trend was nonproportionate growth in population in Matanuska-Susitna and Kodiak. In Matanuska-Susitna, population was determining the growth of employment. Matanuska-Susitna experienced suburbanization from Anchorage which actually encouraged growth of employment to serve the suburban population. The population of Kodiak fell slightly between 1965 and 1976; this was a result of the closure of the Kodiak Naval Station during the period. Civilian employment growth actually replaced the decline in military employment. The three major economies in terms of personal income were Valdez, Kenai, and Matanuska-Susitna, all with more than $100 million in personal income in 1976.

Functional Integration

Economies can be functionally integrated even though they are physically separate if they interact in the production and distribution process. Any set of economies which are open, allowing the exchange of goods and the flow of productive factors, are functionally integrated. The extent of these flows between the individual economies in Southcentral Alaska is one measure of how integrated are the economies. The Southcentral Alaskan economy will not have perfect functional integration; the smallness of these economies and their separation in distance will assure this. In this section, we will attempt to determine the degree of integration of these economies.

Transportation links and trade flows are measures of the degree of exchange between economies. The Southcentral region, relative to the rest of the state, has highly developed transportation links. Most larger communities in the region are linked by roads and/or ferry and by a highly developed communications system. There are numerous deepwater ports and commercial marine freight service. The communities of the Kenai, Seward, Matanuska-Susitna Census Divisions, and Anchorage are linked by the Seward, Sterling, and Glenn Highways. Valdez is linked through the Richardson Highway. Ferry service connects Cordova, Valdez, Kodiak, Seward, Whittier, Homer, and Seldovia. Van container service is available in Cordova, Valdez, Kodiak, and Seward (ISER, 1978).

The trade flows between these areas were described in a census of transportation conducted by the Institute of Social and Economic Research (ISER, 1976). Table 33 shows the distribution of intrastate freight from Southcentral points of origin. This is not a pure measure of trade flows since it includes transshipments of goods, but it does provide an indication of the trade links between the economies of the region. Freight and mail measure the flow of goods between communities, which include both final goods and material inputs. It is not a perfect measure of integration since it does not indicate the flow of labor and capital between communities. Of all the census divisions, Skagway-Yakutat is the least tied to the Gulf of Alaska region of the Southcentral economies.

TABLE 33. DISTRIBUTION OF INTRASTATE FLOWS OF FREIGHT AND MAIL FROM SOUTHCENTRAL ORIGINS, 1973

(Percent of flows from Southcentral origins)

DESTINATION ORIGIN	Anchorage	Cordova	Kenai	Kodiak	Matanuska-Susitna	Seward	Skagway-Yakutat	Valdez-Chitina-Whittier	Total
Anchorage	5.84	.86	6.04	4.14	1.32	1.03	.07	2.63	21.93
Cordova	63.88	13.54	.38	7.17	.48	0	.65	1.17	87.27
Kenai	39.90	.62	15.50	2.64	.17	.15	.15	23.20	82.33
Kodiak	76.96	.02	11.87	6.73	0	.01	0	.26	95.85
Matanuska-Susitna	10.59	0	32.46	0	.50	25.91	0	5.71	75.17
Seward	12.36	.08	5.53	0	0	0	0	68.60	86.57
Skagway-Yakutat	.14	.02	28.80	0	0	0	.67	0	29.63
Valdez-Chitina-Whittier	41.14	7.77	15.05	5.46	.73	7.97	2.93	.60	81.65

SOURCE: ISER., Census of Alaska Transportation, September 1976.

Only 30 percent of the freight leaving Skagway is shipped to other areas of Southcentral Alaska. For a number of the divisions (Valdez, Kodiak, Kenai, and Cordova), Anchorage is the destination for major portions of their flows; while, as an illustration of the role of Anchorage in the statewide transportation system, less than 30 percent of Anchorage goods flows to other regions of Southcentral. The existing transportation links and the flows of freight show that the economies of Southcentral Alaska, when Anchorage is included, do exhibit a degree of functional integration. The integration described by the trade flows means that changes affecting one area will have corresponding effects in the other economies of the region.

Homogeneity

The economies of the Southcentral region vary in two ways which significantly affect their structure--size and basic sectors. Size will determine the economies of scale which can be reached in a region and the structure of the support sector. Larger economies can support larger, more diverse support sectors. The basic sectors also provide an influence on the support sectors and the economic structure. The economies of the Southcentral region can be separated into groups based on size and the basic sector. Kenai, Matanuska-Susitna, and Valdez are relatively large economies with nonfishing basic sectors. Mining and manufacturing are important for Kenai; construction and transportation, for Valdez; and the suburban phenomenon, for Matanuska-Susitna. The growth of these economies will not be affected by natural resource cycles. The remaining economies are significantly influenced by fisheries, and their attendant cyclical behavior. These classifications are not distinct. Kodiak and Yakutat may experience significant petroleum development in the future which will change their economic base.

Table 34 describes a measure of the structure of these local economies. The per capita employment in the support sector measures the relative size of the support sector (transportation-communication-utilities, trade, finance-insurance-real estate, services, and state and local government). This ratio provides an indication of how the economy would respond to exogenous changes in its population caused by expansion of the basic sector. The similarity among the structures of the local economies can be seen. Except for Valdez and Matanuska-Susitna, the ratio is close to .2. Valdez has a lower value because a large proportion of the population was enclave construction employment associated with TAPS which did not make full demand on the support sector. The low level of the ratio in Matansuka-Susitna results because of its suburban link to Anchorage. Comparison of the per capita support sector levels to the Anchorage level of .28 shows that the support sector, at least by this measure, is relatively undeveloped. The similarity of per capita support sector levels means that these economies may respond to future expansion of their populations in a similar manner.

Southcentral Alaska is treated as a single region in our projections. The major question addressed in this section was whether it is valid to treat Southcentral Alaska as a single economy for projection. This is different than asking whether Southcentral Alaska is a single economy.

TABLE 34. THE STRUCTURE OF LOCAL ECONOMIES

(The per capita level of support sector employment, 1976)

Census Division	Population	Support Sector Employment	Per Capita Support Employment
Kenai	16,753	3,521	.21
Seward	3,395	681	.20
Cordova-McCarthy	2,353	522	.22
Valdez-Chitina-Whittier	13,000	2,327	.18
Matanuska-Susitna	14,010	1,888	.13
Kodiak	9,366	1,870	.20
Yakutat	550	122	.22
Anchorage	185,179	52,540	.28

SOURCES: Alaska Department of Labor, worksheets, except for Yakutat which is from Alaska Consultants, Yakutat, Comprehensive Plan, 1976.

Although the area is not fully integrated, we have shown that trade links do exist between the local economies. Between 30 and 96 percent of the freight leaving Southcentral ports goes to other areas in the Gulf of Alaska region. The importance of Anchorage as a regional center should not be understated; Anchorage serves the region as the center for administrative, distributive, and financial services. This both ties the region together and limits the growth of the support sectors in the local economies. The local economies were shown to have similar structures. The relative importance of the support sectors in these economies was shown to be similar. Except for the Matanuska-Susitna Census Division, the ratio of support employment to population was around .20. This structural similarity means that the response of these local economies to exogenous change will be similar. Although we cannot assume that the response to exogenous change is completely independent of location, the above analysis of trade links and structural similarity shows that we can expect similar regional responses to exogenous change. By making the additional assumption that future changes will follow historical patterns, Southcentral Alaska can be used as a region for projection purposes.

Summary

The economy of Alaska expanded rapidly during the period 1965 to 1976. The major industries responsible for this growth were construction and mining. Development of the Cook Inlet fields was important to growth in the early part of the period, while the development of Prudhoe Bay influenced economic growth significantly during the latter part of the period. The expansion of state government between 1970 and 1972 was also responsible for a portion of the economy's growth. The construction of the trans-Alaska pipeline was the most important factor influencing growth during the period. The economy experienced its fastest growth during the period of peak pipeline employment.

The Alaska growth process consists of growth-initiating factors and the response of the economy to these factors. The major cause of growth was expansion of the basic sector industries--mining, construction, manufacturing, agriculture-forestry-fisheries, and federal government. The response to change in these sectors occurs with the expansion of activity in the support sectors. Over the historical period, the response of the support sector has been nonproportional to the growth in the basic sector. The support sector has expanded its share of the economy as a result of the increased scale of the economy which allows a more local production of the goods and services consumed. This type of structural change can be expected to continue in the future.

The growth associated with this period affected population, unemployment, and personal income. Population increased primarily because of in-migration in response to the increased economic opportunities. Population did not respond as rapidly as employment growth; this was a result of a change in the character of the population. The increase in the population occurred mostly in the working ages. Unemployment was only minimally affected during the period, and the unemployment rate fell only during the period of most rapid growth in 1975. The seasonality component of unemployment fell throughout the period primarily as a result of the increased importance of the less seasonal support industries. Growth increased real personal incomes; so that for most of the period, it increased faster than the U.S. average. Finally, prices exhibited a trend toward the U.S. level as the scale of the economy expanded. The rapid expansion with the TAPS caused this trend to be reversed.

III. THE ALASKAN ECONOMY IN THE BASE CASE

This chapter will describe the projected growth of the Alaskan economy without the development of the Western Gulf of Alaska Outer Continental Shelf (sale no. 46). In order to examine the effect of previous OCS activity on the impacts of Western Gulf development, three alternative base cases will be examined. Each of these cases will have similar assumptions concerning future non-OCS developments, but they will have different assumptions about the development of OCS activity in Lower Cook Inlet, the Beaufort Sea, and the Northern Gulf of Alaska.

The Purpose of the Base Case

Petroleum development in the Western Gulf of Alaska may affect both the structure and the size of the Alaska economy. Changes in the economy which result from the development of OCS resources can be defined as the impact of this development. The impact can only be described as changes from a certain pattern of economic growth which would have occurred without OCS development. The base case describes the projected growth of the economy without the development for which the impact is to be measured. Comparing two projections of the economy, the base case and the OCS case, will define the impact of OCS development.

The base case scenarios described below are consistent, plausible patterns of development; however, they should not be mistaken for best-guess patterns of development in any sense. The actual pattern likely to occur is subject to an enormous amount of uncertainty determined by technology, market prices, federal policies, and other uncertain events. To project any one economic future would be little more than idle speculation, since at this point many major events and decisions affecting Alaska are uncertain. The MAP model is designed to permit the formulation of ranges of scenarios which reflect these uncertainties in order to trace out the range of possible outcomes. This study does this in respect to various alternative OCS scenarios. The same approach could be used to determine the range of alternative non-OCS assumptions. To estimate the impacts of OCS development, a single base case is needed. This must be selected on the basis of the consistency and plausibility of the assumptions, consistency with historical growth, and consistency with assumed future patterns of economic relations. The effect of this base case choice will be measured by testing the sensitivity of the results to certain of the more important assumptions.

The purpose of establishing a base case must be kept in mind when examining the results. The base case is run in order to isolate the changes resulting from OCS development; this should influence the variables we examine. Rapid growth associated with OCS development will affect most economic variables. Although many variables will be affected, a much smaller number is important, and information on these dimensions of impact will describe the effect of rapid growth on state and regional economies. The base case will be analyzed to provide a point of reference for these dimensions.

Base Case Assumptions

The base case is defined by assumptions about the future levels of certain exogenous variables. The set of assumptions necessary for a base case scenario includes three important components. The first involves assumptions about the level of employment in those industries whose level is assumed to be influenced by factors outside the economy, the exogenous industries. Those industries include manufacturing, agriculture-forestry-fisheries, federal government, mining, and a portion of the construction industry and the transportation industry. The second set of assumptions involves the level of certain exogenously determined revenues which result from the production of the petroleum industry. These include royalties, production taxes, property taxes, and corporate income tax. The final assumption concerns the rule which defines an assumed spending pattern for the state.

The uncertainty surrounding the future petroleum and world energy markets, as well as economic decisions which influence state economic growth, means that any assumption about the appropriate base case scenarios is subject to criticism. An extensive development of a base case scenario which required considerable time and research would, because of the uncertainty, be subject to the same type of criticism. The uncertainty involves such major factors as the construction and timing of the ALCAN gas line and future state spending policy. Because of this, an extensive development of the base case scenario was not undertaken in this study; instead, a reasonable set of assumptions was developed which placed emphasis on consistency of assumptions and reasonableness of approach. This section describes the set of assumptions used in the base case.

NON-OCS ASSUMPTIONS

Industry Assumptions

There are two special groups of industry assumptions which are required. First, assumptions about employment connected with special projects, mainly resource development projects, are needed. Secondly, assumptions about the growth of the major exogenous industries--manufacturing, agriculture-forestry-fisheries, and federal government--are required.

Special projects include petroleum projects, major construction projects, and the operations of these projects. Petroleum activity is assumed to continue at Prudhoe Bay with further exploration and development of the Kuparak and Lisburne formations. Mining employment peaks in this area at 1,783 in 1980. The Upper Cook Inlet fields are the other major area of petroleum activity. Employment is assumed to increase from its present level between 1985 and 1990 as the oil fields are shut down. Gas production continues after 1990 but with a reduced work force. There is little other new mining activity in the state with other mining maintaining current levels throughout the projection period.

Major construction projects in the state during the projection period include the Trans-Alaska Pipeline Service (TAPS) and the ALCAN gasline. TAPS is completed in 1977, after which the line's capacity is assumed to be increased by the addition of four pump stations between 1979 and 1982. The ALCAN gasline is assumed to be built between 1981 and 1984 with peak employment of 4,800 in 1982. The only other special construction project in the state during the projection period is the construction of the Pacific LNG plant between 1980 and 1983; this project employment peaks in 1982 with 1,300 employees.

TAPS is assumed to require 850 workers per year for its long-term operations. ALCAN operations employment is assumed to be 96 beginning in 1985. TAPS' higher operations employment can be accounted for, since TAPS has more pipeline in Alaska, Valdez port employment is part of TAPS employment, and TAPS has substantial Alaska headquarters employment. Operations employment for the Pacific LNG plant is 60 beginning in 1984.

The level of employment in federal government and agriculture-forestry-fisheries and output in manufacturing is set exogenously. Federal government employment is assumed to follow its general historical trend and remain constant at the 1976 level throughout the forecast period. The trend in the historical period reflected increases in civilian employment offsetting decreasing military employment. Employment in agriculture-forestry-fisheries is assumed to be dominated by increases in fisheries. Given favorable conditions, employment in Alaska fisheries has been projected to increase by almost four times between 1975 and 2000. This will result with the establishment of an American trawl fishery which completely replaces foreign fishing off Alaska (ISER, 1979). The opposite extreme would be an assumption of no employment growth without bottomfish development. In this study, we assume an average rate of growth of 3 percent per year. This is consistent with moderate replacement of the foreign fishery by Alaskans (Scott, 1979).

Output in manufacturing is assumed to increase at an average annual rate of 4 percent, which is consistent with both the historical trend and the assumed growth in the fisheries industry.

National Variables

Alaska is part of the larger U.S. economy, and it is affected by changes in the national economy. Three assumptions about the future growth of the U.S. economy are needed. These assumptions are based upon the long-term projections of the consumer price index by Data Resources, Inc. Assumed U.S. rates were those from DRI's TRENDLONG0678 forecast (DRI, 1978). This assumption assumes the continuation of long-term trends in important exogenous variables. The average annual rate over the period of the forecast was used as our assumption. The consumer price index was assumed to grow at 5.5 percent per year. The U.S. real per capita disposable income, adjusted to reflect consistent tax assumptions, was assumed to grow at 2.2 percent per year. Finally, DRI does not provide a projection of U.S. weekly compensation. U.S. weekly compensation was assumed to increase at a rate of 6.8 percent per year.

Petroleum Revenues

The petroleum revenues received by the state consist of royalties, production taxes, property taxes, and the corporate income tax. The major source of these revenues in the projection period is the Prudhoe fields. The revenues are determined by the assumed rate of production of oil and gas and its wellhead value. Prudhoe oil production is assumed to peak in 1985 at 641.5 million barrels, while gas production is assumed to maintain its peak production of 912 billion cubic feet per year once this is reached in 1987. The wellhead value of Prudhoe oil is determined by the following assumptions: constant real West Coast market price of $12 per barrel, constant real vessel and processing costs of $1.75 per barrel, and a TAPS tariff of $5.25 in 1978. The nominal TAPS tariff is assumed to remain constant until 1990 when increasing operating costs are assumed to dominate decreasing capital costs; after 1990 the real tariff is assumed to remain constant. The wellhead value of gas was assumed to equal $1.00 per MCF in 1978; this assumes the producers pay a $.45 per MCF processing cost.[2] These wellhead values are only part of an array of many possible wellhead values. The range of wellhead values is a function of the uncertainty about the future levels of those factors influencing these values. Revenues are determined by existing state laws describing royalties, production taxes, property taxes, and corporate income taxes.

THE STATE EXPENDITURE RULE

Because of the central role of state and local government in the Alaska economy and because the behavior of these governmental units depends largely on policy choices to be made over the next several years within

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[2] These base case assumptions were selected prior to the passage of the 1978 Energy Bill which sets a ceiling of $1.68 per MCF on Prudhoe gas.

a framework far different from the past, the treatment of expenditures by state and local governments is a central feature of any development scenario.

Two factors determine the current framework in which state expenditure policy will be determined. First, revenues to the state will increase tremendously with the completion of the trans-Alaska oil pipeline. These revenues will follow closely the pattern of production from Prudhoe Bay. Secondly, the establishment of the Permanent Fund will place new constraints on the use of certain petroleum revenues. The Permanent Fund was adopted in 1976 as a constitutional amendment. It established that a minimum of 25 percent of all mineral lease rentals, royalties, royalty sale proceeds, federal mineral revenue sharing payments, and bonuses received by the state would be placed in the fund. This forced savings is only a portion of the revenues available to the state. Revenues accumulating in the General Fund will be greater than in the Permanent Fund for most of the period.

These changes in the structure of state spending limit the usefulness of past spending policies in determining the spending rules to be used. The rate of state expenditures, because it is a matter of policy choice to be made within a framework far different from past experience, cannot be modeled simply from past experience. However, past experience can provide a guide for developing the hypothetical spending rule used in the simulation. Scott, in his paper "Behavioral Aspects of the State of Alaska's Operating Budget FY 1970 - FY 1977," found two major factors responsible for the growth of state expenditures. First, real per capita state expenditures increased in response to real per capita income growth, a demand effect. Secondly, expenditures increased in relation to the available funds for state expenditures. The pattern between capital and operating expenditures differed. Capital expenditures increased strongly in response to available fund growth but the higher levels were not maintained. The higher levels of operating expenditures were maintained. Adjustments to available funds seemed to provide a new base for the growth of these expenditures.

Based on this analysis, the following pattern of state expenditures was assumed. Expenditures were assumed to increase in response to increases in personal income. The income elasticity of both capital and operating expenditures was less than one to reflect assumed increases in scale economies associated with the production of state services. The major difference was that the real level of state operating expenditures was assumed to be maintained when real per capita income falls, while the level of capital expenditures was assumed to fall in response to this change.

The response to fund availability was composed of two parts. Expenditures responded to changes in the general fund balance. The response was weighted depending on the existing surplus; the weight equalled the previous year fund balance divided by general fund expenditures. In other words, the response to a change in the general fund was weighted by the number of years of existing expenditures which could be taken out of the general fund. The response of capital expenditures was greater than the operating expenditure response.

Most relationships in the model are derived from historical relations. The elasticities in the operating and capital expenditure equations cannot be derived in this manner since the structure will be uniquely different in the future. Assumptions about these elasticities must be made. The elasticities in both sets of equations are chosen so that the elasticity of real per capita income equals .5. Real per capita expenditures increase at half the rate that real per capita incomes increase. This rate was chosen both to reflect economies of scale in production of government services and to reflect a decreased importance of state government in the Alaskan economy. Alaska has a much higher ratio of state expenditures to personal income than other states, and it was assumed that this ratio should fall toward the other states. The elasticities for that portion of state expenditure growth which was affected by the fund availability were determined by examining the changes in the period 1970 to 1971 which was the last period of rising general fund balance. Changes in this period served as a guide for making assumptions about the fund balance elasticity of state expenditures. Elasticities on the increase in the general fund of 2 percent for the operating budget and 10 percent for the capital budget were used.

Admittedly, these expenditure rules are highly speculative, but they seem to reflect the wide range of policy choices open to state government as a consequence of new oil revenues. It is impossible to predict the specific expenditure path. Because of this, we assume a hypothetical rule which is reasonable. The sensitivity of the impacts measured with this rule will be tested.

ALTERNATIVE OCS SCENARIOS

Three alternative scenarios describing OCS activity prior to the Western Gulf Lease sale will be described in this section. Three lease sale areas--the Lower Cook Inlet, Beaufort Sea, and the Northern Gulf of Alaska--are involved. The first Lower Cook lease sale took place in 1977. The Beaufort sale is scheduled for 1979. The Northern Gulf sale is scheduled for 1980. The three alternative scenarios describe low, moderate, and high levels of activity in each area. The employment levels in each of these scenarios are described in Tables 35, 36, and 37.

These scenarios differ in timing as well as magnitude. The Lower Cook scenarios range from an exploration-only case to a high case with peak employment of almost 2,500. The timing differs significantly between the moderate and high scenarios, with the moderate scenario reaching peak employment three years prior to the high scenario. The high Lower Cook scenario also contains the development of an LNG plant with 60 employees during its operation.

All three Beaufort scenarios contain production of oil and gas. There is less variation in the Beaufort scenarios than in Lower Cook. In all cases, peak employment occurs in 1989; it ranges from 740 in the low scenario to 1,344 in the high scenario. Since the Beaufort is a joint

TABLE 35. LOWER COOK INLET EMPLOYMENT SCENARIOS

	Low[1]	Moderate[2]		High[1]		
	Mining	Mining	Construction	Mining	Construction	Manufacturing
1978	84	70	0	84	0	0
1979	126	321	88	126	0	0
1980	252	664	162	252	0	0
1981	210	804	108	486	213	0
1982	126	572	38	776	213	0
1983	84	523	0	1,285	543	0
1984	42	622	0	1,590	858	0
1985	42	604	0	1,548	317	0
1986	0	545	0	1,347	0	60
1987	0	411	0	1,139	0	60
1988	0	417	0	1,139	0	60
1989	0	417	0	1,139	0	60
1990	0	417	0	1,139	0	60
1991	0	417	0	1,139	0	60
1992	0	417	0	1,139	0	60
1993	0	417	0	1,139	0	60
1994	0	417	0	1,139	0	60
1995	0	417	0	1,139	0	60
1996	0	417	0	1,139	0	60
1997	0	417	0	1,139	0	60
1998	0	417	0	1,139	0	60
1999	0	417	0	1,139	0	60
2000	0	417	0	1,139	0	60

[1]Based on scenarios in Lower Cook Inlet, Final Environmental Impact Statement, 1976.

[2]Based on Lower Cook Inlet scenario in Beaufort Sea Petroleum Development Scenarios. Economic and Demographic Impacts, Technical Report No. 18, Alaska OCS Socioeconomic Studies Program, 1978. Distribution between offshore/onshore and industry was based on the distribution in the Lower Cook EIS.

TABLE 36. BEAUFORT SEA OCS EMPLOYMENT SCENARIOS

	Low		Moderate		High	
	Mining	Construction	Mining	Construction	Mining	Construction
1981	67	49	67	49	67	49
1982	198	198	198	198	198	198
1983	198	247	198	247	198	247
1984	232	247	232	247	232	247
1985	67	99	67	99	67	99
1986	70	281	112	304	70	403
1987	123	331	276	333	148	642
1988	228	395	479	466	321	810
1989	345	395	616	466	583	761
1990	387	132	595	155	710	254
1991	434	132	524	155	758	254
1992	388	66	503	77	748	127
1993	355	132	432	155	681	254
1994	333	132	535	155	647	254
1995	334	59	438	77	616	127
1996	333	18	440	22	572	36
1997	332	0	417	0	551	0
1998	330	0	393	0	547	0
1999	327	0	393	0	548	0
2000	325	0	394	0	542	0

SOURCE: BLM-Alaska OCS Office.

TABLE 37. NORTHERN GULF OF ALASKA OCS EMPLOYMENT SCENARIOS

	Low[1]			Moderate[1]			High[1]		
	Mining	Construction	Manufacturing and Transportation	Mining	Construction	Manufacturing and Transportation	Mining	Construction	Manufacturing and Transportation
1981	149	0	82	106	0	68	166	0	82
1982	149	0	82	171	0	87	266	0	144
1983	114	0	62	271	0	146	340	0	185
1984	21	0	17	284	0	155	418	765	227
1985	0	0	0	315	254	173	391	2,101	430
1986	0	0	0	286	533	290	370	2,208	340
1987	0	0	0	305	915	248	399	2,222	363
1988	0	0	0	576	777	262	798	1,888	713
1989	0	0	0	779	627	367	1,539	998	621
1990	0	0	0	1,114	622	325	2,300	444	820
1991	0	0	0	1,198	88	286	2,461	449	830
1992	0	0	0	1,034	0	261	2,279	139	689
1993	0	0	0	939	0	285	2,248	0	671
1994	0	0	0	840	0	285	2,154	0	695
1995	0	0	0	865	0	285	2,014	0	695
1996	0	0	0	965	0	285	2,044	0	695
1997	0	0	0	990	0	285	2,144	0	695
1998	0	0	0	1,015	0	285	2,194	0	695
1999	0	0	0	1,015	0	285	2,194	0	695
2000	0	0	0	1,015	0	285	2,156	0	683

[1] Sear adjusted

state-federal lease sale, it also provides increased revenues to the state. These include bonus, royalty, severance tax, property tax, and corporate income tax revenues. They are described in Appendix B.

Only the moderate and high scenarios for the Northern Gulf contain production. The low scenario, as in the Lower Cook, is an exploration-only case. Peak employment occurs in 1990 in the moderate case and 1991 in the high case. Peak Alaskan resident employment equals 3,740 in the high case and 2,061 in the moderate case.

Developing these alternative base case scenarios allows us to assess the effects of the level of previous OCS activity on the impacts of the sale under consideration. The uncertainty of the level of OCS activity makes this necessary. By comparing the impact of a Western Gulf scenario with different base case scenarios, we can assess the sensitivity of development to previous OCS activity.

The Causes of Economic Growth

The growth of the Alaskan economy is determined by three separate but interrelated factors: changes in the level of employment in the exogenous sectors of the economy, changes in the level of personal income, and changes in state expenditures. If we measure economic growth as the expansion of employment, the effect of these factors can be seen.

Growth of the exogenous sector directly affects economic growth by the employment it creates. The growth of this sector is determined by external demand for Alaskan products. The most obvious example of this type of growth is the employment associated with the construction of the trans-Alaska pipeline. The employment generated by this project was determined by demand for Alaska's petroleum resources.

The growth of state expenditures is another source of economic growth. State expenditures are a source of growth since they translate revenues raised outside of the Alaskan economy such as petroleum-related revenues into demand for Alaskan products. State expenditures influence employment growth in two ways. First, state capital expenditures on projects such as ports and highways increase the output of the construction industry. This increases the demand for construction employment. Secondly, state operating expenditures are partially spent on personnel expenditures. This determines the level of state government employment.

State spending will be determined by two influences which are proxies for demand and supply effects. Growth of income will generate demand for increased government services. The second influence on expenditures is a supply influence. With the flow of revenues from Prudhoe Bay oil and gas, Alaska will begin to accumulate a surplus in its General Fund. This surplus, unlike the surplus in the Permanent Fund, can be used for state government expenditures. This fund balance is assumed to have a supply effect on expenditures, causing them to be increased as funds accumulate in the balance. This is an assumption which is required about future state spending patterns. The effect of state expenditures on employment is determined by the wage rate of state employees. Once state personnel expenditures are determined, the wage rate determines the number of state employees.

Employment in each of these sectors influences the growth of the economy through the increased demand for goods and services produced in Alaska. For endogenous sectors, employment is determined by the demand for labor needed to produce a desired level of output. The demand for output is a function of real disposable income. Demand is income elastic, so that increases in personal income lead to increased demand. This effect is simultaneous; increased incomes lead to increased demand which increases employment. This increased employment generates its own demand, and the process continues. The process stops when leakages outside the economy dominate the flow of income.

Income increases with increases in the average income per worker and with increases in the number of workers in the economy. The average income is substantially determined by wages and salaries, so it reflects changes in the wage rate. The real wage rate is determined by changes in prices, bottlenecks in the economy associated with rapid growth, and changes in outside wages. The U.S. labor market affects the Alaskan real wage rate because of the small size of the Alaskan labor market and the mobility of Alaskan workers. Because of these factors, migration becomes the equilibrating factor maintaining the relation between Alaska and U.S. wages. Changes in the sectoral composition of employment will also affect the average wage. As high wage sectors such as construction and mining increase in importance, wages and salaries will increase more than proportionally to employment growth.

The response of the economy to increases in income will be determined by the structure of the economy. Larger economies provide more of their own goods and services, there are fewer leakages, and the multiplier is larger. This results because economies of scale allow lowered production costs and the substitution of local production for imports. Growth, by affecting the structure of the economy, will also influence the response of the economy to increases in income.

The effect of an increase in personal income on growth will also depend on the increase in prices resulting from growth. Real income determines the demand for goods and services. The price level of the Alaskan economy is determined by U.S. prices since Alaska imports most of its goods. The size of the economy also affects the price level; larger economies provide economies of scale which reduce the cost of production and reduce prices. The rate of growth also affects prices. Rapidly growing regions are more subject to bottlenecks and supply constraints which lead to price increases.

Employment and income growth influence the growth of population in the state. Population grows as a result of natural increase and migration. Natural increase (the excess of births over deaths) is a function of the age distribution of the population. Migration is determined by the relative economic opportunities available in Alaska. Changes in employment opportunities and the relative per capita income between Alaska and the rest of the United States will determine migration. Migration has a considerable effect on the age-sex distribution of the population. Migration which is determined by economic opportunities primarily affects the age group under forty. Migration after forty years of age is a response to other factors such as retirement and the high cost of living (Seiver, 1975).

State economic growth does not occur uniformly throughout the state but varies by region. Regional growth depends on the factors causing growth. Factors which have a similar influence on state growth may affect the growth in each region differently. For example, equal growth in state government employment and exogenous employment, although they may affect state growth the same, will differ in their regional impacts, depending on the concentration of exogenous employment and the dispersion of state government expenditures.

The causes of regional growth are the same as those at the state level--increases in exogenous employment, increases in personal income, and increases in state expenditures. Growth of any of these factors within the region will lead to growth in the region. The economies of Alaskan regions are not independent, but are interdependent. Because of this, growth in one region will affect growth in other regions. Four processes reflect this interaction; the strength of the interdependence of the Alaskan regional economies depends on the strength of these processes. First, government spending works to distribute growth between the regions. Increases in state revenues which result from growth in one region will be translated into growth in other regions through the distribution of state expenditures. State expenditures are distributed to a region in relation to its population. However, government centers such as Anchorage and Juneau receive a greater-than-proportionate share of state expenditures because of the administrative and headquarters functions they serve. Second, changes in state wage rates will affect growth in the regions. Increases in wage rates increase personal incomes in each region and the demand for goods and services in each region. Third, regions which serve as regional centers will reflect growth in other regions, since they provide goods and services to other regions. The growth of Anchorage which serves as the financial, distributional, and adminstrative center of the state is the most obvious example of this, although smaller centers such as Fairbanks also experience this type of relation. Finally, migration between regions illustrates interaction of the regional economies. Residents of one region respond to employment opportunities in another region by migrating to it, so that employment growth in one region determines the population of other regions.

The Alaskan Economy
Moderate Base Case Growth

The base case describes the general pattern of the Alaska economic growth without development in the Western Gulf of Alaska OCS. The impact of Western Gulf development will be measured as changes from this base case pattern of growth. In analyzing the projected base case growth, we will examine the change in the magnitudes of the important economic variables, as well as changes in the economic structure or process of growth.

The historical economic growth serves as a reference for describing future projected growth. Between 1965 and 1976, the Alaska economy experienced rapid growth. Employment grew at an annual average rate of 8.4 percent throughout the period. Expansion of the mining and construction was largely responsible for this growth. Economic growth also produced some structural changes. The most significant of these were the increased importance of the support sector and the aging of the population. Population grew at an annual rate of 4.1 percent over the period; migration was responsible for the large proportion of this growth. Growth had little effect on unemployment but did improve real per capita incomes of Alaskans relative to the U.S. average. Historical growth had opposite effects on prices. As the scale of the economy grew, the price level relative to the United States fell; however, the rapid growth connected with the impact of TAPS reversed this trend.

The overall growth of the state economy in the future will be affected by growth in its basic sector. Rapid increases or declines in this sector provide interesting periods for our analysis. The early 1980s are important for basic sector growth. Two special construction projects, the ALCAN gas line and the Pacific LNG plant, have peak construction years between 1981 and 1983. Mining activity is also important. Prudhoe employment is assumed to fall from about 1800 in 1980 to about 900 in 1983 and then begin to rise; Lower Cook OCS activity peaks in 1981; and Beaufort and Northern Gulf OCS development begin in 1981. Another event of importance is the shutdown of the Upper Cook Inlet oil production in 1990. This reduces mining employment by 450, an 11 percent fall. Peak Prudhoe oil production occurs in 1985; the effect of this on revenues to the state government makes this an important point in time to consider.

THE STATE

The General Pattern of Development

Economic growth is a multidimensional process which no one indicator can describe. While population, employment, and personal income do not describe the full range of growth, they can be used to describe the general pattern of growth. Employment measures the ability of the economy to create jobs; personal income measures the effect of the economy on residents' command over goods and services; and population growth describes the response of people to these changing economic opportunities. Table 38 shows the projected levels of population, employment, and personal income. Overall, there is substantial growth although not so rapid as in the 1965-to-1976 period.

TABLE 38. AGGREGATE INDICATORS OF ECONOMIC GROWTH
MODERATE BASE CASE, ALASKA
1977-2000

	Population	Employment	Personal Income (Millions of Nominal $)
1977	410,660	185,508	4,072
1978	406,667	178,526	4,236
1979	418,656	185,225	4,743
1980	434,173	194,054	5,395
1981	456,078	206,859	6,420
1982	487,441	225,394	7,958
1983	504,694	231,506	8,645
1984	503,802	224,632	8,360
1985	513,372	227,742	9,008
1986	530,903	236,983	10,155
1987	551,736	248,235	11,535
1988	573,044	259,246	12,979
1989	593,590	269,355	14,453
1990	612,523	278,055	15,919
1991	626,140	282,828	17,082
1992	639,242	287,596	18,420
1993	655,575	295,033	20,171
1994	672,781	303,083	22,121
1995	692,017	312,619	24,367
1996	713,324	323,534	27,051
1997	734,418	334,057	29,785
1998	756,187	344,923	32,888
1999	780,692	357,663	36,514
2000	805,725	370,496	40,496

SOURCE: MAP Model.

Population is projected to be approximately 805,700 by 2000. Between 1978 and 2000, the population grows at an annual rate of almost 3.2 percent. This rate is approximately 25 percent less than the average annual growth rate experienced between 1965 and 1976 but faster than the average rate of 2.8 percent experienced prior to the construction of TAPS. Population falls after the completion of both TAPS in 1977 and ALCAN in 1983. In each case, population declines by less than 1 percent; and the peak population is exceeded the following year. The most rapid period of population growth occurs between 1978, the year TAPS is completed, and 1982, the peak year of ALCAN construction. During this period, population increases at a rate of 4.6 percent per year.

Employment is projected to grow at an average annual rate of 3.4 percent, reaching approximately 370,500 by 2000. Like population, employment experiences its greatest growth between 1978 and 1982 when it grows at a rate of 6.0 percent per year. These projected growth rates are not so great as the 8.4 percent rate of growth experienced between 1965 and 1976. Employment is projected to decline after completion of both the TAPS and ALCAN projects. The decline is more substantial than the decline in population, which is approximately 4 percent in each case. The 1983 employment level is not reached until 1986. Employment is projected to grow faster than population throughout the forecast period; this supports the trend observed in the historical period. The dependency ratio falls from 2.28 in 1978 to 2.2 by 2000.

The growth in personal income is related to the growth in employment, since wages and salaries are a major component of personal income. Changes in the composition of employment, changes in the productivity of labor, and changes in the level of prices will result in differential rates of growth between personal income and employment. Personal income is in nominal dollars, so it reflects both the real growth of the economy and increases in prices. Personal income grows at an annual average rate of 10.8 percent. Personal income grows faster in the period prior to the 1983 ALCAN peak construction. Between 1978 and 1982, personal income grows at a rate of 17.1 percent per year; which is twice the average yearly rate after 1983. This illustrates the importance of the high-wage pipeline construction employment to growth in personal income. Between 1978 and 2000, personal income grows at an annual average rate of 10.8 percent, which is less than the 15.4 percent rate experienced between 1965 and 1976.

Although population, employment, and personal income do not experience growth at so rapid a rate as they experienced between 1965 and 2000, economic growth is projected to be substantial. Employment is projected to increase by 107 percent, population by 98 percent, and personal income by 856 percent between 1978 and 2000. The difference between the projection and the historical period is caused by the major role pipeline construction played in the historical period.

Employment and the Structure of the Economy

The increased demand for industrial output will result in growth of Alaska employment. Total Alaska employment is projected to more than double by the end of the projection period. We saw in the historical period that growth does not occur in all industrial sectors evenly. Between 1965 and 1976, we observed structural change which increased the importance of the support sector in the economy. The projected economic growth continues the structural change observed in the historical period.

Table 39 illustrates the changing structure of the Alaska economy. This table shows the growth of three sectors of the Alaska economy--the support sector which includes transportation-communication-utilities, trade, finance, and service employment; the government sector which includes state, local, federal civilian, and federal military employment; and the basic sector which includes mining, manufacturing, agriculture-forestry-fisheries, and construction.

The sector which is projected to grow most rapidly is the support sector. This sector grows at an annual average rate of approximately 5.1 percent between 1978 and 2000; this is faster than the growth of total employment. The support sector expands more rapidly in all parts of the period. This sector expands its share from approximately 37 percent of total employment in 1978 to 53 percent by 2000. Expansion of this sector is consistent with past trends in the Alaska economy. This projected expansion of this sector does not exceed the limits suggested by national comparisons. The projected share is close to the average share of this

TABLE 39. THE STRUCTURE OF EMPLOYMENT
MODERATE BASE CASE, ALASKA
1978, 1980, 1985, 1990, 1995, 2000

	Support Sector		Government		Basic Sector	
	Employment	% of Total	Employment	% of Total	Employment	% of Total
1978	66,504	37.3	68,862	38.6	43,159	24.2
1980	76,658	39.5	69,783	36.0	47,612	24.5
1985	97,786	42.9	74,546	32.7	55,410	24.3
1990	130,174	46.8	80,037	28.7	67,844	24.4
1995	155,621	49.8	82,001	26.2	74,997	24.0
2000	197,090	53.2	84,669	22.9	88,737	24.0

Support Sector includes transportation-communication-public utilities, trade, finance, and service employment.

Government includes state, local, and federal employment.

Basic Sector includes mining, manufacturing, agriculture-forestry-fisheries, and construction employment.

SOURCE: MAP Model

sector in the U.S. economy and several small states described in Table 7. The support sector expands because of increased demand for goods and services. Demand increases as incomes increase. The nonproportional response of this sector occurs as the scale of the economy expands and allows more local production of these goods and services.

The nongovernment basic sector maintains a relatively constant share of total employment throughout the projection period. Its share is close to 24 percent in all but the years connected with large special projects. The share of total employment is between 25 and 26 percent in the period with ALCAN construction. Employment in the nongovernment basic sector expands at an average annual rate of 3.3 percent between 1978 and 2000. Employment in this sector reaches a peak of over 58,000 in 1982 and 1983 when both the ALCAN and Pacific LNG projects are at their peak. After completion of these projects in 1983, basic sector employment falls by almost 7 percent. The peak level is not reached again until 1987. Growth in this sector after the ALCAN project ends in 1984 averages an annual rate of 3.1 percent. Growth is mostly a result of the expansion of manufacturing and construction since there is only limited expansion of special project construction and mining.

The growth of the government sector is a result of the expansion of state and local government since federal employment is assumed to follow its historic trend and remain constant. State and local government employment increases by almost 16,000 between 1978 and 2000. The growth of state and local government is not strong enough to maintain the share of the government sector. The share of government employment falls from almost 39 percent in 1978 to 23 percent in 2000.

Population

Population grows through natural increase and net in-migration. Natural increase occurs when there is an excess of births over deaths. Migration results in population increases when in-migrants outnumber out-migrants, and population decreases when the opposite is true. Each of these factors affects not only the size of the population but the age and sex distribution as well. The projected population increase of 399,000 between 1978 and 2000 is significantly affected by migration. Population growth in the base case also continues the aging of the population. Table 40 shows the components of population change.

As in most small regions experiencing rapid growth, migration is the most important component of population change. Table 40 shows net migration from the previous year. Between 1978 and 2000, almost half of the population growth is net in-migration. Net in-migration occurs in all but three years of the projection period; net out-migration occurs in 1977, 1978, and 1984, years following the completion of major TAPS and ALCAN construction. The economic opportunities associated with ALCAN and Pacific LNG construction are also responsible for major in-migration in 1981 when migration is responsible for 68 percent of the population growth, and 1982 when migration accounts for 76 percent of the population growth. Migration also plays an important part in population growth between 1986 and 1990 when the Northern Gulf is developed. Migration is

TABLE 40. THE COMPONENTS OF POPULATION CHANGE
MODERATE BASE CASE, ALASKA
1977-2000

	Net Migration	Natural Increase
1977	-24,935	6,383
1978	-11,241	7,202
1979	5,268	6,697
1980	8,650	6,870
1981	14,768	7,144
1982	23,727	7,654
1983	8,784	8,501
1984	-9,582	8,697
1985	1,383	8,163
1986	9,400	8,127
1987	12,437	8,403
1988	12,531	8,788
1989	11,392	9,165
1990	9,453	9,491
1991	3,888	9,735
1992	3,344	9,754
1993	6,561	9,767
1994	7,288	9,918
1995	9,140	10,097
1996	10,959	10,351
1997	10,423	10,676
1998	10,801	10,972
1999	13,230	11,280
2000	13,357	11,682

SOURCE: MAP Model

responsible for over fifty percent of population growth in each of these years.

Population growth results in changes to the age-sex distribution of the population. Table 41 compares the age-sex distribution of the population in 1980 and 2000. The aging of the population is projected to continue, with the cohorts over 30 gaining as a proportion of the population. The proportion of the population over 30 increases from 37.6 percent in 1980 to 43 percent in 2000. One reason for the fall in the dependency ratio can be easily seen; between 1980 and 2000, the proportion of children (0-14) falls from 29.6 percent to 28.1 percent.

Personal Income

Personal income is projected to increase at an average rate of 10.8 percent per year. Increase in personal income is one of the benefits of growth; it measures the command of residents over goods and services. The full effect of increases in personal income is diminished by increases in prices; as prices of goods and services increase, a dollar can buy less. Economies which increase real personal income may not be increasing benefits if it does not increase as fast as population. Increases in real per capita income measure real increases in the command of the average resident over goods and services. Table 42 shows the projected change in the price level (RPI) and real per capita income.

The Alaska relative price index measures the increase in Alaska prices relative to a 1957 U.S. average. RPI increases at an average annual rate

TABLE 41. AGE-SEX STRUCTURE OF THE POPULATION
MODERATE BASE CASE, ALASKA
1980, 2000

Age Cohorts	1980 Males	1980 Females	2000 Males	2000 Females
0 - 14	15.08	14.56	14.27	13.81
15 - 29	18.47	14.33	15.84	13.09
30 - 49	13.35	12.12	14.83	13.37
50 - 59	3.31	2.92	3.83	3.70
60 +	3.06	2.81	3.37	3.90

SOURCE: MAP Model

TABLE 42. REAL PER CAPITA INCOME
MODERATE BASE CASE, ALASKA
1977-2000

	Real Per Capita Income[1]	Alaska Relative Price Index ($ 1957 US = 100)
1977	3,924	252.71
1978	3,724	279.75
1979	3,862	293.36
1980	4,029	308.40
1981	4,323	325.62
1982	4,721	345.81
1983	4,737	361.63
1984	4,448	373.05
1985	4,511	389.00
1986	4,687	408.12
1987	4,873	429.09
1988	5,026	450.64
1989	5,151	472.73
1990	5,250	495.08
1991	5,282	516.52
1992	5,347	538.94
1993	5,461	563.47
1994	5,579	589.39
1995	5,706	617.10
1996	5,864	646.66
1997	5,988	677.29
1998	6,132	709.32
1999	6,290	743.61
2000	6,448	779.46

[1] Deflated by Alaska Relative Price Index

SOURCE: MAP Model

of 4.8 percent, between 1978 and 2000. Over the period, RPI moves toward the U.S. average since United States CPI is assumed to increase faster, at a rate of 5.5 percent per year. This supports the pre-pipeline trend; as the scale of the economy increases and more goods and services are produced locally, the price level falls relative to the U.S. average. During the buildup of the ALCAN and Pacific LNG, RPI increases faster than the United States CPI. This diverging price level is a result of the rapid growth connected with development. Overall, the price level follows trends similar to the historical growth.

Real per capita income expands by 73 percent between 1978 and 2000. The average rate of growth is 2.5 percent per year. This is less than the 5.4 percent growth in real per capita income between 1965 and 1976 and the 3.5 percent annual growth rate prior to TAPS construction between 1965 and 1973. This rate is slightly greater than the 2.2 percent increase assumed for the United States in general. The high wage of special project construction workers affects real per capita incomes--real per capita income peaks in 1982 and 1983 and falls by 6 percent after the peak ALCAN year. The rise in real per capita incomes shows an increase in benefits of growth; however, this does not address distributional questions concerning personal income.

The State Fiscal Position. Over the projection period, state government will receive revenues from petroleum development which exceed current levels of expenditure. State government's decision on the expenditure of these revenues will influence the growth of the Alaska economy. In the historical period, we observed state government's role in the growth process. State government contributes to growth by the expenditure of revenues directly through state government employment and indirectly through capital expenditures which influence the level of activity in the construction sector. When revenues from outside the economy such as exogenous petroleum revenues are spent, this extra demand causes growth. This section describes the projected revenues to the state, the state's projected expenditures, and the overall fiscal position of the state in the projection period.

State Revenues. The State of Alaska has two major sources of revenues: exogenous petroleum revenues which are determined by the flow of oil and gas on state lands and endogenous revenues which are determined by the state's economic activity. Endogenous revenues include income tax, business taxes, and other revenues determined by the growth of the economy.[1] Table 43 shows the growth of state government revenues between 1977 and 2000. Total revenues are almost $7.0 billion larger in 2000 than in 1977. Overall, these revenues increase at a rate of 10.4 percent per year. Prudhoe oil revenues peak in 1985. Prior to 1985, the rate of increase in revenues averages 20.9 percent per year, while this slows to 5.2 percent following 1985. The pattern of revenues follows the pattern of petroleum revenues received by the state.

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[1]Other tax revenues include revenues from the personal income tax, nonpetroleum corporate income tax, business license tax, motor fuels tax, alcohol tax, cigarette tax, school tax, ad valorem tax, and other miscellaneous taxes.

TABLE 43. STATE REVENUES
MODERATE BASE CASE, ALASKA
1977-2000

(Millions of Nominal Dollars)

	General Fund Revenues	Petroleum Revenues	Other Tax Revenues
1977	796	197	214
1978	1,054	471	207
1979	1,441	861	274
1980	1,625	996	313
1981	1,989	1,278	356
1982	2,331	1,476	438
1983	2,655	1,643	554
1984	3,230	2,122	654
1985	3,639	2,422	688
1986	3,833	2,431	751
1987	4,100	2,482	820
1988	4,377	2,523	914
1989	4,665	2,571	1,006
1990	4,804	2,467	1,095
1991	4,975	2,414	1,172
1992	5,202	2,438	1,258
1993	5,457	2,467	1,364
1994	5,686	2,435	1,482
1995	5,911	2,381	1,614
1996	6,213	2,373	1,789
1997	6,555	2,374	1,991
1998	6,911	2,372	2,213
1999	7,316	2,378	2,478
2000	7,773	2,379	2,790

SOURCE: MAP Model

The most important source of revenues to the state during the period between 1977 and 2000 are petroleum revenues. Petroleum revenues include royalties, production taxes, property taxes, and petroleum corporate income taxes from petroleum production. Petroleum revenues are earned from production on state lands in Upper Cook Inlet, Prudhoe Bay, and the Beaufort Sea. Because of their importance, Prudhoe Bay production dominates these revenue flows. Petroleum revenues increase until 1989, after which their general pattern is declining revenues. The decrease in revenues reflects declining production at Prudhoe Bay. Between 1977 and 1989, yearly petroleum revenues increase at an average rate of over 23.8 percent a year. After 1989 petroleum revenues fall, falling 7.5 percent by 2000. Other tax revenues, which include personal and business taxes, increase throughout the projection period. The increase in these revenues results from the growth of the economy. These revenues grow at an average rate of 11.8 percent between 1977 and 2000. Other tax revenues fall after completion of TAPS in 1977. The increase in these revenues after 1990 counteracts the decline in petroleum revenues.

State Expenditures. State government expenditures increase during the projection period; they are shown in Table 44. The increase in state expenditures is a result of two forces. First, expenditures grow as a response to the general growth of the economy. Increased population and prices result in increasing expenditures to provide the same level of services as measured by real per capita expenditures. The growth of income is assumed to increase the demand for the level of services provided. The second force operating on state expenditures is the

TABLE 44. STATE EXPENDITURES
MODERATE BASE CASE, ALASKA
1977-2000

	Total Expenditures (Millions of Nominal Dollars)	Real Per Capita[1] Expenditures
1977	1,161	1,119
1978	1,311	1,152
1979	1,415	1,152
1980	1,567	1,170
1981	1,744	1,174
1982	2,019	1,198
1983	2,380	1,304
1984	2,595	1,381
1985	2,762	1,383
1986	3,099	1,430
1987	3,454	1,459
1988	3,873	1,500
1989	4,288	1,528
1990	4,713	1,554
1991	5,092	1,575
1992	5,419	1,573
1993	5,797	1,569
1994	6,254	1,577
1995	6,733	1,577
1996	7,268	1,576
1997	7,888	1,586
1998	8,561	1,596
1999	9,296	1,601
2000	10,135	1,614

[1]Deflated by Alaska Relative Price Index

SOURCE: MAP Model

accumulation of unspent revenues. These revenues will place pressure on the government to increase expenditures.

State expenditures increase more than eight times between 1977 and 2000. The average annual growth rate during this period is 9.9 percent per year. After 1989, when petroleum revenues peak, the growth of expenditures is at a rate of only 8.1 percent per year. The projected growth in state expenditures repeats, over a much longer period, the experience of the state after the Prudhoe lease sale. The Prudhoe Bay experience may provide an indication of how the state will expand services in the future. Despite the rapid growth of expenditures during the historical period, the functional distribution of expenditures remained fairly stable. From this, we may be able to infer that the state will continue to distribute expenditures between the nine functional categories (education, social services, health, natural resources, public protection, justice development, transportation, and general government) as in the past (Goldsmith, 1977).

Real per capita expenditures can be considered a measure of the level of state services received by an individual. Increases in state expenditures are of two types--providing additional services and providing the same level of services to an increased population. Increases in services occur throughout the period. Real per capita expenditures increase by 44.2 percent between 1977 and 2000. This is a modest expansion when it is compared to the rise in real per capita expenditures of 118 percent between 1969 and 1973 (Goldsmith, 1977). The growth in real per capita expenditures is not even throughout the period; almost 83 percent of the increase occurs between 1977 and 1989 when oil revenues peak.

Balances. The huge increases in revenues which result from the production of oil and gas place the State of Alaska in a unique position. The excess revenues available allow the state to build up its fund balance. These funds not only provide a source of future revenues; they also generate interest earnings which increase yearly revenues. There are two types of fund balances: the permanent and general funds. (See Table 45.)

The permanent fund is a legislated savings account for the state. In 1976 Alaska adopted a constitutional amendment which established the permanent fund. The relevant section of the constitution is Article IX, Section 15, which reads:

> 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.

This establishes the permanent fund as a minimum amount of petroleum revenues which cannot be spent. The permanent fund grows continually throughout the projection period. By 2000 there are $4.9 billion in the permanent fund. The general fund includes the remainder of the state's unspent revenues. For most of the period, the general fund is more important than the permanent fund. At its peak in 1996, the general fund has almost $12 billion, which is greater than three times the amount in the permanent fund. The decline in petroleum revenues after

TABLE 45. STATE FUND BALANCES
MODERATE BASE CASE, ALASKA
1977-2000

(Millions of Nominal Dollars)

	General Fund Balance	Permanent Fund Balance	Fund Balance Interest
1977	668	2	35
1978	617	49	47
1979	815	153	47
1980	1,054	275	69
1981	1,501	411	94
1982	2,055	563	136
1983	2,627	732	186
1984	3,550	949	239
1985	4,738	1,188	320
1986	5,852	1,437	421
1987	6,947	1,684	517
1988	7,972	1,936	613
1989	8,934	2,193	703
1990	9,687	2,445	790
1991	10,294	2,689	861
1992	10,844	2,937	922
1993	11,330	3,188	979
1994	11,667	3,437	1,032
1995	11,833	3,681	1,074
1996	11,851	3,924	1,104
1997	11,695	4,168	1,124
1998	11,342	4,413	1,131
1999	10,790	4,660	1,125
2000	10,006	4,907	1,105

SOURCE: MAP Model

1989 reduce the rate of increase in the general fund. Beginning in 1997, the general fund is drawn down for expenditures. Between 1996 and 2000, the general fund is reduced by almost $2 billion. The cyclical nature of petroleum revenues and their importance as a part of state revenues mean that when expenditure policies are tied to revenues, they will eventually lead to expenditures in excess of revenues. Since the increase in services cannot be supported by normal revenues, the fund balance must be drawn on. Changes in the rate of spending out of revenues will only affect the timing of this, not its eventuality (Goldsmith, 1977). These fund balances provide an additional source of revenue to the state. The general fund is assumed to earn interest at the rate of 7 percent per year. while the permanent fund earns a slightly higher rate of 7.5 percent. These rates reflect the diverse portfolio held by the state which includes both long- and short-term bonds as well as in-state loans. At their peak in 1998, these revenues are about 16 percent of the state's general fund revenues. The interest revenues fall as the general fund is decreased.

State Fiscal Position. The state's fiscal position is determined by two factors. First, the Prudhoe Bay petroleum revenues are the major portion of state revenues which are a fixed flow of resources through time. Growth in the economy will not affect the level of these revenues. Secondly, economic growth increases expenditures without the same response in nonpetroleum revenues. These factors lead to the pattern of the fund balances shown in the previous section.

Table 46 contains two indicators which illustrate the state's fiscal position. The first is the excess of general fund revenues over general fund expenditures. As long as this is positive, the general fund balance will increase; when it is negative, the fund balances must be drawn down to meet expenditures. The excess of revenues over expenditures increases until 1985, after which it falls. After 1985 expenditures are increasing faster than revenues. After 1998 expenditures are greater than revenues, and the fund balance must be drawn down. This pattern has long-range effects since it affects not only the level of the general fund but also the interest earned on the fund balances. This interest is an important part of revenues to the state.

The other factor affecting the value of the fund balances to the state is prices. As prices increase, the purchasing power of the fund will decrease. Table 46 shows the value of the total general and permanent fund balances in constant 1977 dollars. The effect of prices is to reduce the real value of the fund earlier. The real value of the fund peaks in 1993 at $6.5 billion; this is four years before the nominal fund balance peaks. By 2000, the real fund balance has fallen 26 percent from its peak; this compares to the 6 percent fall the nominal fund balance experiences by 2000. The real fund balance illustrates the effect of price increases on the fixed flow of revenue which is included in the fund.

GROWTH OF THE REGIONAL ECONOMIES

The regions of Alaska do not uniformly reflect state growth. Differences reflect the location of exogenous employment growth as well as the

TABLE 46. STATE FISCAL POSITION
MODERATE BASE CASE, ALASKA
1977-2000

	General Fund Revenues Minus General Fund Expenditures (Millions of Nominal Dollars)	Fund Balance (Millions of 1977 Constant Dollars)
1977	-137	671
1978	- 4	602
1979	302	835
1980	361	1,090
1981	583	1,486
1982	707	1,916
1983	740	2,350
1984	1,140	3,051
1985	1,426	3,854
1986	1,364	4,519
1987	1,342	5,089
1988	1,276	5,562
1989	1,219	5,955
1990	1,004	6,199
1991	851	6,359
1992	798	6,469
1993	738	6,519
1994	586	6,484
1995	409	6,360
1996	262	6,172
1997	88	5,926
1998	-109	5,619
1999	-305	5,256
2000	-536	4,841

SOURCE: MAP Model

size and structure of the regional economy. This section will describe the distribution of state growth in the base case between two of the state's regions, Anchorage and Southcentral. As we have seen in the historical analysis, Anchorage and Southcentral, while closely related, are different types of economies. Anchorage is the state's major region. Its growth is largely affected by its role as the administrative and distributive center for the state. This provides an indirect link between the Anchorage economy and the state's resource industries. Because of this role, growth in other parts of the state is reflected by growth in Anchorage. Southcentral is a combination of many small, local economies which are significantly dependent on the resource industries; both petroleum development and fisheries are important to these economies. These small economies, while physically separated, form a regional economy with similar structure and important trade and transportation links.

Anchorage

Aggregate Indicators. Table 47 shows three indicators of the growth of the Anchorage economy during the projection period. Employment, population, and real disposable income show that the state growth is reflected in Anchorage even though there is no major exogenous resource development. Population grows at an annual average rate of 3.6 percent during the period. Anchorage grows faster than the state, and the concentration of population in Anchorage continues throughout the projection period. In 1977, 46.3 percent of the state's population is in Anchorage; by 2000, that has increased to 53.5 percent. Population does not fall after completion of TAPS but experiences a slight decrease in 1984 after the

TABLE 47. AGGREGATE INDICATORS OF ECONOMIC GROWTH
MODERATE BASE CASE, ANCHORAGE
1977-2000

	Population	Employment	Real Disposable Personal Income (Millions of Constant $)
1977	190,188	85,523	573
1978	197,348	84,128	586
1979	201,235	87,606	626
1980	207,323	91,938	677
1981	218,549	98,521	743
1982	235,361	107,641	828
1983	245,371	111,732	874
1984	244,577	109,304	867
1985	249,962	111,258	899
1986	259,583	116,354	958
1987	271,446	122,666	1,032
1988	283,370	128,846	1,102
1989	295,031	134,617	1,171
1990	305,932	139,743	1,235
1991	314,949	143,103	1,281
1992	323,997	146,538	1,330
1993	334,571	151,342	1,397
1994	345,660	156,519	1,466
1995	357,795	162,462	1,547
1996	371,182	169,227	1,639
1997	384,828	275,961	1,729
1998	399,234	183,020	1,824
1999	415,315	191,184	1,938
2000	431,026	199,012	2,047

SOURCE: MAP Model

peak ALCAN year. Between 1984 after the ALCAN is completed and 2000, the population grows at an average annual rate of 3.6 percent.

Population follows the pattern of employment growth. Employment grows at an average annual rate of 4.0 percent between 1978 and 2000. As with population, employment experiences a slight decrease in 1984 when the ALCAN construction is in its final year. After 1984, employment grows at an average of 3.8 percent per year. Throughout the projection period, the dependency ratio (the ratio of population to employment) falls; this ratio is 2.22 in 1977 and 2.17 by 2000. This small decline results from the aging of the population and the increased participation in the labor force of the working-age population.

The final indicator of regional economic growth in the projection period is the total regional real disposable income. This accounts for the effect of prices and taxes on incomes. Total real disposable income increases at an average of 6.0 percent per year between 1978 and 2000. It experiences a slight peak in 1983, the final peak ALCAN year.

The Economic Structure. Table 48 shows the changes in structure of the Anchorage economy as measured by the distribution of employment. The major exogenous industries of mining and exogenous construction grow only slightly after completion of TAPS; this employment is made up of headquarters mining employment. Growth over this sector occurs with the expansion of headquarters employment for the development of Lower Cook, Beaufort, and Northern Gulf OCS development. The major growth occurs in

TABLE 48. ECONOMIC STRUCTURE
MODERATE BASE CASE
ANCHORAGE

	Support Sector I		Support Sector II		Government		Basic Sector	
	Employment	% of Total	Employment	% of Total	Employment	% of Total	Employment	% of Total
1978	36,835	43.9	12,153	14.5	31,427	37.4	3,439	4.1
1980	42,516	46.4	13,652	14.9	31,763	34.6	3,746	4.1
1985	54,917	49.7	17,453	15.8	33,527	30.3	4,632	4.2
1990	74,018	53.6	22,850	16.5	35,580	25.8	5,692	4.1
1995	89,403	56.0	27,195	17.0	36,368	22.8	6,780	4.3
2000	114,667	58.9	34,495	17.7	37,427	19.2	8,107	4.3

Support Sector I includes trade, services, and finance-insurance-real estate employment.

Support Sector II includes transportation-communication-public utilities and other construction employment.

Government includes state, local, and federal employment.

Basic Sector includes manufacturing, agriculture-forestry-fisheries, mining, and exogenous construction employment.

SOURCE: MAP Model

the local support sector. This sector is composed of two components: 1) local construction and transportation-communication-utilities and 2) trade, services, and finance-insurance-real estate. Each component of the support sector increases its share of total employment during the projection period. Local construction and transportation-communication-utilities increase from 14.0 percent in 1977 to 17.7 percent by 2000; while trade, service, finance-insurance-real estate increases from 43.9 percent to 58.9 percent. These changes are a continuation of historical changes in the structure of the Anchorage economy. These shares are greater than the shares of similar industries on the state level because of the important administrative and distributive role of Anchorage.

Southcentral

Aggregate Indicators. Unlike Anchorage, the growth of Southcentral depends largely upon the growth of the regional exogenous sector. The exogenous sector is influenced significantly by four events: the construction of the Pacific LNG plant between 1980 and 1983, the development of the Lower Cook OCS, the development of the Northern Gulf OCS, and the shutdown of the Upper Cook oil fields in 1990. Three aggregate indicators--population, employment, and disposable real income--are shown in Table 49. Population falls after the completion of the trans-Alaska pipeline in 1977. Between 1978 and 2000, population is projected to grow at an average annual rate of 2.2 percent. Population falls slightly (less than one percent) in 1991 when the Upper Cook Inlet oil fields are closed.

TABLE 49. AGGREGATE INDICATORS OF ECONOMIC GROWTH
MODERATE BASE CASE, SOUTHCENTRAL
1977-2000

	Population	Employment	Real Disposable Personal Income (Millions of Constant $)
1977	58,958	23,117	180
1978	53,826	20,898	145
1979	55,799	21,946	159
1980	59,054	23,745	184
1981	62,075	25,688	214
1982	63,464	26,915	237
1983	63,425	26,528	224
1984	64,866	26,732	221
1985	66,203	27,497	235
1986	68,340	28,810	256
1987	69,987	30,024	279
1988	72,143	31,149	294
1989	74,454	32,310	310
1990	76,801	33,520	329
1991	76,095	32,987	318
1992	75,663	32,788	318
1993	76,558	33,299	329
1994	77,470	33,824	340
1995	78,879	34,629	355
1996	80,669	35,635	373
1997	82,006	36,400	388
1998	83,321	37,158	403
1999	84,802	38,046	421
2000	86,386	38,978	439

SOURCE: MAP Model

Employment grows faster than population in Southcentral during the projection periods. Employment falls after TAPS is completed in 1977. After this, it grows at an average rate of 2.9 percent per year. The ratio of population to employment was much higher in 1978 in Southcentral (2.58) than in the state (2.27). The Southcentral ratio falls toward the state ratio by 2000 (2.22 for Southcentral and 2.17 for the state). This trend was experienced in the historical period; the population-to-employment ratio fell from 4.24 in 1965 to 3.07 prior to the TAPS construction in 1974. The declining dependency ratio results from a change in the character of the population. As at the state level, the population is aging and the labor force participation is increasing. These factors account for the greater proportion of employed in the population.

Disposable real income grows throughout the period after falling with the completion of the trans-Alaska pipeline; in 1978 it is almost 20 percent lower than in 1977. Between 1978 and 2000, disposable real income increases at an annual average rate of 5.2 percent.

<u>The Economic Structure</u>. Table 50 shows the changes in the structure of the Southcentral economy during the projection period as described by changes in the distribution of employment. Two important trends can be observed from this table. First, those exogenous sectors which have recently been important to the region's growth, construction and mining, decrease their importance throughout the projection period. After completion of TAPS, this exogenous construction decreases, then increases to a peak of 2,578 in 1982 with construction of the Pacific LNG plant

TABLE 50. ECONOMIC STRUCTURE
MODERATE BASE CASE
SOUTHCENTRAL

	Support Sector I		Support Sector II		Government		Basic Sector	
	Employment	% of Total	Employment	% of Total	Employment	% of Total	Employment	% of Total
1978	8,134	38.6	3,101	14.7	4,717	22.4	5,146	24.4
1980	9,173	38.2	3,515	14.7	4,837	20.2	6,462	26.9
1985	10,792	38.8	4,316	15.5	5,412	19.4	7,317	26.3
1990	13,321	39.1	5,338	15.7	6,058	17.8	9,358	27.5
1995	14,641	41.4	5,442	15.4	6,265	17.7	9,040	25.5
2000	17,155	42.6	6,157	15.3	6,548	16.3	10,369	25.8

Support Sector I includes trade, services, and finance-insurance-real estate employment.

Support Sector II includes transportation-communication-public utilities and other construction employment.

Government includes state, local, and federal employment.

Basic Sector includes manufacturing, agriculture-forestry-fisheries, mining, and exogenous construction employment.

SOURCE: MAP Model

and development of the Lower Cook OCS. After the Cook Inlet oil fields are shut down in 1990, mining employment is reduced. The second trend is the increasing importance of the support sector in the region. Trade, services, and finance-insurance-real estate increase their share of total employment from 38.6 percent in 1978 to 42.6 percent in 2000. This follows a historical trend. The increased scale of the Southcentral economy during the projection period leads to a greater-than-proportional increase in support sector employment.

Alternative Base Cases

Two additional base case projections were made. These base cases differ in the assumed level of OCS activity in the Lower Cook Inlet, Beaufort Sea, and Northern Gulf of Alaska. The major difference between these base cases is one of magnitude; the high base case assumes a higher level of OCS activity than the moderate base case. The low base case assumes only exploration activity in the Lower Cook and Northern Gulf and lower development activity in the Beaufort. The major difference between the projected growth of the base cases in these three scenarios will also be in magnitude. Each alternative base case will be described by four major variables: employment, population, total state expenditures, and the fund balance. These cases affect the structure of the economy in a manner similar to the moderate case. (The detailed scenarios are shown in Appendix C.)

LOW BASE CASE SCENARIO

The minimum base case scenario includes the same non-OCS assumptions as the moderate scenario. The difference between these cases involves the assumptions about OCS activity in the Lower Cook Inlet, Beaufort, and Northern Gulf. The minimum development scenario assumes only exploration activity in the Lower Cook and the Northern Gulf. Lower Cook OCS employment occurs between 1978 and 1985 with a peak of 252 in 1980. In contrast, the moderate case has a Lower Cook OCS employment peak of 912 in 1981 and operations employment of 417 remains throughout the period. The level of activity assumed in the low Beaufort scenario is much closer to the moderate scenario. The low Beaufort scenario contains production and has employment through the entire projection period. Peak employment of 740 occurs in 1989; this is 68 percent of the peak in the moderate Beaufort scenario. Operations employment is approximately 82 percent of the moderate case by the end of the period. Since Beaufort OCS production occurs in state waters, Beaufort will also generate tax, bonus, and royalty revenues to the state. Northern Gulf exploration activity is over by 1985; in the moderate case, peak Alaska employment of 2,061 is reached in 1990.

General Pattern of Growth

Table 51 describes four indicators of the magnitude of economic growth projected for the low base case. Population is projected to increase at an annual average rate of growth of 3.0 percent between 1978, the year after the TAPS project is complete, and 2000. The most rapid period of growth is between 1978 and 1983, the peak ALCAN year; growth averages

TABLE 51. AGGREGATE INDICATORS OF ECONOMIC GROWTH
LOW BASE CASE, ALASKA
1977-2000

	Population	Employment	State Expenditures (Millions of Nominal Dollars)	Fund Balance[1] (Millions of Nominal Dollars)
1977	410,660	185,508	1,161	671
1978	406,709	178,557	1,311	666
1979	417,661	184,486	1,415	967
1980	431,495	192,187	1,559	1,330
1981	452,241	204,393	1,723	1,921
1982	483,427	223,073	1,993	2,639
1983	500,077	228,948	2,356	3,389
1984	498,073	221,443	2,567	4,540
1985	505,276	223,064	2,733	5,975
1986	518,872	229,850	3,046	7,352
1987	534,660	238,100	3,363	8,716
1988	551,766	247,041	2,732	10,301
1989	569,539	256,222	4,116	11,287
1990	586,227	264,339	4,521	12,314
1991	601,891	271,666	4,872	13,193
1992	617,622	278,987	5,252	14,008
1993	635,402	287,820	5,671	14,742
1994	653,250	296,526	6,145	15,310
1995	672,192	305,953	6,629	15,694
1996	691,214	315,284	7,154	15,916
1997	712,212	325,991	7,723	15,973
1998	733,838	336,928	8,404	15,820
1999	757,989	349,560	9,135	15,460
2000	782,602	362,233	9,966	14,858

[1]Sum of permanent and general funds

SOURCE: MAP Model

4.4 percent per year during this period. Population falls after completion of TAPS in 1977 and the last peak ALCAN year in 1983; in both cases, the decrease is less than one percent. The rate of population growth is slightly less than the 3.2 percent rate in the moderate base. By the peak ALCAN construction year, 1983, population is approximately 4,600 greater in the moderate base case. This is mainly a response to the more rapid Lower Cook development in the moderate case. By 2000, population is 23,000 less in the low base case.

Employment is projected to be 362,223 by 2000 in the low base case. This is 8,300 less than in the moderate base case. Employment falls from 185,500 in 1977 to 178,560 in 1978 with the completion of TAPS in the low base case. After 1978, employment grows at an annual rate of 3.27 percent. Like population, employment is projected to grow most rapidly with the buildup before the ALCAN. Between 1978 and 1982, employment increases at the average rate of 5.7 percent per year. The overall growth is less than the growth in the moderate base case. As in the moderate base case, population is projected to increase less rapidly than employment.

Throughout the projection period, state expenditures in the low base case are only slightly less than in the moderate base case. By 2000, expenditures in the low base case are $9,966 million, which is almost two percent lower than in the moderate base case. In 1981, at the peak of Lower Cook moderate development, moderate case expenditures are only slightly more than one percent higher. The lower base case also has a similar effect on the fund balances. The fund balance in the low base case is $55 million less than the fund balance in the moderate case by 2000. This is a difference of only one percent. The moderate base case has a larger fund balance even though it has larger expenditures because of the greater revenues received from the Beaufort OCS. The pattern of the fund balance is similar in both cases. In the low base case, the fund balance increases at an annual average rate of 17.2 percent until 1997, when it peaks. Between 1997 and 2000, the fund falls by 7 percent in the low case because fund balances are drawn down to meet state expenditures. This is similar to the pattern found in the moderate base case.

The growth projected for the low base case is similar in magnitude to that projected in the moderate base case. There is significant difference in the major variable by 2000. The difference varies from population, which is 3 percent smaller, to state expenditures, which are only .4 percent smaller. The difference results because of development in the Lower Cook and Northern Gulf OCS which occurs in the moderate case but not in the low case.

Structural Differences and Similarities. The main difference between the low and moderate base cases involves the magnitude of the variables. The effect of economic growth on the process of change is similar in both base cases. Four major structural changes were observed in the moderate base case. These were measured by changes in the employment distribution, the dependency ratio, the regional distribution of the population, and the fund balance. The change in the employment distribution measures the increased importance of the support sector in the Alaska economy. As the economy grows larger, the support sector experiences a greater-than-proportional growth because more goods and services are produced locally. The dependency ratio decreases as a greater proportion of the population is employed. This results from increases in the proportion of the population of labor-force age and increased labor-force participation of this population. The concentration of population in Anchorage was also observed in the moderate base case. Anchorage's role as the administrative and distributive center for Alaska assures the continuing growth of Anchorage even if the major cause of growth continues to be resource development outside the region. The final structural characteristic observed in the moderate base case concerns the state fiscal sector. The influence of petroleum revenues on state expenditures leads to expenditures which increase faster than revenues. Eventually, the fund balances must be drawn down to meet expenditures.

Table 52 compares these structural characteristics in the low and moderate scenarios. This table shows that, while the base cases differ in magnitude, they are quite similar in the important structural characteristics. The support sector expands to about 53 percent of total employment in both cases. The dependency ratio (population/employment) falls by about 4 percent between 1980 and 2000 in both cases. Similarly, Anchorage is projected to contain almost 54 percent of the state's population by 2000. The projected pattern of general fund revenues net of general fund expenditures is similar in both cases. In the early part of the period,

TABLE 52. STRUCTURAL CHARACTERISTICS
LOW AND MODERATE BASE CASES

		1980	1990	2000
Percent of Total Employment in Support Sector	low base case	39.4%	46.1%	53.0%
	moderate base case	39.5%	46.8%	53.2%
Dependency Ratio	low base case	2.25	2.22	2.16
	moderate base case	2.24	2.20	2.17
Percent of Total Population in Anchorage	low base case	47.8%	50.0%	53.5%
	moderate base case	47.8%	50.0%	53.5%
General Fund Revenues Minus General Fund Expenditures (millions of nominal $)	low base case	363	1,027	-602
	moderate base case	361	1,044	-536

revenues exceed expenditures; the fund is being built up. By the end of the period, expenditures are greater than revenues; and the fund must be drawn down to make up the difference in expenditures.

HIGH BASE CASE SCENARIO

The high and moderate base case scenarios differ only in the assumptions made about OCS development in the Lower Cook, Beaufort Sea, and Northern Gulf. The Lower Cook development scenarios differ in both magnitude and timing between the two cases. Peak employment does not occur in the high case until 1984; the peak level of employment is 2,448. Peak employment occurs in the moderate case in 1981; moderate case employment is greater than high case for the first four years of the period. Operations employment in the high case is almost three times as high as in the moderate case; it includes operation of an LNG plant. The Beaufort high scenario peaks in 1989 at 1,344, which is 24 percent greater than the moderate Beaufort peak. By 2000, employment is 38 percent greater in the high case. The higher Beaufort production also means greater revenues from production in state waters. Northern Gulf development in the high scenario peaks in 1991 with 3,740, while the moderate scenario peaks in 1990 with 2,061. This is a difference of 81 percent.

General Pattern of Development. Table 53 shows four indicators of the magnitude of economic growth in the high base case. Population is projected to be 837,888 in 2000. This is 32,163, or 4.0 percent, greater than in the moderate base case. The population falls after TAPS is completed in 1978 but does not experience a similar fall after ALCAN in

TABLE 53. AGGREGATE INDICATORS OF ECONOMIC GROWTH
HIGH BASE CASE, ALASKA
1977-2000

	Population	Employment	State Expenditures (Millions of Nominal Dollars)	Fund Balance[1] (Millions of Nominal Dollars)
1977	410,660	185,508	1,161	671
1978	406,709	178,557	1,311	666
1979	417,661	184,486	1,415	967
1980	431,495	192,187	1,559	1,330
1981	454,273	205,895	1,723	1,924
1982	486,141	224,856	2,011	2,635
1983	509,747	235,658	2,376	3,387
1984	520,191	236,585	2,653	4,521
1985	540,357	245,927	2,904	5,922
1986	560,731	255,056	3,325	7,222
1987	582,340	264,996	3,665	8,509
1988	605,100	275,525	4,071	9,745
1989	623,917	283,001	4,490	10,967
1990	639,451	288,328	4,877	12,021
1991	656,425	295,235	5,206	12,968
1992	670,490	300,080	5,617	13,836
1993	686,752	306,934	5,993	14,658
1994	704,358	314,864	6,452	15,346
1995	723,291	323,807	6,945	15,868
1996	742,659	333,013	7,479	16,258
1997	764,683	344,153	8,062	16,514
1998	787,251	355,465	8,738	16,597
1999	812,471	368,566	9,489	16,490
2000	837,888	381,508	10,343	16,164

[1]Sum of permanent and general funds

SOURCE: MAP Model

1984. The moderate base case experiences a fall between 1983 and 1984. This increase is a result of development activity in the Lower Cook which increases employment from 989 in 1982 to its peak of 2,448 in 1984. This increase counteracts the fall in population after ALCAN is complete. The growth rate of population between 1978 and 2000 is an average of 3.3 percent per year which is slightly higher than in the moderate base case.

Unlike the moderate base case, employment does not fall after the peak ALCAN year 1983. The OCS development of both Lower Cook and Northern Gulf prevent the loss of employment after ALCAN. Because of the earlier Lower Cook development in the moderate base case, employment in the high case is less than in the moderate case until 1983. Employment in the high case grows at an annual average rate of 3.5 percent between 1978 and 2000. By 2000, employment is almost 11,000 greater than in the moderate base case.

The state's fiscal position is affected in two ways by the different base cases. First, different rates of growth in population, prices, and personal income will affect the level of expenditures. Secondly, differential production in the Beaufort Sea will mean different revenue streams to the state. By 2000, state expenditures are projected to have reached $10.3 billion in the high base case. This is 2.1 percent greater than the projected state expenditures in the moderate base case. Expenditures are greater in the moderate base case until 1984 because of the earlier Lower Cook OCS activity. Overall, expenditures increase at an average rate of 10.0 percent per year in the high case. The fund balance is greater in the high base case by $1.3 billion in 2000. The larger fund balance is due to larger Beaufort Sea OCS revenues and the larger expenditures early in the period in the moderate case. These early expenditures reduce the fund and the interest earned on the fund. The fund experiences the same pattern of growth in the high as in the moderate base case, rising to a peak and then falling. The peak in fund balance is reached in 1998, which is one year later than in the moderate base case.

Structural Similarities and Differences. Table 54 shows the indicators of the major structural characteristics of the high and moderate base cases. The structural changes which occur because of the projected growth are similar in both the high and moderate cases. The support sector will include over 53 percent of total employment; the dependency ratio will fall to about 2.2 people per employee; and Anchorage will contain about 54 percent of the state's population. The excess of general fund revenues over expenditures is larger in the high case, although it is still negative in 2000. The pattern of the fund balance growth is similar in both cases.

TABLE 54. STRUCTURAL CHARACTERISTICS
HIGH AND MODERATE BASE CASES

		1980	1990	2000
Percent of Total Employment in Support Sector	high base case	39.4%	47.1%	53.4%
	moderate base case	39.5%	46.8%	53.2%
Dependency Ratio	high base case	2.25	2.22	2.20
	moderate base case	2.24	2.20	2.17
Percent of Total Population in Anchorage	high base case	47.8%	50.0%	53.5%
	moderate base case	47.8%	50.0%	53.5%
General Fund Revenues Minus General Fund Expenditures (millions of nominal $)	high base case	363	1,054	-326
	moderate base case	361	1,004	-536

Summary and Conclusions

The growth of the Alaska economy between 1977 and 2000 is projected to be substantial, although the economy is not projected to grow so rapidly as it did between 1965 and 1976. This section presented three alternative base cases, each with different assumptions about the level of OCS activity in the Beaufort Sea, Lower Cook Inlet, and Northern Gulf of Alaska. By 2000, population is projected to be between 782,602 and 837,888, depending upon the level of OCS activity assumed. Employment is projected to be between 362,233 and 381,508.

The three base case scenarios differ only in magnitude; they exhibit similar patterns of development. This pattern was illustrated by the growth in the moderate base case. The economy's growth is not projected to be constant throughout the period. The most rapid period of growth occurs during the construction of the ALCAN gasline between 1978 and 1982. During this period, the average annual growth of employment is 6.0 percent, compared to 3.4 percent for the whole period. Population grows 44 percent faster than over the entire period when ALCAN is constructed.

Economic growth provides increases in two measures of individual benefits: real per capita income and real state expenditures. Real per capita income increases by 64 percent between 1977 and 2000. This means that the real purchasing power of the average Alaskan increases with economic growth. Real per capita expenditures are a proxy for the level of services provided by the state government. Real per capita state expenditures increase by 44 percent over the projection period. Over 82 percent of the increase occurs prior to 1989 when petroleum revenues peak.

Economic growth in all three base case scenarios results in similar structural characteristics. Sturctural changes caused by growth affected each scenario in a similar fashion. In all scenarios, the importance of the support sector is projected to grow throughout the period. The proportion of the population which is employed is also projected to increase over the period. Population is projected to concentrate in Anchorage in all scenarios. The final structural pattern which is similar in all cases is the relationship between state revenues and expenditures. In all cases, expenditures exceed revenues by the end of the period, necessitating the reduction in the fund balance.

IV. THE IMPACT OF WESTERN GULF OCS DEVELOPMENT ON THE ALASKAN ECONOMY: THE MODERATE BASE CASE

In order to capture the important dimensions of uncertainty surrounding oil and gas development in the Western Gulf of Alaska, the development patterns implied by three alternative resource discovery scenarios were examined and contrasted with the base case projections presented above. The alternate OCS scenarios were designed to capture differences in resource quantities, transport requirements, and technology, all of which will affect the impacts of any development which actually occurs. The three scenarios which were examined included the level of development which would occur if the mean, 95 percent, and 5 percent probability resource levels were discovered in the Western Gulf lease sale area. This chapter will describe the impacts of each of these scenarios relative to the moderate base case. The impact of the 95 percent discovery relative to the low base case and the 5 percent discovery relative to the high base case will be discussed in the following chapter. The first section of this chapter examines the petroleum development scenarios, and the next section presents the economic impacts implied by each of these scenarios.

The Development Scenarios

Three offshore development scenarios were examined based upon geological, technical, and employment data prepared by Dames and Moore (Dames and Moore, 1978). The petroleum development scenarios are for the proposed Gulf of Alaska OCS lease sale no. 46, currently scheduled for Autumn 1980.

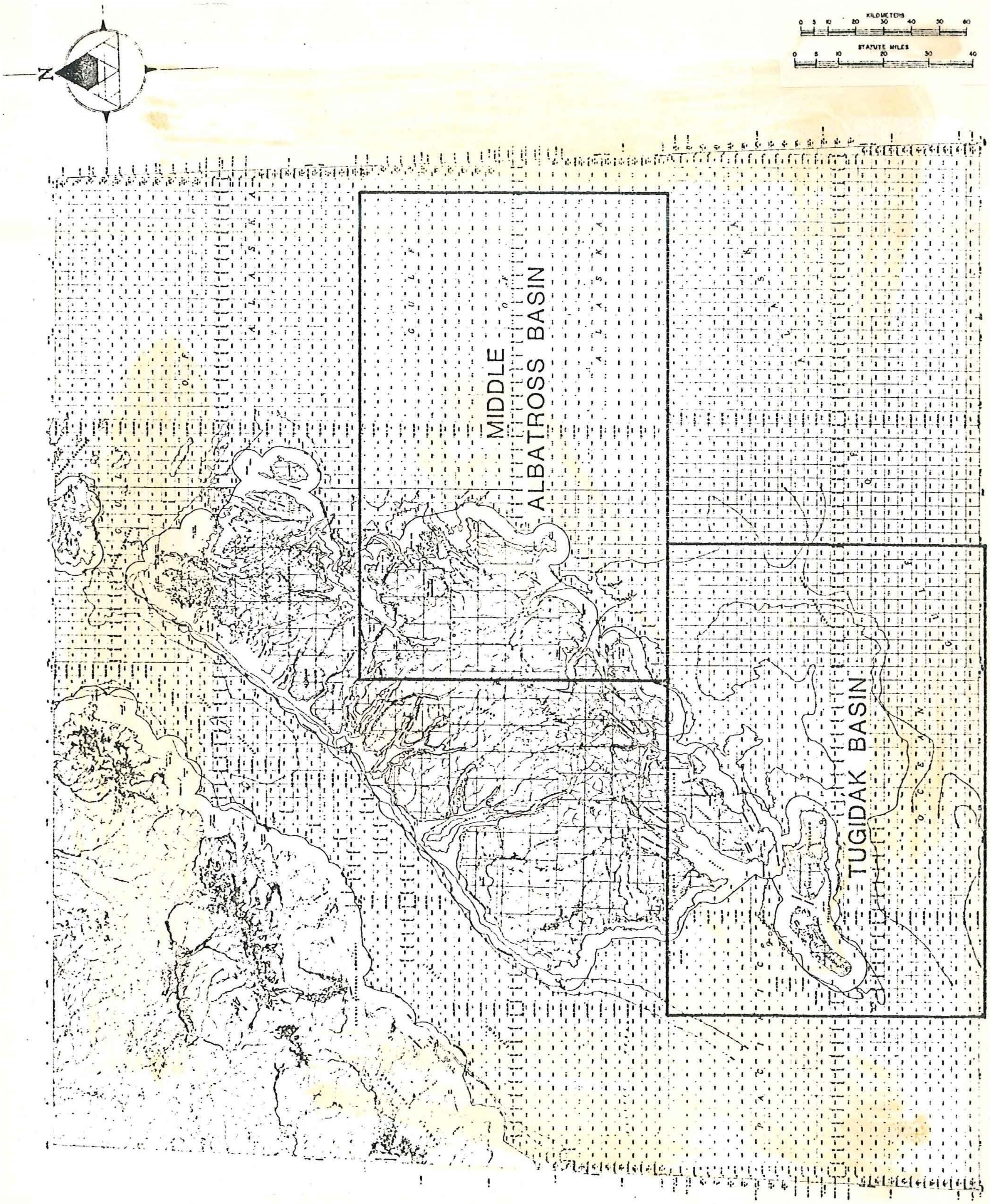
The scenarios discussed below are for the 5 percent, 95 percent, and statistical mean levels of U.S.G.S. resource estimates. These scenarios will affect the Alaska economy through the direct employment associated with the field development and production and the additional revenues earned by the state. Figure 4 shows the location of the study area.

DIRECT EMPLOYMENT

The development of the Western Gulf OCS will have two types of employment effects: direct employment in the field and headquarters employment. Headquarters employment is assumed to increase with development to provide the engineering support, coordination, and administration necessary for the level of activity in the field. All headquarters employment is assumed to be located in Anchorage.

The effect of direct OCS employment on the Alaska economy will depend on the extent to which the incomes earned in OCS development are spent in Alaska. Two factors limit the impact. First, the probable enclave nature of the development will limit the extent of the interaction with the economy when workers are on the job. If OCS development follows the pattern established by Prudhoe Bay development, workers will be located in camps where their direct interaction with the local economy will be limited. The isolated location of these OCS developments near small, existing communities increases the probability of enclave development since small Alaska communities do not have the infrastructure needed to support OCS development. Secondly, the international character of many offshore petroleum firms means they have regular, experienced crews which

FIGURE 4. WESTERN GULF OF ALASKA,
LOCATION OF STUDY AREA



SOURCE: Dames and Moore, 1978.

are dispatched to jobs around the world (Dames and Moore, 1978). The international character of these crews may mean that when they are not working, they will be outside Alaska. The first step in estimating the overall impact of Western Gulf OCS development is to estimate the share of direct employment which will reside in Alaska and interact with the economy. Figure 5 illustrates the process used to derive the direct OCS employment impact on the Alaska economy.

Table 55 shows estimates of the share of direct employment to Alaska residents (SEAR) which were used to adjust the direct employment estimates provided by Dames and Moore (Dames and Moore, 1978). In this context, Alaska resident means any employee who resides in Alaska and interacts with the economy during the duration of the project task. SEAR adjustments were made to the direct field employment only; headquarters employment is all assumed to reside in Alaska. The SEAR-adjusted employment is used in the scenarios provided to the MAP model to generate impacts.

SEAR coefficients were determined by the characteristics of the task and considerations of labor supply and demand. Such task characteristics as rotation, duration of the job, and specialized skills requirements were considered. It was assumed that the longer the task's off-duty rotation, the smaller was the probability that an employee would be an Alaska resident since he could travel from the site to a residence outside the state. For the short-duration jobs, it was assumed there was little reason for workers to reside in Alaska or for Alaskans to move into these jobs. Finally, the more specialized the skills required, the greater the chance

FIGURE 5. DETERMINATION OF OCS EMPLOYMENT ESTIMATES USED IN THE MAP MODEL

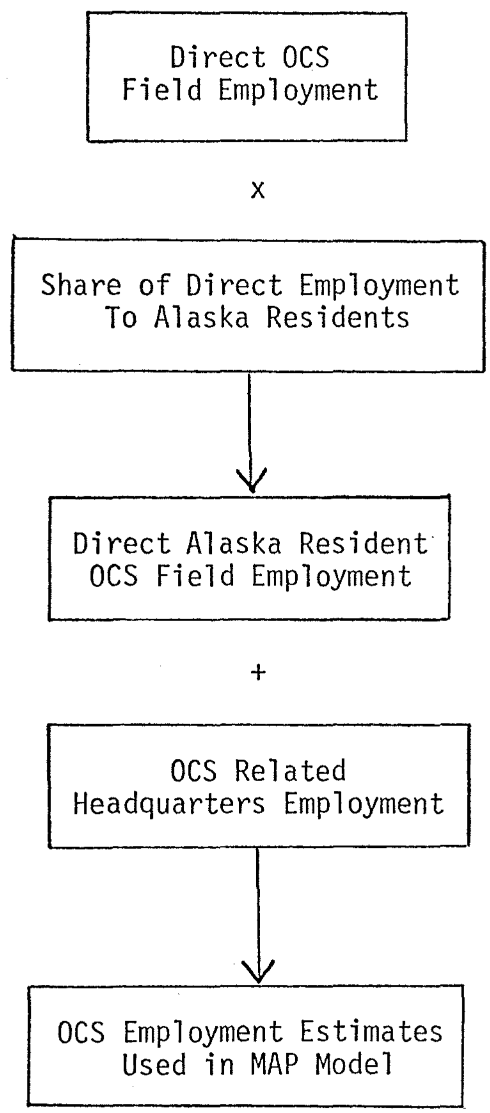


TABLE 55. ESTIMATED SHARE OF ALASKA RESIDENT EMPLOYMENT BY OCS TASK

Task	Phase	Time Period 1979-1984	1985-1989	1990-2000
Onshore				
1. Service Base	all phases	1.00	1.00	1.00
2. Helicopter Service	exploration & development	.50	.53	.58
	production	1.00	1.00	1.00
3. Service Base Construction	development	.50	.53	.58
4. Pipe Coating	development	.20	.21	.23
5. Onshore Pipeline Construction	development	.20	.21	.23
6. Oil Terminal Construction	development	.50	.53	.58
7. LNG Plant Construction	development	.50	.53	.58
8. Oil Terminal Operations	production	1.00	1.00	1.00
9. LNG Plant Operations	production	1.00	1.00	1.00
Offshore				
1. Surveys	exploration	.20	.21	.23
2. Rigs	exploration	.20	.21	.23
3. Platforms	development	.10	.30	.33
	production	1.00	1.00	1.00
4. Platform Installation	development	.10	.105	.116
5. Offshore Pipeline Construction	development	.10	.105	.116
6. Tugboats	exploration	.40	.42	.46
	development	.80	.88	.97
	production	.80	.88	.97

the skills would not be available in Alaska and outside workers would be hired. This meant a smaller probability that the worker would reside in Alaska. These factors change in a systematic fashion through the phase of development, so that the probability of workers residing in Alaska increases from the exploration to the production phase. The final factor considered was time. It was assumed that over time, as more OCS projects occur and present non-OCS petroleum projects wind down, the supply of labor for each of these tasks within Alaska will increase. This will increase the probability that workers will reside in Alaska. This is reflected by the increase in SEAR coefficients through time. Appendix C describes the detailed assumptions behind the SEAR coefficients.

REVENUE

Unlike the OCS activity proposed for the Beaufort Sea, production in the Western Gulf OCS occurs only in federal waters. Because of this, the state will not earn royalty, bonus, or severance tax revenues from the project. The major source of additional revenues will be the property tax revenues from onshore facilities. The property tax revenues earned by the state were based on the estimates of construction cost provided by Dames and Moore (Dames and Moore, 1978). The property tax which the state receives is 20 mills on certain oil and gas properties. The property tax specifically excludes such property as oil refining property, gas processing property, and interest or rights to produce oil. The property value taxed is depreciated over the life of the field and increased with inflation (Alaska Department of Revenue, 1977).

ALTERNATIVE WESTERN GULF SCENARIOS

The Mean Probability Resource Level Scenario

The mean scenario represents activity surrounding exploration and development of tracts assumed to be leased in the 1980 sale. It is assumed that 0.2 billion barrels of oil and 0.7 trillion cubic feet of gas are discovered. In this scenario, the discoveries are located in two separate fields, the Albatross and Tugidak Basins. Only one economic field is discovered in the Albatross Basin which contains .16 billion barrels of oil (Dames and Moore, 1978).

Exploration activity in this scenario begins in 1981 and lasts for three years. Field development and the construction of facilities begin in 1984. Production begins in 1987. Total direct construction employment peaks in 1984. The resources are insufficient to justify construction of an onshore terminal, so development activity consists of the construction of a single platform, service base, and offshore loading system. The largest mining employment occurs during exploration. Petroleum employment maintains a permanent workforce of only 64 after 1991. Production ends in 1999. Transportation activity peaks in the first year of exploration (1981) with 98 employees. (Employment levels are shown in Table 56.)

The nonproportional relation between Alaska resident employment and direct employment results from the changing task composition of industry employment. Alaska resident construction employment peaks at 260 in 1984, the same year as the peak in total construction employment. After

TABLE 56. DIRECT EMPLOYMENT REQUIREMENTS MEAN SCENARIO

	Construction		Mining[1]		Manufacturing		Transportation	
	Total Direct Employment	SEAR Adjusted Employment	Total Direct Employment	SEAR Adjusted Employment	Total Direct Employment	SEAR Adjusted Employment	Total Direct Employment	SEAR Adjusted Employment
1981	0	0	280	92	0		98	41
1982	0	0	283	93	0		98	41
1983	0	0	137	42	0		49	21
1984	521	260	10	10	0		0	0
1985	467	49	63	50	0		40	33
1986	300	32	275	118	0		34	29
1987	0	0	271	81	0		12	10
1988	0	0	206	80	0		24	22
1989	0	0	41	41	0		24	22
1990	0	0	39	39	0		24	22
1991	0	0	39	39	0		24	22
1992	0	0	64	64	0		24	22
1993	0	0	64	64	0		24	22
1994	0	0	64	64	0		24	22
1995	0	0	64	64	0		24	22
1996	0	0	64	64	0		24	22
1997	0	0	64	64	0		24	22
1998	0	0	64	64	0		24	22
1999	0	0	52	52	0		24	22
2000	0	0	0	0	0		0	0

[1]Includes headquarters employment based on 2.67 persons per exploration well, .6 persons per development well, and 40 persons per 2,000,000 barrels per day during production. Once peak is reached, production employment is maintained (Alaska OCS Office).

SOURCE: Dames and Moore, 1978

1984, the major construction activity is platform installation which is offshore work, assumed to have a low Alaska resident share because it requires specialized skills and is temporary. Alaska resident mining employment peaks in 1986, although total mining employment peaks in the exploration phase. By 1989, all mining employment is production employment, all of which is assumed to be Alaska resident. Transportation employment, like mining, has a much smaller Alaska resident component during exploration. However, peak resident employment occurs in the first year of exploration in 1981 when 41 Alaska residents are employed in transportation.

There are no direct state revenues generated by this development. Only shore-based facilities (taxed by the Kodiak Borough) are located on shore.

The 5 Percent Probability Resource Level Scenario

This scenario describes the activity surrounding the exploration, development, and production in the largest assumed find discussed in this report. It is assumed that 1.2 billion barrels of oil and 3.5 trillion cubic feet of non-associated gas are discovered. Oil and gas are found in both the Albatross and Tugidak Basins, although gas found in the Tugidak Basin is uneconomical and is not developed.

Exploration begins in 1982 and lasts five years. Mining employment reaches an early peak of 1,097 in 1984 during exploration. Field development begins in 1985 and lasts until 1989. Construction employment begins in 1983 and reaches a peak of 2,410 in 1987. Mining employment peaks after exploration at 1,254 in 1990 and maintains a permanent employment of approximately 740. Production of oil begins in 1990 and gas in 1986. This scenario also includes an LNG plant which begins production in 1986 and has a long-term employment of 50. Transportation employment peaks in 1985 during development, with 457 employees. Table 57 shows the employment levels in this scenario.

As in the mean scenario, the Alaska employment share is greatest in the production phase and smallest during exploration. Alaska mining employment peaks at 880 in 1990, when total mining employment peaks. Alaska employment plays a relatively small part in the exploration peak in 1984. The Alaska resident construction employment peaks in 1985, two years prior to total construction employment. This is a result of the increased importance of platform installation after 1985. Peak Alaska resident construction employment is 647. The shifting task composition of transportation employment accounts for the increased importance of Alaska resident employment after production begins. After peaking in 1985 at 373, transportation employment maintains a permanent employment of about 191.

This scenario produces property tax revenues from onshore facilities. Property tax revenues begin in 1987. Revenues decline after 1987. By 2000, property tax revenues have fallen to $2.4 million. (See Table 58.)

TABLE 57. DIRECT EMPLOYMENT REQUIREMENTS
5 PERCENT SCENARIO

	Construction		Mining[1]		Manufacturing		Transportation	
	Total Direct Employment	SEAR Adjusted Employment	Total Direct Employment	SEAR Adjusted Employment	Total Direct Employment	SEAR Adjusted Employment	Total Direct Employment	SEAR Adjusted Employment
1981	0	0	263	91	0		90	38
1982	0	0	552	171	0		196	82
1983	207	364	539	161	0		196	82
1984	1,547	587	1,097	345	0		432	260
1985	1,579	647	1,083	395	0		457	373
1986	1,527	315	705	313	50	50	298	276
1987	2,410	530	490	314	50	50	249	226
1988	1,547	205	768	634	50	50	219	200
1989	933	98	1,036	797	50	50	207	191
1990	467	54	1,254	880	50	50	201	185
1991	0	0	1,007	812	50	50	186	184
1992	0	0	737	729	50	50	196	191
1993	0	0	696	658	50	50	196	191
1994	0	0	685	685	50	50	196	191
1995	0	0	710	710	50	50	196	191
1996	0	0	735	735	50	50	196	191
1997	0	0	735	735	50	50	196	191
1998	0	0	735	735	50	50	196	191
1999	0	0	735	735	50	50	196	191
2000	0	0	735	735	50	50	196	191

[1] Includes headquarters employment based on 2.67 persons per exploration well, .6 persons per development well, and 40 persons per 2,000,000 barrels per day during production. Once peak is reached, production employment is maintained (Alaska OCS Office).

SOURCE: Dames and Moore, 1978

TABLE 58. WESTERN GULF OCS PROPERTY TAX REVENUES

(Millions of Nominal Dollars)

	5 Percent Scenario
1987	6.4
1988	6.4
1989	6.3
1990	6.1
1991	6.0
1992	5.8
1993	5.5
1994	5.3
1995	4.9
1996	4.6
1997	4.1
1998	3.6
1999	3.1
2000	2.4

SOURCE: Based on construction cost from Dames and Moore, 1978.

The 95 Percent Probability Resource Level Scenario

The 95 percent probability resource level for the lease sale area in the Western Gulf is no oil or gas resources. Because there are no resources, this scenario describes an exploration-only case. Exploration begins in 1981 and lasts three years. The maximum employment occurs in the first two years with 405 mining employees and 147 transportation employees. The Alaska share of this employment is low; at its maximum, it includes 120 mining employees and 62 transportation employees. Because there is no production, there are no property taxes generated by this project. (See Table 59.)

Definition and Measures of Impact

OCS development will lead to changes in those factors which have been isolated as important for economic growth: exogenous employment, personal income, and state expenditures. Changes in these factors will result in changes in population, the structure of employment, the state's fiscal position, and the regional distribution of growth. These changes are the economic impact of OCS development.

We will examine the impact of each of the three petroleum scenarios. The impacts will be compared to economic growth in the moderate case. The impact will vary since the scenarios vary in terms of their primary employment impact, timing, level of production, and revenues which accrue to the state. The impacts will be measured as changes from the base case. In making this comparison, it must be assumed that the economy responds the same to employment and revenues generated by Western Gulf OCS development as it did to past exogenous changes.

TABLE 59. DIRECT EMPLOYMENT REQUIREMENTS
95 PERCENT SCENARIO

	Mining[1]		Transportation	
	Total Direct Employment	SEAR Adjusted Employment	Total Direct Employment	SEAR Adjusted Employment
1981	405	120	147	62
1982	405	120	147	62
1983	137	41	40	21
1984	0	0	0	0

[1]Includes headquarters employment based on 4 persons per exploration well, .6 persons per development well, and 40 persons per 2,000,000 barrels per day during production. Once peak is reached, production employment is maintained (Alaska OCS Office).

SOURCE: Dames and Moore, 1978

Rapid economic growth associated with OCS development will affect most economic variables. Although many variables will be affected, a much smaller number is important; and information on these dimensions of impact will describe the effect of rapid growth on the state economy. Petroleum development in the Alaska OCS can have two major types of impact. First, OCS development will affect the magnitude of the economic indicators. OCS development will expand the economy. Secondly, OCS development may change the process of growth. OCS development may change certain structural trends observed in the base case. Both of these dimensions will be considered when the impact of OCS development is examined.

The impact of any specific scenario can be discussed by referring to the following set of questions:

1. How has the magnitude of economic indicators been changed by OCS development?
   a. How has the growth of the aggregate indicators of economic activity--employment, population, personal income--been affected by OCS development?
   b. How has OCS development affected the state's fiscal position? Have state revenues and expenditures changed? What is the effect on the fund balance?
   c. What is the effect of OCS development on the earning power of individuals, as measured by real per capita income?

d. What is the effect of OCS development on the average level of services, as measured by real per capita state expenditures, provided by the state?

2. Has OCS development changed the process of growth?

   a. Are the components of population growth changed in relative importance?

   b. Are past trends in the age-sex distribution and its effect on the dependency ratio changed by OCS development?

   c. Are past trends in the composition of employment changed by OCS development?

   d. Does OCS development change the interaction among regions?

Summary of the Moderate Base Case

The moderate base case is one of three base cases used in this report. The alternative base cases used in this study differ by the assumed level of previous OCS activity; the non-OCS assumptions in all three base cases are similar. The moderate base case includes moderate development scenarios of the first Lower Cook OCS lease sale area, the Beaufort Sea OCS lease sale area, and the Northern Gulf OCS lease sale area.

Substantial growth is projected over the period 1978 to 2000 for the moderate base case. Employment is projected to reach 370,496 by 2000 and grow at an annual average rate of 3.4 percent. The most rapid growth occurs with the construction of the ALCAN gasline between 1981 and 1984. Population is projected to grow at a rate slightly less than employment and reach 805,725 by 2000. Personal income is projected to expand at an average annual rate of 10.8 percent between 1978 and 2000. The growth of these aggregate variables, while substantial, is less than the growth during the period 1965-1976.

Four structural characteristics of this projected growth were observed. First, as the scale of the economy expands, the importance of the support sector increases. Secondly, the changing age distribution of the population and increased labor force participation lead to decreases in the dependency ratio (population/employment). Third, as the state grows, more of this growth is concentrated in Anchorage. Finally, the state's fund balance increases to a peak and then falls as expenditures exceed revenues and the fund balance is used to make up the difference.

The Impacts of Western Gulf OCS Development: Mean Scenario

This section will describe the economic impact of the mean Western Gulf OCS development scenario. The mean scenario impacts will be described in detail in this section, while the impacts of the 5 percent and 95 percent scenarios will be described as they relate to this scenario. The major difference between these scenarios is in the magnitude of impact; the structural characteristics are similar.

The phases of activity in the development of the Western Gulf exploration, development, and production are not distinct. Exploration begins in 1981; development begins in 1984; and production begins in 1987. This schedule of activity provides two significant time periods to examine: 1980-1986, when development and exploration occur, and 1987-1999, when only production activity occurs.

The Western Gulf mean scenario differs significantly from previous development scenarios we have examined (ISER, 1979). The most important difference for the results discussed in this report is the small size of production employment associated with the lease area. Long-term production employment in both mining employment and transportation averages only 88. Mining also drops significantly after development; Alaskan resident employment in mining falls from a peak of 118 in 1986 to 39 by 1990. The final major difference is that production ends in 1999, one year prior to the end of our normal projection period in 2000.

The differences, particularly the small size of long-term OCS employment, necessitate some caution in interpreting the model results. The small size of the direct employment associated with the project increases the relative importance of the state expenditure response to the overall impact. Western Gulf development according to the mean scenario is projected to have a negative impact on state expenditures. This projected reduction of state expenditures reduces state employment and dampens the impact of the direct OCS employment on the economy. We are not assuming that the reduction of state expenditures with increased population would be the state's response. The negative expenditure impact is a result of the expenditure rule assumed in the model. This rule determines the growth in real per capita expenditures as a function of the growth in real per capita income. Expenditures are reduced in the OCS case because real per capita income grows slower after its peak than in the base case. This, combined with the small size of the direct employment, produces a decline in expenditures. In all cases, the level of expenditures in the OCS case cannot be considered significantly different from the level in the base case. Reference to the level of OCS development in the case where there is no expenditure response will allow us to assess the effect of the expenditure rule on OCS impact.

In this case, we assume that there is no state expenditure response to OCS development and that expenditures remain at their base case levels. The difference in the impacts in the two cases is a result of the expenditure rule.

EMPLOYMENT

This section will examine the impact of OCS development on employment. Employment is one of the aggregate indicators of economic growth. OCS development increases the growth of employment over most of the projection period. OCS development not only affects the magnitude of employment growth but may also change the structure of employment observed in the base case. If OCS development affects the growth of industries differently from the base case, the structure will change.

The long-term employment impact of Western Gulf development is insignificant. By 1999, employment is projected to be only 15 greater than in the moderate base case. (See Table 60.) The average growth rate between 1980 and 1999 is 3.3 percent per year, the same as in the base case. The peak impact occurs in 1984 when employment is 1,304, or .6 percent greater than in the base case. This is the same year that total direct Alaska resident employment reaches its peak.

The overall general pattern of employment impact follows the pattern of direct Alaska resident employment. Direct employment is close to 20 percent of the total impact in 1984 when direct employment peaks. Development of the Western Gulf OCS does not prevent the fall in employment in 1983 after the peak ALCAN construction years. The growth of employment from 1980, the year of the OCS lease sale, to 1986, the end of both the exploration and development, averages 3.43 percent per year. This is only slightly faster than the 3.39 growth rate in the base case. The growth rate after 1986 is less than in the base case. The reduced rate of growth in the production period is a result of the decrease in employment impact after its peak in 1984.

Western Gulf development according to the mean scenario has insignificant long-term effects on total Alaskan employment. The projected impacts after 1989 are close to the direct OCS employment levels. In some years (1989-1991), the employment impact is negative. The major reason for this result is the projected decline in state and local government employment which results from the decline in state expenditures. After

TABLE 60. EMPLOYMENT IMPACT
WESTERN GULF OCS
MEAN SCENARIO, ALASKA

	Base Case Employment	Mean OCS Scenario Employment	Impact
1980	194,054	194,054	0
1984[1]	224,632	225,936	1,304
1985	227,742	228,576	834
1986[2]	236,983	237,589	606
1990	278,055	277,993	-62
1995	312,619	312,695	75
1999	357,663	357,679	15

[1]Peak direct Alaska resident employment.

[2]The end of the exploration-development phase.

SOURCE: MAP Model

1990, state and local government employment averages about 100 less than in the base case. The effect of eliminating this expenditure impact is to increase the growth of total employment. With constant expenditures case, the employment impact of Western Gulf development is 278 in 1999, which is .8 percent greater than the base.

The growth caused by OCS development does not significantly change the structure of employment from that observed in the base case. Table 61 compares the structure of the economy, as described by the employment distribution in the base and impact cases. The major change in the structure of the economy observed in the base case is supported by the introduction of the mean Western Gulf OCS development scenario. The support sector increases in importance throughout the projection period, increasing to approximately 53 percent in both cases.

POPULATION

Population is an aggregate indicator of economic activity which measures the response of people to increased employment opportunities. OCS development will increase the magnitude of population growth. OCS development may also change the characteristics of the population such as the age-sex distribution or the importance of the components of change. This section will examine the impact on population of Western Gulf OCS development.

Population is only 376 greater by 2000 because of Western Gulf OCS development. Population impact peaks in 1984 at about 1,900 which is less than one percent greater than the base case. This is the year in

TABLE 61. THE STRUCTURE OF THE ECONOMY
MEAN SCENARIO
ALASKA

	Proportion of Total Employment				
	1980	1985	1990	1995	2000
Support Sector					
Moderate Base	39.5	42.9	46.8	49.8	53.2
Mean Scenario	39.5	43.0	46.8	49.8	53.2
Government					
Moderate Base	36.0	32.7	28.8	26.2	22.9
Mean Scenario	36.0	32.7	28.8	26.2	22.8
Basic Sector					
Moderate Base	24.5	24.3	24.4	24.0	24.0
Mean Scenario	24.5	24.3	24.4	24.0	24.0

Support Sector includes transportation-communication-public utilities, trade, finance, and service employment.

Government includes state, local, and federal employment.

Basic Sector includes mining, manufacturing, agriculture-forestry-fisheries, and construction employment.

which both the employment impact and the level of direct Alaska resident employment on the project reach their peak. The average growth rate between 1980 and 1999 is 3.1 percent per year. This is not significantly different from the growth rate in the base case. As in the base case, population grows slightly slower than employment; the dependency ratio falls from 2.28 in 1978 to 2.18 in 1999. Table 62 describes the population impact. This pattern of population impact is also affected by the reduction is state government employment. When state expenditures are held constant between the base and mean scenario cases, the 1999 population impact more than doubles.

The pattern of growth is affected by OCS development. The development of the Western Gulf OCS does reverse the decrease experienced after the peak ALCAN construction year, 1983. The peak population impact of the Western Gulf occurs in 1984. The addition of this employment results in a slight increase in population between 1983 and 1984. Population, like employment, grows faster than in the base case in the period from the beginning of exploration to the end of development and slower after that. Between 1980 and 1986, the average annual rate of growth is 3.5 percent in the mean scenario and 3.4 percent in the base case. Between 1986 and 1999, the rate of growth in the mean scenario is 3.2 percent compared to 3.3 percent in the base case. The main reason for this differential growth is that impact population increases throughout exploration and development. Once production begins, impact population stabilizes at a level lower than the peak.

TABLE 62. POPULATION IMPACT
WESTERN GULF OCS
MEAN SCENARIO, ALASKA

	Base Case Population	Mean OCS Scenario Population	Impact
1980	434,173	434,173	0
1984[1]	503,802	505,702	1,900
1985	513,372	514,895	1,523
1986[2]	530,903	532,225	1,321
1990	612,523	612,961	438
1995	692,017	692,525	508
1999	780,692	781,069	376

[1] Peak direct Alaska resident employment.

[2] The end of the exploration-development phase.

SOURCE: MAP Model

Table 63 compares the role of migration in population change between 1981 and 1992. These years cover the peak development years when the population impact from OCS development increases to its peak in 1984 and then falls to a constant level of approximately 500 by 1989. The importance of migration as a component of population change does not significantly differ from the base case during this period. Migration accounts for over 50 percent of the population change between 1981 and 1983 and between 1986 and 1990 in both case. After 1990, migration is less important to population growth than natural increase. The decrease in level of employment in the Northern Gulf and Western Gulf and the higher number of births resulting from high population are responsible for this effect. The small size of the Western Gulf employment impact results in its having little effect on the overall components of population growth. The major effect of this development occurs in 1984 when it reduces out migration by 1,386, or 14 percent.

Two related trends concerning the structure of the population were observed in both the base case and the historical period. The first was the reduction in the dependency ratio. This trend is also projected to occur in the Western Gulf development case. By 2000, the dependency ratio in both the base and OCS development cases has fallen. The dependency ratio is 2.18 in 2000 with OCS development. The major reasons for this are an increase in the labor force participation of the working-age population and an increase in the proportion of working-age population in the population. This is related to the second observed change in the structure of the population, the aging of the population. Table 64

TABLE 63. THE MIGRATION COMPONENT OF POPULATION CHANGE
WESTERN GULF MEAN OCS SCENARIO
1981-1992

	Migration as a Percent of Total Population Change	
	Moderate Base Case	Mean OCS Scenario
1981	67.4	68.0
1982	75.6	75.7
1983	50.8	50.4
1984[1]	-	-
1985	14.5	10.2
1986	53.6	52.8
1987	59.7	58.6
1988	58.8	58.4
1989	55.4	54.9
1990	50.0	49.6
1991	28.5	28.7
1992	25.5	25.6

[1]End of ALCAN. Net out-migration occurs.

SOURCE: MAP Model

TABLE 64. AGE-SEX STRUCTURE OF THE POPULATION
WESTERN GULF MEAN OCS SCENARIO
ALASKA

	1980		2000	
Age Cohorts	Males	Females	Males	Females
0-14	15.08	14.56	14.27	13.81
15-29	18.47	14.33	15.82	13.08
30-49	13.35	12.12	14.84	13.38
50-59	3.31	2.92	3.83	3.71
60 +	3.06	2.81	3.37	3.91

SOURCE: MAP Model

shows the age-sex distribution prior to OCS development and at the end of the projection period. As in the base case, the population is projected to age. The population over 30 increases from 37.6 percent in 1980 to 43 percent in 2000.

PERSONAL INCOME

The final aggregate indicator of economic growth is personal income. The overall impact of OCS development is to increase personal income slightly relative to the base case. (See Table 65.) By 1999, Western Gulf OCS development will have increased the level of personal income by one million, less than one percent above the base case. Personal income is projected to increase at an average annual rate of 10.6 percent between 1980 and 1999. This is in both the OCS and the base cases. The peak impact occurs in 1984, when personal income is $100.4 million, or 1.2 percent greater than in the base case. The long-term personal income impact is higher when state expenditures are held to their base case levels. In 1999, the impact is $40 million in this case. Even correcting for the effect of state expenditures, the Western Gulf impact on personal income is small.

The impact of Western Gulf OCS development on personal income rises to its 1984 peak, then falls until 1991. This coincides with the decrease in the level of project employment. OCS development is not enough to prevent the fall in personal income after the peak ALCAN year in 1983. The magnitude of the fall is similar in both the base and impact cases. Growth in personal income averages a rate of 11.2 percent per year during

TABLE 65. PERSONAL INCOME IMPACT
WESTERN GULF OCS MEAN SCENARIO
ALASKA

(Millions of Nominal Dollars)

	Base Case Personal Income	Mean OCS Scenario Personal Income	Impact
1980	5,395	5,395	0
1984[1]	8,360	8,461	100
1985	9,008	9,063	55
1986[2]	10,155	10,198	44
1990	15,919	15,914	-5
1995	24,367	24,375	9
1999	36,514	36,516	1

[1] Peak direct Alaska resident employment.

[2] The end of the exploration-development phase.

SOURCE: MAP Model

the development and exploration phase. After the end of this phase in 1986, the average rate of growth is 10.3 percent per year. As with employment and population, the rate of growth of personal income is faster during the exploration-development phase than during the same time period in the base case and slower than in the base case after this period.

The growth in personal income reflects the ability of the economy to generate increased returns to factors. It is not the best measure of the welfare of the region because it reflects both the growth of employment and prices. One measure of welfare is real per capita income. This measures the command of the average individual over goods and services. Real per capita income accounts for the effect of prices and population on the growth in personal income. Table 66 shows the impact of Western Gulf development on real per capita income. The development of the Western Gulf OCS has two differential periods of impact. OCS activity has a positive effect on real per capita incomes until 1986; after this, the impact on real per capita income is negative. The impact on real per capita income is greatest in 1984, the year of the peak direct Alaska resident construction employment; real per capita income is $30, or 0.6 percent greater than in the base case. By 1999, real per capita income is less than but not significantly different from the base case. The differential between the OCS development and base cases is affected by the composition of employment. The greatest difference occurs when the peak in high wage construction employment occurs, not when the peak in total employment occurs. Real per capita income as a measure of welfare does not consider the distribution of income.

TABLE 66. REAL PER CAPITA INCOME IMPACT[1]
WESTERN GULF OCS MEAN SCENARIO
ALASKA

	Real Per Capita Income			Relative Price Index		
	Base Case	Mean Scenario	Impact	Base Case	Mean Scenario	Impact
1980	4,029	4,029	0	308.4	308.4	0
1984[2]	4,448	4,479	30	373.0	373.6	.6
1985	4,511	4,521	10	389.0	389.3	.3
1986[3]	4,687	4,692	6	408.1	408.4	.2
1990	5,250	5,245	-5	495.0	495.0	0
1995	5,706	5,704	-2	617.1	617.1	0

[1]Deflated by Alaska RPI.

[2]Peak real per capita income impact. Peak direct Alaska resident employment.

[3]The end of the exploration-development phase.

SOURCE: MAP Model

The OCS development of the Western Gulf has no significant effect on Alaskan price levels because of the small size of the direct employment effect. The relative price index is less than one point greater than in the base by 1986, the end of the exploration-development phase. After 1986, the economy in the OCS development case is projected to expand less rapidly than in the base case. Because of this, prices do not increase so fast in the OCS case, and the price differential between the cases is eliminated.

THE STATE FISCAL POSITION

The development of the Western Gulf OCS will affect the state fiscal position in two ways. First, OCS development will affect the revenues received by the state. Although the state will not receive direct revenues from the OCS activity in this scenario, the extra economic growth which will result because of OCS activity will generate additional state revenues. Secondly, OCS development will affect the state's fiscal position through its impact on state expenditures. The change in population and economic activity which will result from OCS development may change the determinants of state expenditures. The interaction of expenditures and revenues will affect the fund balance and the level of services provided by the state. This section will describe the impact of OCS development on the state's fiscal position.

REVENUES

The OCS development of the Western Gulf of Alaska produces no direct revenues for the state. This major source of revenues are those revenues generated by the growth of the economy and earnings of the permanent fund. Table 67 illustrates the impact of OCS development on total general fund revenues and endogenous revenues, which is the component of general fund revenues. By 1986, total general fund revenues are about $3.8 billion. This is $4 million greater than in the base case. The revenue impact falls with the decrease in direct employment until 1992, when direct resident employment stabilizes. After 1995, the revenue impact increases. By 1999, the impact on total general fund revenues is $13 million. Total general fund revenues grow only slightly faster because of OCS development over the 1980-to-1999 period.

Prior to 1990, the major component of the impact revenues are the endogenous revenues, those revenues generated by the growth of the economy.[1] These revenues include income taxes and business taxes. The income taxes paid by OCS resident Alaska employees are included in these revenues. When the impact on general fund revenues peaks initially in 1985 at $7 million, endogenous revenues account for 86 percent of the revenue impact. By 1999, the majority of the revenue impact is projected to result from increased earnings on the fund balances. In 1999, the extra earnings on the fund balances account for approximately 92 percent of the additional revenues.

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[1]Endogenous revenues include personal income taxes, nonpetroleum corporate income taxes, business license taxes, motor fuels tax, alcohol tax, cigarette tax, ad valorem tax, school tax, fees and license revenues, ferry revenues, and miscellaneous taxes and revenues.

TABLE 67. STATE REVENUE IMPACT
WESTERN GULF OCS MEAN SCENARIO
ALASKA

(Millions of Nominal Dollars)

	General Fund Revenues			Endogenous Revenues		
	Base Case	Mean Scenario	Impact	Base Case	Mean Scenario	Impact
1980	1,625	1,625	0	231	231	0
1984[1]	3,230	3,234	4	452	455	3
1985	3,639	3,646	7	458	464	6
1986[2]	3,833	3,837	4	515	519	4
1990	4,804	4,806	2	945	944	-1
1995	5,911	5,918	8	1,647	1,647	1
1999	7,316	7,330	13	2,761	2,761	1

[1] Peak direct Alaska resident employment.

[2] The end of the exploration-development phase.

SOURCE: MAP Model

STATE EXPENDITURES

The pattern of projected state expenditure impacts has a significant effect on the overall impact pattern projected for Western Gulf OCS development. Table 68 shows the expenditure impact of OCS development. Two distinct periods of impact occur. Prior to the end of the development phase in 1986, expenditure impacts are positive; after 1986, total state expenditures are reduced by Western Gulf OCS development. State expenditure impacts peak in 1985 at $10 million. By 1999, state expenditures are $19 million less than in the base case. At both its peak in 1985 and at the end of production in 1999, the difference from the base case is insignificant; in both cases, the difference is less than 0.5 percent of the base level. The OCS development of the Western Gulf according to the mean scenario has little effect on state expenditures.

Expenditures increase for two reasons. First, expenditures increase because of increases in population and prices. As population and prices increase, expenditures must increase to maintain the same level of service. Secondly, expenditures will increase if the level of service provided by state government increases. Real per capita expenditures are a measure of the level of services provided by the state. Table 68 shows the impact of OCS development on the real per capita expenditures. Real per capita expenditures are less than in the base case throughout the period. The difference is less than one percent throughout the period. The maximum difference in real per capita expenditures is in 1984, when they are $5 less than in the base case. By 1999, real per capita expenditures are only $4 less with OCS development.

TABLE 68. STATE GOVERNMENT EXPENDITURE IMPACTS
WESTERN GULF OCS MEAN SCENARIO
ALASKA

	Total State Expenditures (Millions of Nominal Dollars)			Real Per Capita State Expenditures[1]		
	Base Case	Mean Scenario	Impact	Base Case	Mean Scenario	Impact
1980	1,567	1,567	0	1,170	1,170	0
1984[2]	2,595	2,598	3	1,381	1,375	-5
1985	2,762	2,772	10	1,383	1,383	0
1986[3]	3,099	3,099	0	1,430	1,426	-4
1990	4,713	4,703	-10	1,554	1,550	-4
1995	6,733	6,723	-10	1,577	1,573	-4
1999	9,296	9,277	-19	1,601	1,597	-4

[1]Deflated by Alaska RPI.

[2]Peak direct Alaska resident employment.

[3]The end of the exploration-development phase.

SOURCE: MAP Model

FUND BALANCE

The state's fund balance consists of the total of the permanent and general fund. The permanent fund will not be affected by Western Gulf OCS development because OCS development on the Western Gulf does not produce the type of revenues subject to the permanent fund. The fund balance impact will be on the general fund. The fund balance follows the same pattern as in the base case, rising to a peak in 1997 and then falling as the fund balance is drawn on to meet expenditures. However, development of the Western Gulf OCS according to the mean scenario increases the level of the fund balance. This is not a suprising result since state expenditures are reduced and revenues increased because of this development. By the end of the exploration-development phase in 1986, the fund balance is projected to be $3 million greater than in the base case. By the end of the production period in 1999, the fund balance is $204 million, or almost one percent less than in the base case. The increased fund balance generates more interest revenue which contributes to the increased fund balance. Table 69 shows the same pattern when the fund balance is adjusted for price increases. By 1999, the real fund balance is increased by $69 million. General fund revenues minus general fund expenditures describe the balance between revenues and expenditures. The addition of the Western Gulf OCS development according to the mean scenario increases general fund revenues net of expenditures above the base case levels. During this period, the revenue impact of OCS development is greater than the expenditure impact. This is responsible for the positive fund balance impact in this scenario.

TABLE 69. IMPACT ON STATE FISCAL POSITION
WESTERN GULF OCS MEAN SCENARIO
ALASKA

	Real Fund Balance (constant 1977 dollars)			General Fund Revenues Minus General Fund Expenditures (millions of nominal dollars)		
	Base Case	Mean Scenario	Impact	Base Case	Mean Scenario	Impact
1980	1,090	1,090	0	361	361	0
1984[1]	3,051	3,046	-5	1,140	1,141	1
1985	3,854	3,849	-5	1,426	1,426	0
1986[2]	4,519	4,518	-1	1,364	1,369	5
1990	6,199	6,219	20	1,004	1,016	12
1995	6,360	6,405	45	409	426	17
1999	5,256	5,326	69	-305	-276	29

[1]Peak direct Alaska resident employment.

[2]The end of the exploration-development phase.

SOURCE: MAP Model

The overall impact of Western Gulf OCS development on the state fiscal position is ambiguous. The fiscal position is a combination of the impact on state services as measured by real per capita expenditures and the fund balance. According to these projections, Western Gulf development causes each of these measures to move in opposite directions. The fund balance is increased because of OCS development. The increase results because of a reduction in state expenditures which results partially from decrease in the level of real per capita expenditures.

THE REGIONS

This section examines the regional impacts of OCS development on two regions, Anchorage and Southcentral Alaska. Different types of impact can be expected in each region since the character of the regions differs. Anchorage is the metropolitan center of the state. OCS development will impact Anchorage both through the direct OCS headquarters employment and through Anchorage's role as the administrative and distributive center for the state. Southcentral will be mainly affected by the direct OCS development; Western Gulf activity occurs within Southcentral Alaska. This section will describe the impact of OCS activity on each region in terms of the growth of the aggregate indicators of economic growth--population, employment, and disposable real personal income--and changes in the structure of the economy as measured by the distribution of employment.

Anchorage

Table 70 shows the impact on Anchorage of developing the Western Gulf OCS according to the mean scenario. The pattern of these indicators is similar to that found for the state. The pattern of increase is determined by the pattern of direct resident employment impact and the level of state government expenditures. The projected reduction in state government expenditures is important for Anchorage since Anchorage growth is not directly influenced by OCS activity.

Population is projected to increase to 415,474 by 1999 with Western Gulf OCS development. This is only an 158 increase over the base case. Population grows at an average annual rate of 3.7 percent from 1980 to 1999. This is approximately the same as the rate in the base case. The Anchorage population impact peaks in 1984, when population is 1,016 greater than in the base case. Even though the major direct employment occurs in the Southcentral region, Anchorage has almost half of the population impact. In 1984, 53 percent of the state population impact occurs in Anchorage; by 1999, the Anchorage impact is 42 percent of the statewide impact. As in the base case, population continues to concentrate in Anchorage. By 1999, Anchorage contains 53.2 percent of the state population in both the base case and the OCS development case.

The reduction in state expenditures influences the pattern of OCS employment impact in Anchorage. By 1999, employment is projected to be 191,176, which is approximately the same as in the base case. The Anchorage employment impact also peaks in 1984 at 613 which is 0.5 percent greater

TABLE 70. IMPACT ON AGGREGATE INDICATORS OF ECONOMIC GROWTH
WESTERN GULF OCS MEAN SCENARIO
ANCHORAGE

	Population		
	Base Case	Mean Scenario	Impact
1980	207,323	207,323	0
1984[1]	244,577	245,593	1,016
1985	249,962	250,689	726
1986[2]	259,583	260,177	594
1990	305,932	306,153	221
1995	357,795	358,002	207
1999	415,315	415,474	158

	Employment		
	Base Case	Mean Scenario	Impact
1980	91,938	91,938	0
1984	109,304	109,917	613
1985	111,258	111,642	384
1986	116,354	116,606	253
1990	139,743	139,698	-45
1995	162,462	162,481	18
1999	191,184	191,176	-8

	Real Disposable Personal Income[3] (Millions of Constant Dollars)		
	Base Case	Mean Scenario	Impact
1980	677	677	0
1984	867	874	7
1985	899	903	4
1986	958	961	2
1990	1,235	1,235	0
1995	1,547	1,547	0
1999	1,938	1,937	0

[1] Peak direct Alaska resident employment.

[2] The end of the exploration development phase.

[3] Deflated by Alaska RPI.

SOURCE: MAP Model

than the base case population. Between 1980 and 1986, employment grows at about 4 percent in both the base and OCS cases. As in the base case, population increases slower than employment, and the dependency ratio has fallen to 2.17 by 1999.

Real disposable income is projected to approximately $2.0 billion in 2000. Real disposable income increases at an average rate of 5.7 percent per year from 1980 to 1999 in both cases. There is no long-term impact on real disposable income projected.

Economic Structure. The impact of OCS development in the Western Gulf may not affect all industries equally. Table 71 illustrates the effect of OCS development on the structure of employment. All of the industrial sectors grow with OCS development. As in the base case, the most rapid growth occurs in the support sector. Over the impact period, 1980-2000, transportation-communication-utilities and local construction increases its share of employment from 14.9 percent to 17.7 percent; and trade, services, and finance-insurance-real estate increases its share from 46.4 percent to 58.9 percent. The basic sector maintains a relatively constant share of employment; the increase in this sector comes mainly from the growth in manufacturing. Although government employment increases, its share falls from 34.6 percent to 19.2 percent between 1980 and 2000. The development of the Western Gulf OCS supports the changing structure of the economy projected in the base case.

TABLE 71. ECONOMIC STRUCTURE
WESTERN GULF OCS MEAN SCENARIO
ANCHORAGE

	Support Sector I		Support Sector II		Government		Basic Sector	
	Employment	% of Total	Employment	% of Total	Employment	% of Total	Employment	% of Total
1980	42,516	46.4	13,652	14.9	31,763	34.6	3,746	4.1
1985	55,173	49.7	17,524	15.8	33,574	30.3	4,642	4.2
1990	74,004	53.6	22,852	16.6	35,541	25.7	5,705	4.1
1995	89,431	56.0	27,207	17.0	36,338	22.7	6,793	4.3
2000	114,587	58.9	34,495	17.7	37,400	19.2	8,107	4.2

Support Sector I includes trade, services, and finance-insurance-real estate employment.

Support Sector II includes transportation-communication-public utilities and other construction employment.

Government includes state, local, and federal employment.

Basic Sector includes manufacturing, agriculture-forestry-fisheries, mining, and exogenous construction employment.

SOURCE: MAP Model

Southcentral Alaska

Table 72 describes the impact of Western Gulf OCS development according to the mean scenario on the Southcentral region of Alaska. This table shows three aggregate indicators of economic growth which are projected to increase with OCS development. The lease sale area is located in the Southcentral region so that the major direct impact will occur in this region. The relatively underdeveloped support sector of the region will limit the impact of OCS development.

Population is projected to grow at an average annual rate of 1.9 percent from the lease sale in 1980 to 1999. By 1999, the population is 85,053, which is 251 greater than in the base case. The peak population impact occurs at the end of the exploration-development phase in 1986. Population is almost 611 greater than in the base case.

Employment is projected to increase to 38,142 by 1999, which is only 96 greater than in the base case. With Western Gulf development, employment increases at an annual rate of 2.5 percent between 1980 and 1999 in both cases. Peak employment impact occurs in 1984 when peak direct Alaska resident employment occurs. In 1984, employment is 405 greater than in the base case. Direct resident OCS employment accounts for 64 percent of the total employment impact in 1990 and 64 percent in 2000. The employment impact is always positive in Southcentral; state government employment plays a smaller role in this region than in Anchorage.

TABLE 72. IMPACT ON AGGREGATE INDICATORS OF ECONOMIC GROWTH
WESTERN GULF OCS MEAN SCENARIO
SOUTHCENTRAL

	Population		
	Base Case	Mean Scenario	Impact
1980	59,054	59,054	0
1984[1]	64,866	65,404	538
1985	66,203	66,667	464
1986	68,340	68,952	611
1990	76,801	77,022	221
1995	78,879	79,181	301
1999	84,802	85,053	251

	Employment		
	Base Case	Mean Scenario	Impact
1980	23,745	23,745	0
1984	26,732	27,137	405
1985	27,497	27,737	240
1986	28,810	29,091	280
1990	33,520	33,590	70
1995	34,629	34,744	115
1999	38,046	38,142	96

	Real Disposable Personal Income[2] (Millions of Constant Dollars)		
	Base Case	Mean Scenario	Impact
1980	184	184	0
1984	221	228	7
1985	235	239	3
1986	256	260	4
1990	329	329	1
1995	355	356	2
1999	421	423	1

[1]Peak direct Alaska resident employment.

[2]Deflated by Alaska RPI.

SOURCE: MAP Model

Real disposable personal income in 1999 is only $1 million greater than the base case because of OCS development. As with the employment impacts, the peak real disposable personal income impact occurs with peak Alaska resident project employment in 1984. Real disposable personal income is $7 million, or 3 percent greater than in the base case in 1990. The importance of the high wage OCS employment results in this increase. Western Gulf OCS development has its major impact on Southcentral Alaska.

ECONOMIC STRUCTURE

Western Gulf OCS development according to the mean scenario supports the structural change which was projected in the base case. All sectors increase employment between 1980 and 2000; however, the rate of increase differs between industries. As in the base case, government's share decreases from 20.2 percent in 1980 to 16.3 percent. Trade, service, and finance-insurance-real estate expands its share of employment from 38.2 percent to 42.6 percent between 1980 and 2000. This response is expected since the local economy will expand the goods and services produced locally as its scale increases. With the buildup of OCS activity in the Northern and Western Gulf, the basic sector increases its share from 26.9 percent in 1980 to 27.5 percent in 1990. After the peak in Northern Gulf activity and the shutdown of the Upper Cook Inlet fields in 1990, the basic sector's share of total employment is reduced to 25.5 percent. Table 73 describes these structural changes.

TABLE 73. ECONOMIC STRUCTURE
WESTERN GULF OCS MEAN SCENARIO
SOUTHCENTRAL

	Support Sector I		Support Sector II		Government		Basic Sector	
	Employment	% of Total	Employment	% of Total	Employment	% of Total	Employment	% of Total
1980	9,173	38.2	3,515	14.7	4,837	20.2	6,462	26.9
1985	10,865	38.7	4,380	15.6	5,427	19.3	7,406	26.4
1990	13,345	39.1	5,370	15.7	6,046	17.7	9,384	27.5
1995	14,678	41.3	5,480	15.4	6,256	17.6	9,091	25.6
2000	17,155	42.6	6,155	15.3	6,539	16.3	10,369	25.8

Support Sector I includes trade, services, and finance-insurance-real estate employment.

Support Sector II includes transportation-communication-public utilities and other construction employment.

Government includes state, local, and federal employment.

Basic Sector includes manufacturing, agriculture-forestry-fisheries, mining, and exogenous construction employment.

SOURCE: MAP Model

The Impacts of Western Gulf OCS Development: 5 Percent Scenario

The five percent probability resource level scenario projects a higher level of oil and gas discovery than the mean scenario. The higher level of discovery requires greater development activity than in the mean scenario. The most important difference between these scenarios is the magnitude of direct employment; differences in magnitude are also the major differences between the impacts associated with each scenario. This section will describe the magnitude of the impact associated with the 5 percent scenario in terms of four measures of economic activity: employment, population, state expenditures, and the fund balance. We will also compare the structural similarities and differences between the mean scenario and the 5 percent scenario.

The five percent scenario includes the development of two fields. Oil and non-associated gas are developed in the Albatross Basin, and only oil is developed in the Tugidak Basin. For our analysis, we will concentrate on the period between the lease sale in 1980 and the end of development in 1990. Peak direct resident employment occurs in 1985. The period after 1990 is dominated by production.

GENERAL PATTERN OF GROWTH

The general pattern of development projected with the inclusion of the 5 percent Western Gulf scenario is shown in Table 74. Four indicators--employment, population, state expenditures, and the real fund balance--are shown. The other variables mentioned in the discussion can be found

TABLE 74. THE IMPACT ON MAJOR ECONOMIC INDICATORS
WESTERN GULF OCS 5 PERCENT SCENARIO
ALASKA

	Population			Employment		
	Base Case	5% Scenario	Impact	Base Case	5% Scenario	Impact
1980	434,173	434,173	0	194,054	194,054	0
1985[1]	513,372	523,415	10,043	227,742	234,154	6,412
1990[2]	612,523	622,824	10,301	278,055	282,362	4,307
1995	692,017	699,740	7,723	312,619	314,665	2,045
2000	805,725	813,749	8,025	370,496	372,859	2,363

	State Expenditures (Millions of Nominal Dollars)			Real Fund Balance[3] (Millions of Constant Dollars)		
1980	1,567	1,567	0	1,090	1,090	0
1985	2,762	2,806	44	3,853	3,821	-32
1990	4,713	4,753	40	6,199	6,178	-21
1995	6,733	6,730	-3	6,360	6,406	45
2000	10,135	10,121	-14	4,841	4,982	141

[1] Peak direct resident employment.

[2] End of exploration and development phase.

[3] Deflated by Alaska RPI.

SOURCE: MAP Model

in Appendix D. This scenario, like the mean scenario, increases employment, population, and state expenditures throughout the projection period. In this section, we will discuss the impact of Western Gulf OCS development according to the 5 percent scenario.

Population is projected to be 813,749 by 2000. This is 8,025, or 1.0 percent greater than population in the base case population. Between 1980 and 2000, the population growth rate averages 3.2 percent per year, which is greater than the 3.1 percent rate in the base case for the same time period. The maximum increase in population resulting from OCS development occurs in 1988 when population is almost 10,400 greater than in the base case. This is after direct resident construction employment reaches its peak and results from a combination of increased natural increase. By 1990, when development ends, population impact is approximately the same, 10,300. The growth rate between 1980 and the end of development averages 3.7 percent per year, compared to 3.5 percent in the base case. After the major development and exploration activity is over in 1991, the growth slows to 2.7 percent per year, which is slightly less than the base case growth rate during this same period.

The pattern of population growth and impact can be explained by the growth of total employment. Total employment is projected to be 2,363 or 0.6 percent greater than in the base case by 2000. The inclusion of the Western Gulf 5 percent development scenario increases the growth rate between 1980 and 2000 from 3.1 percent per year in the base case to 3.3 percent per year. The maximum increase in employment occurs in 1985, the year of peak direct employment impact.

The state fiscal position is affected by Western Gulf OCS development according to the 5 percent scenario. This impact is shown by state expenditures and the real fund balance. State expenditures are projected to increase to $10.1 billion by 2000; this is less than in the base case by 0.1 percent. This insignificant difference is a result of growth in real per capita income similar to the moderate case. The growth rate between 1980 and 2000 is only slightly different from the base case. State expenditures grow at approximately 9.8 percent per year over the period in both cases. The average rate of growth in expenditures is 11.2 percent per year between 1980 and 1990 and that falls to 7.9 percent per year between 1991 and 2000. Expenditures grow slightly faster in the base case after 1991. As in the mean scenario, all determinants of the growth in expenditures--population, prices, per capita real income--grow slower during this period as the adjustment from peak impact to production employment is made. The growth in expenditures is not so rapid as either population or prices. Because of this, real per capita expenditures are lower than in the base case. By 2000 real per capita expenditures are $20 less than in the base case.

The pattern of the real fund balance growth in this scenario is similar to the base case pattern. The real fund rises to a maximum amount in 1993, then falls in both cases. With Western Gulf OCS development, the real fund balance rises to a maximum of almost $6.5 billion by 1993. After this, the fund is drawn down as the general fund is used to make up the difference between expenditures and revenues. The pattern of fund balance growth with Western Gulf OCS development in the 5 percent scenario differs in two ways from the base case. First, the peak in 1993 is greater. The real fund balance is $14 million greater in 1993 with OCS development. Secondly, the real fund balance does not fall by as much after 1993. By 2000, the real fund balance is actually greater by $141 million than in the base case; the fund balance is 2.9 percent greater in 2000 because of OCS development.

STRUCTURAL SIMILARITIES AND DIFFERENCES

The major structural characteristics of the projected economic growth which were observed to be important in the base case were the increased importance of the support sector, the decreasing dependency ratio, the concentration of population in Anchorage, and the pattern of fund balance growth. The mean Western Gulf OCS development scenario was shown to support the base case trends. Table 75 compares indicators of these structural characteristics between the mean scenario and the 5 percent scenario.

Similar structural changes occur in both the mean and 5 percent scenario cases. Both of these scenarios support the base case trends projected in these characteristics.

TABLE 75. STRUCTURAL CHARACTERISTICS OF THE ALASKA ECONOMY
WESTERN GULF OCS 5 PERCENT SCENARIO

	1980	1990	2000
Percent of Employment in the Support Sector			
Mean Scenario	39.5	46.8	53.2
5% Scenario	39.5	47.0	53.3
Dependency Ratio (Population/Employment)			
Mean Scenario	2.24	2.21	2.18
5% Scenario	2.24	2.21	2.18
Percent of Population in Anchorage			
Mean Scenario	47.8	50.0	53.5
5% Scenario	47.8	49.9	53.5
General Fund Revenues Minus General Fund Expenditures (Millions of Nominal Dollars)			
Mean Scenario	361	1,016	-504
5% Scenario	361	1,017	-428

The Impact of Western Gulf OCS Development: 95 Percent Scenario

Table 76 shows the impact of the 95 percent Western Gulf OCS development scenario on employment, population, state expenditures, and fund balance. This scenario describes the exploration-only case when no petroleum resources are found. The scenario has only minimal impact on the Alaska economy.

Exploration occurs between 1981 and 1983. There is direct OCS employment only in those years. The scenario increases employment and population by less than one percent. The maximum population impact occurs in 1982 when population is .2 percent greater than in the base case. At its maximum difference, employment is only .2 percent greater than in the base case.

The long-term impact is a result of adjustments during the exploration phase. For example, the growth during exploration phase increases state expenditures. State expenditures increase from this new base throughout the projection period. The major long-term impact of this development scenario is on the fund balance. By 2000, the real fund balance is $9 million less than in the base case. The increased expenditures and the reduced interest revenues account for the growing negative impact on fund balances.

The minimal impact of this scenario means that it will not affect the structural changes found in the base case.

TABLE 76. THE IMPACT ON MAJOR ECONOMIC INDICATORS
WESTERN GULF OCS 95 PERCENT SCENARIO
ALASKA

	Population			Employment		
	Base Case	95% Scenario	Impact	Base Case	95% Scenario	Impact
1980	434,173	434,173	0	194,054	194,054	0
1981	456,078	456,530	452	206,859	207,193	334
1982	487,441	488,154	712	225,394	225,883	489
1983	504,694	505,236	542	231,506	231,820	313
2000	805,725	805,825	101	370,496	370,508	12

	State Expenditures (Millions of Nominal Dollars)			Real Fund Balance[1] (Millions of Constant Dollars)		
1980	1,567	1,567	0	1,090	1,090	0
1981	1,744	1,744	0	1,485	1,485	0
1982	2,019	2,022	4	1,916	1,914	-2
1983	2,380	2,385	5	2,350	2,347	-3
2000	10,135	10,136	1	4,840	4,831	-9

[1]Deflated by Alaska RPI.

SOURCE: MAP Model

Summary and Conclusions

Western Gulf OCS development will change the magnitude of economic indicators. In all three cases--the 5 percent, mean, and 95 percent scenarios--the aggregate indicators of economic activity increase. Even though the aggregate indicators increase, the long-term inpact of Western Gulf OCS development will be insignificant. If the Western Gulf OCS is developed according to the 5 percent scenario, employment will be 0.6 percent larger than the base case in 2000; population will be 1.0 percent larger; and personal income will be 0.9 percent larger. The mean scenario increases employment by only 12 over the base case at the end of production in 1999; population, by 376; and personal income, by $1 million. The 95 percent scenario is the exploration-only case, and it increases the aggregate indicators by less than one percent.

The pattern of overall impact is due to two factors. First, the direct impact of Western Gulf development is small. In the mean case, long-term direct employment is only 86. Secondly, the pattern of the growth of real per capita income results in a decrease in state expenditures in the final years of both production cases. This fall dominates the moderate case and dampens the impacts in the high case. This effect cannot be assumed to describe the reaction of the state to increased growth; it is a technical result of our assumed state spending rule. Because expenditures are reduced, the impact of OCS development on the fund balance is positive in both the production cases.

Two measures of individual welfare are real per capita income and real per capita state expenditures. In both development cases, the impact on real per capita income is positive during exploration and development. Once production begins, the changing composition of employment and higher prices lead to a reduction in real per capita incomes below the base case levels. Real per capita expenditures are less than in the base case in both production cases.

Overall, the process of growth remains unchanged by OCS development. The structural changes and changing relationships projected in the base case are supported by OCS development. The increased proportion of employees in the population is also observed in both development cases. As in the base case, the increased scale of the economy increases the importance of the support sector as the economy provides more of its own goods and services. Finally, development of the Western Gulf OCS increases the concentration of population in Anchorage.

V. THE IMPACT OF WESTERN GULF OCS DEVELOPMENT: THE CUMULATIVE CASE

The impact of Western Gulf OCS development will depend on the base case to which it is compared. In Chapter III, we developed three base cases, each containing a different level of previous OCS lease sale activity. Varying the base case by the level of previous OCS activity will allow us to bracket the range of possible Western Gulf OCS impact. The sensitivity of the Western Gulf OCS impacts to the level of previous OCS activity is of interest. In the last chapter, we provided an analysis of the impact of OCS development relative to the moderate base case. In this chapter, we will examine the range of impacts from the 5 percent scenario on the high base case and the 95 percent scenario on the low base case. For the most part, these impacts will differ only in magnitude from those discussed in the mean scenario. The changes in magnitude will be described by the general pattern of growth. Structural similarities and differences will also be discussed.

The Impact of Western Gulf OCS Development At the 5 Percent Level: The High Base Case

THE HIGH BASE CASE

The major difference between the high and moderate base cases is the level of activity assumed in the Lower Cook, Beaufort, and Northern Gulf OCS lease sale areas. The high case has a peak direct employment which is more than one-and-one-half times greater than in the moderate case in the Lower Cook, 24 percent greater in the Beaufort, and 81 percent greater in the Northern Gulf. The high Lower Cook scenario also includes construction and operation of an LNG facility. The high base case has greater levels of economic activity than the moderate case. Population is projected to be 837,888 by 2000 in the high base case, with a 3.3 percent average annual growth rate. Employment is projected to increase to 381,508 by 2000. This is almost 11,012 greater than employment in the moderate base case. The overall state fiscal position differs between the cases. Expenditures by 2000 are about two percent greater in the high base case than in the moderate case. The larger Beaufort revenues also lead to an increase in the fund balance between the high and moderate base cases. By 2000, the real fund balance in the high base case is $5.2 billion, which is $480 million greater than in the moderate base case. The change in the structural characteristics found in the moderate base case are also found in the high base case.

THE GENERAL PATTERN OF GROWTH

Table 77 examines the economic growth with Western Gulf OCS development according to the 5 percent scenario relative to the high base case. Comparing these cases shows us the impact of OCS development. The impact is similar to that projected in the other cases; population, employment, and state expenditures all increase as a result of OCS development. The fund balance is reduced because of OCS development, but the negative impact decreases by the end of the period.

TABLE 77. THE IMPACT ON MAJOR ECONOMIC INDICATORS
WESTERN GULF OCS
5 PERCENT SCENARIO/HIGH BASE CASE

	Population			Employment		
	Base Case	5% Scenario	Impact	Base Case	5% Scenario	Impact
1980	431,495	431,495	0	192,187	192,187	0
1985[1]	540,357	551,243	10,886	245,927	252,964	7,036
1990[2]	639,451	650,925	11,473	288,328	293,324	4,997
1995	723,291	732,263	8,972	323,807	326,410	2,603
2000	837,888	847,577	9,689	381,508	384,591	3,083

	State Expenditures (Millions of Nominal Dollars)			Real Fund Balance (Millions of Constant 1977 Dollars)		
1980	1,559	1,559	0	1,094	1,094	0
1985	2,904	2,972	68	3,779	3,736	-43
1990	4,877	4,948	71	6,090	5,997	-93
1995	6,945	6,973	28	6,451	6,370	-81
2000	10,343	10,389	46	5,210	5,161	-49

[1] Peak direct Alaska resident employment.

[2] The end of the development phase.

SOURCE: MAP Model

Population increases at an average rate of 3.4 percent per year from the beginning of OCS development in 1980 to the end of the period in 2000. In 2000, population is projected to be 847,577, which is 1.2 percent greater than in the base case. The maximum increase in population as a result of OCS development occurs in 1988 when population is 11,544 or 2 percent greater than in the base case. The growth rate during the exploration-development phase (1980-1990) averages 4.2 percent per year. After 1991, when production is the dominant activity, the growth rate averages 2.7 percent per year. The economy grows faster than in the base case during the exploration and development phase and slower during the production phase.

Employment is projected to increase to 384,591 by 2000. This is 3,083 greater than in the base case. The overall growth rate is approximately 3.5 percent per year in both the base and OCS cases. The peak employment impact occurs in 1985 when total employment is 7,036 or 2.9 percent greater than in the base case. Direct OCS resident employment peaks in 1985. Employment, like population, increases faster in the exploration-development phase (1980-1990) than after 1990 when production is the dominant activity.

The state's fiscal position is affected by Western Gulf OCS development. By 2000, state expenditures are projected to be $46 million or less than one percent greater than in the base case; total expenditures are projected to be $10.4 billion by 2000. The maximum impact of OCS development on state expenditures occurs in 1986 when expenditures are

$91 million greater than in the base case. The maximum expenditure impact occurs after the maximum population impact because of the lags built into the expenditure rule. The pattern of expenditure growth differs between the base case and the 5 percent scenario. Expenditures increase faster with Western Gulf OCS development than in the base case, 12.2 percent per year compared to 12.1 percent, during the exploration-development phase (1980-1990). After 1990, the increase in expenditures is more rapid in the base case, 7.8 percent compared to 7.7 percent per year. The increase over the base case is not so great as the combined increase in prices and population, so OCS development has a negative impact on real per capita state expenditures. Real per capita state expenditures are $14 less than in the base case by 2000.

The pattern of real fund balance growth is similar in both the base case and the OCS development case. In both cases, the real fund balance rises to a peak in 1994 and then falls as the fund balance is drawn down to make up the difference between revenues and expenditures. At its peak in 1994, the real fund balance with OCS development is $6.5 billion, which is $85 million less than in the base case. By 2000, the real fund balance is $49 million, or one percent less than in the base case because of OCS development.

The relative impacts of the 5 percent development scenario are differ when they occur with the moderate or high base case. The major cause of this difference is the expenditure impact projected in the moderate base case. The population impact in 2000 differs between these cases by

20.7 percent; the population impact is 8,025 with the moderate base case and 9,689 with the high scenario. The employment impact in 2000 is 2,363 with the moderate base case and 3,083 with the high base case, a difference of 30 percent. The expenditure impacts differ in sign in 2000; the impacts are negative with the moderate base case and positive with the high base case. The fund balance impact is positive with the moderate base case and negative with the high base case. The pattern of fund balance impact is similar in each case, with the negative fund balance impact being reduced by the end of the period.

STRUCTURAL SIMILARITIES AND DIFFERENCES

Table 78 compares certain structural characteristics of economic growth in the mean OCS-moderate base case scenario and the 5 percent OCS-high base case scenario. These indicators describe the four types of structural change found in the base case: first, the increased importance of the support sector as the scale of the economy increases; second, the increasing proportion of the population which is employed; third, the continuing concentration of population in Anchorage; finally, the pattern of state expenditure which results in their being greater than revenues.

The development of the Western Gulf OCS, according to the 5 percent scenario given the high base case, experiences the structural change which is similar to that found in the mean scenario case. The support sector increases its share of employment to about 54 percent in both cases. The dependency ratio decreases through the projection period, although it is slightly higher in the 5 percent scenario. By 2000, Anchorage has

TABLE 78. STRUCTURAL CHARACTERISTICS OF THE ALASKA ECONOMY
WESTERN GULF OCS
OCS-MODERATE BASE SCENARIO/
5% OCS-HIGH BASE SCENARIO

	1980	1990	2000
Percent of Employment in the Support Sector			
Mean Scenario	39.5	46.8	53.2
5% Scenario	39.4	47.3	53.5
Dependency Ratio (Population/Employment)			
Mean Scenario	2.24	2.21	2.18
5% Scenario	2.25	2.22	2.20
Percent of Population in Anchorage			
Mean Scenario	47.8	50.0	53.5
5% Scenario	47.8	49.9	53.4
General Fund Revenues Minus General Fund Expenditures (Millions of Nominal Dollars)			
Mean Scenario	361	1,016	- 504
5% Scenario	363	1,039	- 309

increased its share of state population to about 54 percent in both cases. In both the mean OCS-moderate base scenario and the 5 percent OCS-high base case scenario, general fund revenues minus expenditures are negative by 2000. In both cases, the fund balance must be drawn on to meet expenditures by 2000.

The Impact of Western Gulf OCS Development At the 95 Percent Level: The Low Base Case

THE LOW BASE CASE

The low base case scenario contains the same non-OCS assumptions as the moderate and high base case scenarios. It differs from these cases in its assumptions about OCS activity in the Lower Cook, Beaufort Sea, and Northern Gulf. Lower Cook and Northern Gulf are assumed to have exploration-only in this scenario. Production occurs in the Beaufort. Peak employment in the Beaufort reaches 740 in 1989; this is 68 percent of the peak in the moderate Beaufort scenario. The growth in the low base case is less than in the moderate case. Over the period 1978-2000, population is projected to increase at an average rate of 3 percent per year. Population is projected to be 782,602 by 2000. Employment is projected to increase to 362,233 by 2000 in the low case. State expenditures are less than one percent lower than in the moderate case by 2000. They are projected to be almost $10 billion by 2000. The fund balance is $300 million less than in the moderate base case by 2000. In 2000, the fund balance is projected to be $14.8 billion. The pattern of fund balance growth is similar in both cases, rising to a peak of almost

$16 billion in 1997, then falling as funds are used to make up the difference between expenditures and revenues. The structural changes found in the moderate base case are also found in the low base case.

THE GENERAL PATTERN OF GROWTH

The 95 percent scenario describes the activity associated with only exploration in the Western Gulf OCS. The development has minimal impact on the Alaska economy. Table 79 shows the impact of exploration on population, employment, state expenditures, and the fund balance. The maximum increase in population occurs in 1982 when OCS exploration activity increases population by 714, or .2 percent. The maximum employment impact occurs in 1982. Employment is 489 or 0.2 percent greater than in the base case because of exploration activity. The expenditure impact follows the same pattern. Expenditures are $5 million or 0.2 percent greater in 1983. By 2000, expenditures are still $1 million greater than in the base case. The extra expenditures throughout the period result in the fund balance being $26 million less by 2000. These impacts are similar to those experienced with the moderate base case.

Because of the small impacts associated with OCS exploration, the structural change projected in the base case is not affected.

TABLE 79. THE IMPACT ON MAJOR ECONOMIC INDICATORS
WESTERN GULF OCS
95 PERCENT SCENARIO/LOW BASE CASE

	Population			Employment		
	Base Case	95% Scenario	Impact	Base Case	95% Scenario	Impact
1980	431,495	431,495	0	192,187	192,187	0
1981	452,241	462,693	452	204,393	204,726	334
1982	483,427	484,141	714	223,573	223,563	489
1983	500,077	500,620	543	228,948	229,261	314
2000	782,602	782,698	96	362,233	362,243	10

	State Expenditures (Millions of Nominal Dollars)			Real Fund Balance[1] (Millions of Constant Dollars)		
1980	1,559	1,559	0	1,094	1,094	0
1981	1,723	1,723	0	1,497	1,497	0
1982	1,993	1,997	4	1,936	1,934	-2
1983	2,356	2,361	5	2,378	2,375	-3
2000	9,966	9,967	1	4,850	4,841	-9

[1]Deflated by Alaska RPI.

SOURCE: MAP Model

VI. SENSITIVITY ANALYSIS

Our knowledge of future events is uncertain. In spite of this uncertainty, we need to make assumptions about certain future events. Events which are important to the future economy must be incorporated in our projections. These assumptions which form the basis for both the base case and OCS development scenarios are uncertain. The uncertainty surrounding these assumptions makes it necessary to investigate the extent to which our major findings are sensitive to the more important of these assumptions.

The previous sections tested the sensitivity of Western Gulf OCS impacts to OCS-related assumptions. By examining the alternate OCS scenarios, we saw the effect of varying resource discovery levels on impacts. Examining the cumulative cases provided an indication of the sensitivity of our results to the level of previous OCS activity. In this section, we will test the sensitivity of our results to two general categories of assumptions. The first set of assumptions to be examined concerns the state expenditure policy which was assumed to be adopted in the forecast period. Changes in the assumed expenditure policy will alter the effect of OCS development on state expenditures and may change the impacts on the economy. The second set includes the assumptions about the level of activity in the base case. We will examine the effect on the OCS impact results of major changes in the base case assumptions.

In this section, six specific sensitivity tests were conducted on the mean Western Gulf OCS development scenario. Comparing these results to the mean results in our basic case will allow us to assess the sensitivity of our results to these major sets of assumptions. The sensitivity test will also expand our understanding of the assumed state expenditure rule and the negative expenditure impacts found in the mean scenario.

Sensitivity to Major Changes in the Base Case

The base case assumptions used in this study contain an element of uncertainty concerning two major construction projects, the ALCAN gasline and the state capital move from Juneau to Willow. ALCAN construction is included in our assumptions; the capital move is not. This section tests the sensitivity of our results to these assumptions.

In the base case, the ALCAN gasline is assumed to be constructed between 1981 and 1984 to transport natural gas from Prudhoe Bay to the "Lower 48." There is uncertainty concerning not only the timing of this construction but also the eventuality of construction. For a variety of reasons, including the recent recognition of substantial oil and gas reserves in Canada and Mexico, the outlook concerning the feasibility of the ALCAN line has changed since it was approved (Tussing and Barlow, 1979). Because of this uncertainty, it is necessary to test the effect on OCS impact of changes in the ALCAN assumptions. We examine the effect on the OCS impact of eliminating ALCAN construction from the base case. Eliminating ALCAN has two types of direct effects. First, major exogenous employment will be eliminated from 1981 to 1984. Secondly, eliminating ALCAN will reduce state revenues. Without the ALCAN, there will be no gas production in either Prudhoe or the Beaufort Sea. The state will not earn royalties, production taxes, or corporate income taxes from this gas. The reduction in revenues will affect economic activity through its effect on state expenditures.

The sensitivity of our findings to increased levels of exogenous base case activity was also tested. The base case assumptions did not include the capital move from Juneau to Willow. Although Alaskans voted to move the capital in 1974, recent cost estimates and disagreement over the method of paying for the move have made it less likely. In the sensitivity test, the major direct effect of the capital move is assumed to be the increased construction activity connected with the move. State government employment is not assumed to be affected by the move. (See Table 80.) The capital move is assumed to occur between 1981 and 1984, which is at the same time as the ALCAN construction.

TABLE 80. CAPITAL MOVE SCENARIO

	Construction Employment
1980	0
1981	869
1982	664
1983	1,185
1984	1,135
1985	716

SOURCE: Alaska Department of Labor, Alaska's Economic Outlook to 1985, 1978.

Table 81 compares the impact of the mean Western Gulf OCS development scenario on three sets of base case assumptions--the basic case, the no-ALCAN case, and the capital move case. These tests show that the magnitude of OCS impact is relatively insensitive to the addition of the capital move to the base case assumptions, but sensitive to the removal of ALCAN. Since the base case is changed in each case, the relative effect of OCS development will differ in each case. During the ALCAN and capital construction period (1980-1984), the impacts in all three cases vary by small amounts. By 1990, the population and employment impacts of the no-ALCAN are much larger, while the capital move cases vary by less than 22 people from the base case. State expenditures increase in the no-ALCAN case. The major reason for this concerns the growth rate of real per capita income. The pattern of growth of real per capita income in both the base case and the OCS case is similar when ALCAN is excluded. By 2000, the state expenditure impact is greater in the no-ALCAN case than in either of the other cases; this determines the difference in the other variables.

The Sensitivity to State Expenditure Policy

In the previous analysis, it was necessary to specify an expenditure rule which captured the essential features of state fiscal policy. Inasmuch as state expenditures are actually a matter of policy choice, the expenditure rule could follow any one of an infinite number of possible specifications. The expenditure rule chosen in the analysis assumes that real per capita expenditures grow at a rate equal to one-half the rate of growth in real per capita income. Expenditures are

TABLE 81. THE IMPACT OF WESTERN GULF OCS DEVELOPMENT WITH THREE ALTERNATIVE BASE CASES: BASIC CASE, NO-ALCAN CONSTRUCTION, AND THE CAPITAL MOVE MEAN SCENARIO

	1981	1983	1990	1999
Population Impact				
Basic Case	396	536	438	376
No ALCAN	387	500	972	1,018
Capital Move	402	541	460	447
Employment Impact				
Basic Case	293	319	- 62	15
No ALCAN	286	295	220	293
Capital Move	279	323	- 35	51
Personal Income Impact (Millions of Nominal Dollars)				
Basic Case	15	18	- 5	1
No ALCAN	14	16	18	43
Capital Move	15	19	- 3	7
State Expenditures Impact (Millions of Nominal Dollars)				
Basic Case	0	3	- 10	- 19
No ALCAN	0	4	2	3
Capital Move	0	3	- 9	- 16
Fund Balance Impact (Millions of Nominal Dollars)				
Basic Case	0	- 3	38	204
No ALCAN	0	- 3	- 24	- 20
Capital Move	0	- 3	34	183

SOURCE: MAP Model

also assumed to increase with increases in the available general fund balance. Past pattern of state expenditures points to these factors as determinants of expenditure growth (Scott, 1978). Even if we accept the general form of this rule, the relative effect of any one component may vary and the sensitivity of the measured impacts to this variation needs to be tested.

Three alternative formulations of the basic expenditure rule were tested. Each alternate rule differed by the assumed influence of real per capita income and the available general fund balance on the growth of state expenditures. Two cases examine the sensitivity of our measured impacts to the effect of real per capita income on expenditures. The expenditure elasticity of real per capita income is the percentage increase in state expenditures resulting from a one percent increase in real per capita income. In the basic rule, the expenditure elasticity of real per capita income was .5; two extreme elasticities were tested: the expenditure elasticity of real per capita income equal to 0 (EL3=0) and equal to 1 (EL3=1). The final rule tested the sensitivity of our results to the removal of the effect of the available general fund balance on expenditures (EX6=0). The major difference in all of the variables examined will result from differences in the expenditure impact.

Table 82 compares the relative OCS impacts of the various expenditure rules. The sensitivity of OCS impact to the expenditure elasticity of real per capita income can be seen by examining the impacts produced by

TABLE 82. THE EFFECT OF ALTERNATE STATE EXPENDITURE POLICIES ON THE IMPACT OF WESTERN GULF OCS DEVELOPMENT MEAN SCENARIO

	1985	1990	1999
Population Impact			
Basic Case	1,523	438	376
EL3=1	1,568	-140	-1,136
EL3=0	1,595	924	1,034
EX6=0	1,499	445	270
Employment Impact			
Basic Case	834	-62	15
EL3=1	870	-424	-762
EL3=0	906	232	317
EX6=0	831	-49	-39
Personal Income Impact (Millions of Nominal Dollars)			
Basic Case	55	-5	1
EL3=1	58	-36	-118
EL3=0	59	19	45
EX6=0	55	-4	-6
State Expenditures Impact (Millions of Nominal Dollars)			
Basic Case	10	-10	-19
EL3=1	11	-29	-85
EL3=0	13	2	5
EX6=0	9	-9	-17
Fund Balance Impact (Millions of Nominal Dollars)			
Basic Case	-2	38	204
EL3=1	-6	79	606
EL3=0	-3	-8	1
EX6=0	-2	34	206

SOURCE: MAP Model

the basic rule, the full income effect rule (EL3=1), and the no-income effect rule (EL3=0). The relative pattern of expenditure impacts can be explained by the pattern of real per capita income growth. The basic pattern of real per capita income growth in the impact case relative to the base case was shown in Chapter IV. Real per capita income increases faster than in the base case as direct OCS employment builds to a peak. After the peak employment is reached, real per capita income increases at a slower rate.

The growth rate of real per capita income is slower after the peak direct employment occurs than for the same period in the base case. This effect, combined with the small size of direct employment, leads to a reduction of state expenditures in the mean scenario case. The tests in Table 82 illustrate the importance of this effect. In 1985, the impacts in all indicators are similar. By 1990, after peak employment has been reached, the state expenditures impact is negative in all cases with positive income elasticities. This is because the rate of real per capita income growth after 1984 is lower than in the base case. The negative impact is greater the larger the elasticity. By 1999 the case with no income effect on expenditures has a much larger impact. The impact on population, employment, personal income, and the fund balance is influenced by the expenditure effect. The case with the full income effect has negative population, employment, and personal income impacts.

The final expenditure rule tested removed the influence of the available fund balances from the determination of state expenditures. The impacts of OCS development are lower when the fund balance does not influence expenditures. This can be seen by comparing the impacts of the no-fund balance effect case (EX6=0) and the basic case. The population, employment, and personal income impacts are greater in the basic case by 1999. The differences between these cases cannot be considered significant.

A more important issue concerning the choice of the expenditure rule is the assumption implicit in our analysis that the state will choose to respond to changes caused by OCS development as it responded in the base case. If the state should behave differently in the face of OCS activity, the measured impacts may change significantly. To ascertain the importance of this to our results, it may be useful to distinguish that portion of the total impact due to changes in state spending from that which is due to changes in the private sector of the economy.

In order to isolate the component of our measured impact which is due to changes in state expenditures, we examined the impacts of the case in which the base case level of state expenditures was maintained. OCS development was not assumed to affect state expenditures in this case. Since OCS development increases both population and prices, such a policy would mean a reduction in the level of real per capita expenditures. This case is not presented as a plausible response of the state. However, it does permit us to separate for purposes of analysis that portion of impact due to state expenditures.

Table 83 illustrates the state expenditure impact. The proportion of impact due to state expenditures is equal to the proportion of impact not accounted for in the constant expenditure case. By comparing the basic rule with the constant expenditure case, we can estimate the proportion of the reduction caused by the negative expenditure impacts. The state expenditure impact is greater in 1999 than in 1990. In 1990, decreases in state expenditures account for 50 percent of the population impact, 75 percent of the employment impact, and 75 percent of the personal income impact. By 1999, state expenditure decrease accounts for a 58 percent reduction of the population, 85 percent reduction of employment, and 98 percent reduction of personal income.

Comparing the impacts of OCS development under our assumed expenditure rule and with constant expenditures illustrates the sensitivity of our results to our assumptions about expenditures. In this case, the important assumption is not about the form of the expenditure rule in general, but in the state's response to OCS development. If the state does not respond to OCS development as it does to other development, impacts will differ from those projected in this study.

TABLE 83. THE STATE EXPENDITURE IMPACT
WESTERN GULF OCS
MEAN SCENARIO

	1985	1990	1999
Population Impact			
Basic Rule	1,523	438	376
Constant Expenditure	1,245	772	904
Employment Impact			
Basic Rule	834	-62	15
Constant Expenditure	654	185	278
Personal Income Impact (Millions of Nominal Dollars)			
Basic Rule	55	-5	1
Constant Expenditure	44	15	40

VII. SUMMARY AND CONCLUSIONS

In this report, we have assessed the major impacts that offshore oil and gas development in the Western Gulf of Alaska will have on the process of Alaska economic growth. These projected impacts were assessed in terms of both an assumed base case growth without the project and the historical economic growth. Relative to both historical growth and projected economic growth, development of the Western Gulf will have only minor effects on the economy of the state.

For all of the scenarios, the qualitative nature of the influence of OCS development on the growth process is similar. Development generates direct employment activity in the construction, mining, manufacturing, and transportation industries which builds to a peak during the development phase, then declines to a stable, long-term level as production dominates the activity. This development activity generates both new private incomes and public revenues which induce impacts. Expenditure of wages and salaries earned in OCS activity generates further income and employment in the endogenous sector of the economy through the increased demand for the output of these sectors. The increased economic activity also influences public expenditures which affect economic activity.

The qualitative nature of the impacts is also similar across scenarios. Four major structural changes were observed in the base case and the historical period. First, as the scale of the economy increased, more goods and services were produced locally and the importance of the support sector increased. Secondly, the population aged and labor force participation increased over time; this led to an increase in the proportion of the population which is employed. Thirdly, the role of Anchorage as the administrative and distributive center of Alaska resulted in population growth continuing to center in Anchorage. Finally, state expenditures and revenues were projected to follow a pattern in which expenditures would increase faster than revenues after the major petroleum revenues peaked. This pattern of expenditure and revenue increase would necessitate drawing down the general fund balance. This results from the declining importance of the petroleum revenues throughout the period. All of the Western Gulf OCS development scenarios support these trends.

The qualitative impact of OCS development on individual welfare was also similar across scenarios. In all scenarios, real per capita incomes increased significantly over the base case levels during the buildup to the peak employment. After this, increases in population and prices led to no real significant increases in real per capita income. The level of real per capita state expenditures is also reduced by OCS development relative to the base case. The reduction in real per capita state expenditures is responsible for a fall in expenditures with OCS development. This fall dominates the direct OCS effects in the mean scenario and dampens the impacts in the high case with the moderate base case. In the high OCS case with the high base case, this effect does not occur.

Quantitatively, the impacts across scenarios differ. The single most important determinant of impact is the size of the field. The 5 percent scenario has larger development activity and so has a larger impact. The 95 percent scenario contains only exploration and has only minimal impact on the major economic variables. Table 84 shows the relative year 2000 impacts across the five OCS scenarios. The major dimensions of both base case growth and OCS development are uncertain. By examining the three alternate development scenarios, we get some feeling for the range of impacts possible from OCS development in the Western Gulf.

TABLE 84. SUMMARY OF THE LONG-RUN IMPACTS OF ALTERNATIVE DEVELOPMENT SENARIOS (IMPACTS IN THE YEAR 2000)

	Population	Employment	State Expenditures (Millions of Nominal Dollars)	Fund Balance (Millions of Nominal Dollars)
Moderate Base Case				
Mean OCS Scenario (1999)	376	15	-19	204
5% OCS Scenario	8,025	2,363	-14	458
95% OCS Scenario	101	12	1	-28
High Base Case				
5% OCS Scenario	9,689	3,083	46	-119
Low Base Case				
95% OCS Scenario	96	10	1	-26

SOURCE: MAP Model

APPENDIX A

Historical Growth, 1965-1976

TABLE A.1. GROWTH IN EMPLOYMENT, ALASKA, 1965-1976

Industry	Average Monthly Employment 1965	1970	1971	1972	1973	1974	1975	1976
Mining	1,100	3,000	2,400	2,100	2,000	3,000	3,800	4,000
Contract Construction	6,400	6,900	7,400	7,900	7,800	14,100	25,900	30,200
Manufacturing	6,300	7,800	7,800	8,100	9,400	9,600	9,600	10,300
Food Processing	3,000	3,700	3,600	3,800	4,600	4,300	4,300	5,100
Logging-Lumber and Pulp	2,300	2,800	2,800	2,800	3,200	3,600	3,400	3,200
Other Manufacturing	1,000	1,300	1,400	1,500	1,500	1,700	1,900	2,000
Transportation, Communication and Public Utilities	7,200	9,100	9,800	10,000	10,400	12,400	16,500	15,800
Trucking and Warehousing	1,200	1,700	1,500	1,600	1,500	2,200	4,000	3,200
Water Transportation	1,000	800	800	800	900	1,000	1,400	1,300
Air Transportation	1,900	3,000	2,800	3,000	3,300	4,000	4,800	4,700
Other Transportation	500	900	1,000	1,000	1,100	1,300	1,800	1,900
Communications and Public Utilities	2,600	2,700	3,700	3,600	3,600	3,900	4,500	4,700
Trade	10,000	15,400	16,200	17,100	18,300	21,100	26,200	27,600
Wholesale	1,900	3,200	3,200	3,300	3,400	4,000	5,900	6,100
Retail	8,100	12,200	12,900	13,800	14,900	17,100	20,300	21,500
Finance, Insurance and Real Estate	2,200	3,100	3,200	3,700	4,300	4,900	6,000	7,100
Services	7,500	11,400	12,600	14,000	15,200	18,300	25,100	27,700
Hotels, Motels, etc.	1,000	1,400	1,600	1,800	1,900	2,500	3,200	3,200
Personal	700	800	900	900	900	800	900	900
Business	1,400	2,000	2,100	2,100	2,100	3,000	7,300	8,700
Medical	1,400	2,200	2,600	3,000	3,300	3,800	4,300	5,000
Other	3,000	5,000	5,400	6,200	7,000	8,200	9,400	9,900

TABLE A.1. (continued)

Industry	Average Monthly Employment 1965	1970	1971	1972	1973	1974	1975	1976
Government	29,000	35,600	38,000	40,500	41,600	43,800	47,200	47,200
Federal	17,400	17,100	17,300	17,200	17,100	18,000	18,300	17,900
State	7,000	10,300	11,700	13,300	13,800	14,200	15,500	14,100
Local	5,300	8,100	9,000	10,000	10,700	11,600	13,400	15,200
Agriculture, Forestry and Fisheries	100	800	900	900	1,000	1,000	1,000	1,200
Total Civilian Non-Agricultural Wage and Salary Employment	70,500	93,100	98,300	104,200	110,000	128,200	161,300	171,100
Total Civilian Basic	31,300	35,600	35,800	36,200	37,300	45,700	58,600	63,600
Military	33,000	31,400	30,100	26,500	27,500	27,500	25,300	24,500
Total Basic	64,300	67,000	65,900	62,700	64,800	73,200	83,900	88,100
Total Support Sector	26,900	39,000	41,800	44,800	48,200	56,700	73,800	78,200
Total Employment	114,000	129,900	133,900	136,500	143,200	161,500	190,200	203,200

Basic Employment Includes: Mining; Construction; Manufacturing; Federal Government; Agriculture, Forestry and Fisheries, and Military.

Support Sector Includes: Transportation, Communication and Public Utilities; Trade; Finance, Insurance and Real Estate; and the Services.

SOURCE: Alaska Department of Labor, Alaska Labor Force Estimates, various years.
Alaska Department of Labor, Estimates of Total Resident Population and Estimates of Total Civilian Population.

TABLE A.2. ANCHORAGE CIVILIAN EMPLOYMENT GROWTH, ALASKA, 1965-1976

Industry	1965	1970	1971	1972	1973	1974	1975	1976
Total	30,678	41,995	45,452	48,252	50,627	58,713	69,645	73,113
Agriculture, Forestry and Fisheries	33	52	63	76	82	100	110	100
Mining	371	958	916	806	769	1,036	1,301	1,409
Contract Construction	3,127	3,514	3,924	4,272	4,178	5,882	7,054	7,587
Manufacturing	791	1,018	1,117	1,215	1,286	1,379	1,571	1,629
Transportation, Communication and Public Utilities	2,618	3,907	4,591	4,522	4,625	5,383	7,343	7,409
Transportation	1,694	2,800	2,805	2,821	3,129	3,938	5,419	5,172
Air	773	1,482	1,455	1,629	1,835	2,123	2,610	2,668
Other	921	1,318	1,350	1,192	1,294	1,814	2,809	2,504
Communication	674	764	1,411	1,289	1,046	1,163	1,426	1,670
Public Utilities	250	343	374	411	451	483	499	568
Trade	5,280	8,617	9,334	9,948	10,663	12,298	14,928	15,958
Wholesale	1,226	2,220	2,292	2,423	2,475	2,860	4,077	4,240
Retail	4,053	6,397	7,042	7,525	8,188	9,438	10,852	11,718
Finance, Insurance and Real Estate	1,295	1,980	2,087	2,415	2,803	3,151	3,615	4,257
Services	3,767	6,403	7,027	7,725	8,319	10,119	13,465	15,450
Hotels	460	755	709	732	811	1,114	1,345	1,444
Personal	402	535	556	556	567	572	624	607
Business	789	1,188	1,194	1,120	1,190	1,680	3,795	4,914
Medical	681	1,200	1,480	1,759	1,993	2,283	2,286	2,657
Other	1,444	2,725	3,088	3,459	3,758	4,471	5,410	5,828
Federal Government	9,395	9,509	9,530	9,435	9,559	9,925	10,222	9,813
State Government	1,672	2,421	3,020	3,500	3,667	3,985	4,056	4,053
Local Government	2,329	3,615	3,846	4,349	4,677	5,257	5,979	5,413

SOURCE: Department of Labor, Statistical Quarterly, various issues.

TABLE A.3. EMPLOYMENT BY INDUSTRY, SOUTHCENTRAL ALASKA 1965, 1970-1976

Industry	1965	1970	1971	1972	1973	1974	1975	1976
Agriculture, Forestries and Fisheries	19	99	85	356	491	492	543	680
Mining	345	762	633	611	640	580	900	827
Contract Construction	880	583	896	768	681	1,239	3,656	6,978
Manufacturing	1,188	1,647	1,627	1,818	2,627	2,522	2,656	3,234
Food	1,086	1,293	1,229	1,456	1,995	2,013	2,003	2,127
Transportation, Communication and Public Utilities	542	760	796	793	896	1,329	1,576	1,472
Transportation	373	521	502	442	497	708	1,106	977
Communications	26	85	132	175	209	218	239	247
Public Utilities	132	154	63	176	189	03	231	248
Trade	813	1,338	1,319	1,383	1,460	1,611	2,337	2,533
Wholesale	102	193	275	162	133	202	344	353
Retail	711	1,145	1,134	1,221	1,327	1,459	1,983	2,180
Finance, Insurance and Real Estate	159	211	204	220	238	308	377	480
Services	738	1,027	1,099	1,228	1,440	1,709	2,128	2,597
Hotel	138	154	230	297	300	427	467	462
Personal	25	28	29	39	50	40	49	36
Business	117	114	94	87	139	178	441	756
Medical	139	275	286	315	451	400	391	465
Other	319	456	460	490	500	664	780	878
Government								
Federal	975	828	742	626	602	595	672	637
State and Local	1,465	2,327	2,726	2,932	3,056	3,180	3,455	3,592
Total	7,124	9,582	10,127	10,735	12,131	13,645	18,300	23,030

SOURCE: Estimated from Alaska Department of Labor, Research and Analysis Section Worksheets.
Alaska State Housing Authority, Alaska, Yakutat, Comprehensive Development Plan, Anchorage 1971.
Alaska Consultants, Inc., Anchorage, Alaska, Yakutat, Comprehensive Development Plan, December 1976.

APPENDIX B

MAP Model Assumptions

A set of assumptions about the level of exogenous variables determines a development scenario; this section describes the assumptions in the non-OCS base case scenario. There are four major types of assumptions required for a scenario. First, there are assumptions about the growth of exogenously determined employment in both the petroleum and nonpetroleum sectors. Secondly, assumptions about exogenously determined petroleum revenues received by the state are needed. Thirdly, there are assumptions about national variables. Finally, an assumption about the way the state spends its money is needed. Once these assumptions are set, the set of projections is determined by the model.

EMPLOYMENT ASSUMPTIONS

Employment assumptions include those associated with special projects and those associated with industry growth in manufacturing, agriculture-forestry-fisheries, and federal government.

Special Projects

Special projects include three basic types--petroleum projects, major construction projects, and operations of the major projects. Tables B.1 and B.2 show the project employment assumptions. The methods used to determine these levels are described below.

TABLE B.1. MINING EMPLOYMENT

Year	Prudhoe,[1] Lisburne and Kuparak	N. Gulf[2] and Lower Cook OCS	Upper[3] Cook	Other[4] Mining
1977	1,586	271	575	2,082
1978	1,624	0	575	2,082
1979	1,585	0	575	2,082
1980	1,783	0	575	2,082
1981	1,402	0	575	2,082
1982	1,149	0	575	2,082
1983	897	0	575	2,082
1984	904	0	575	2,082
1985	987	0	575	2,082
1986	963	0	610	2,082
1987	985	0	645	2,082
1988	985	0	680	2,082
1989	1,009	0	715	2,082
1990	1,009	0	750	2,082
1991	1,020	0	300	2,082
1992	1,020	0	300	2,082
1993	940	0	300	2,082
1994	886	0	300	2,082
1995	886	0	300	2,082
1996	886	0	300	2,082
1997	886	0	300	2,082
1998	886	0	300	2,082
1999	886	0	300	2,082
2000	886	0	300	2,082

[1]Based on employment scenarios from Alternatives for the Future: Petroleum Development Study, North Slope of Alaska (Department of Natural Resources, 1977). Scenarios for 1 and 5 billion barrel reserves were adjusted to reflect reserves and production schedules of these fields.

[2]Exploration activity drilled 9.6 wells; assumed employment per well equaled 90 man-years from OCS Technical Report No. 17 (Dames and Moore, 1978).

[3]Estimate by the author based on current employment.

[4]Net employment in mining.

TABLE B.2. CONSTRUCTION EMPLOYMENT

	ECONX 1			ECONX 2
Year	TAPS	ALCAN[3]	Total	Pacific[4] LNG
1977	5,300[1]	0	5,300	0
1978	0	0	0	0
1979	90[2]	0	90	0
1980	90	0	90	146
1981	90	1,425	1,515	844
1982	90	4,763	4,853	1,323
1983	0	4,663	4,663	420
1984	0	265	265	0
1985	0	0	0	0

[1] Based on estimate of TAPS construction employment by the Alaska State Labor Department.

[2] Assumed construction of four pump stations to increase capacity by 1982. Pump Station construction employment estimate from The Beaufort OCS Petroleum Development Scenarios, Dames and Moore, 1978.

[3] Northwest Energy Company manpower estimate, July 17, 1978.

[4] Based on letter to the Department of Natural Resources from S. California Gas, March 17, 1978, estimating peak construction employment of 1,500. Four-year construction period from E.I.S. for Pacific Alaska LNG Project, November 1974.

- Prudhoe Bay, Lisburne, and Kuparak mining employment was estimated from two sources of information. Employment scenarios were based on the scenarios described in the Alaska Department of Natural Resources, Alternatives for the Future: Petroleum Development Study, North Slope of Alaska (1977). The employment schedules were adjusted based on the estimated reserves, productivity, and the production schedules in Beaufort Sea Region Petroleum Development Scenarios (Technical Report No. 6, Alaska OCS Socioeconomic Studies Program, 1978).

- Northern Gulf OCS employment is an estimate of 1977 exploration employment. This was based on information in Monitoring Petroleum Activities in the Gulf of Alaska (Technical Report No. 17, Alaska OCS Socioeconomic Studies Program, 1978). Total employment associated with exploration was divided by the total wells drilled to obtain a man-years-per-well figure of approximately 90. Approximately 9.6 wells were drilled in 1977. Total exploration employment was adjusted by the percentage of Alaskan resident employment assumed in the report. There is no activity assumed after 1977.

- Upper Cook employment was an estimate of current employment made by the author. Employment was assumed to increase slightly between 1985 and 1990 as the oil fields are shut down. Gas production is assumed to continue after 1990.

- Other mining was assumed to maintain its 1976 level, except in Anchorage and Fairbanks which were adjusted to an estimate of the 1977 mining employment.

Table 6 shows special project construction employment.

- ECONX1 are highly paid construction workers associated with major projects, long hours, and extreme working conditions. Two projects are assumed in this category, the trans-Alaska pipeline and the ALCAN gasline. TAPS is completed in 1977. The 1977 employment is based on an actual estimate made by the Alaska Labor Department. After 1977 the line's capacity is assumed to be increased by the addition of four pump stations. Pump station construction employment estimates made in Technical Report No. 6 (Alaska OCS, 1978) were used to estimate employment. With completion of the TAPS construction in 1977, the line's capacity is assumed to be 1.2 million barrels per day. The capacity must be expanded to deliver the assumed base case North Slope production, which is 1.73 million barrels per day by 1983. Four additional pump stations were assumed to be needed to deliver this production. This was based on the ratio of capacity to pump stations (.15 million barrels per pump station) with eight pump stations. With this ratio, twelve pump stations would be needed to deliver 1.73 million barrels per day. These additions would also allow the line some additional capacity. The ALCAN gasline is assumed to be built between 1981 and 1984. The estimates are based on the most recent construction manpower estimates made by Northwest Energy Company in a letter to the state (July 1, 1978).

- ECONX2 employment is associated with special construction projects which are assumed to have regular employment schedules and be able to draw on local labor markets. One project of this type is assumed to be built, the Pacific LNG project. Pacific LNG is scheduled to begin construction in 1980 and operations in 1984 (Anchorage Daily News, September 23, 1978). The construction schedule is based on an estimated peak construction employment of 1,500 (letter from S. California Gas to Alaska Department of Natural Resources, May 17, 1978) and the four-year construction period from the 1974 E.I.S. for the Pacific LNG project.

Operations employment for these projects is transportation employment for the pipelines and manufacturing for the petrochemical projects. Alyeska estimated an operations employment of 300 for startup in 1977 and 850 per year for the long-term operations (Alaska Construction and Oil, October 1976). ALCAN operations employment is assumed to be 96 beginning in 1985. This estimate was based on ALCAN's 1976 application to the Federal Power Commission. The difference in operations employment is accounted for because TAPS has more pipeline in Alaska, the Valdez port employment is part of the TAPS employment, and TAPS has substantial Alaska headquarters employment. Operations employment for the Pacific LNG plant is 60 beginning in 1984.

Employment for these special projects is allocated to MAP Regions as follows:

1. Prudhoe, Lisburne, Kuparak employment to Region 1
2. Upper Cook N. Gulf OCS, Pacific LNG employment in Region 4
3. Other mining at its appropriate regional level
4. ALCAN and TAPS construction based on miles of pipe in region plus 300 TAPS headquarters in Anchorage in 1977
5. ALCAN operations is allocated by the miles of pipeline in each region
6. TAPS operations employment will be allocated as follows: 300 in Anchorage, 200 in Valdez, and the remainder based on the regional distribution of the pipeline.

Industry Growth

The level of employment in federal government and agriculture-forestry-fisheries is set exogenously. Federal government employment is assumed to follow its general historical trend and remain constant at the 1976 level throughout the forecast period. The trend in the historical period reflects increases in civilian employment offsetting decreasing military employment. The regional allocation will also remain constant. Employment in agriculture-forestry-fisheries will be assumed to increase at a rate of 3 percent per year. This reflects an assumption of little growth in agriculture and a modest increase in fisheries. The Southcentral Water Study estimated approximately a 5 percent annual increase with maximum fisheries development. Employment will be assumed to increase at this rate in each region.

Output in manufacturing must be determined exogenously. It is assumed to increase at an average annual rate of 4 percent which is consistent with both the historical trend and the assumed growth in the fisheries industry. Regional growth will be determined by the mix of industries with food manufacturing growing at the same rate as fisheries, 3 percent; lumber growing at 4 percent; paper growing at 2.5 percent; and other manufacturing bringing the growth rate into line with the overall 4 percent per year.

PETROLEUM REVENUE ASSUMPTIONS

Petroleum revenues to the state consist of royalties, production taxes, property taxes, and the corporate income tax. This section will examine the revenue assumptions chosen for the base case. Where it was possible and did not conflict with other assumptions made in this study, we used revenue estimates made by the state; in other cases, revenues were estimated based on assumptions about the wellhead value and production.

COOK INLET REVENUES

Table B.3 details the royalty and severance revenues from oil and gas production in Upper Cook Inlet. The overall assumption is that oil production would be over in 1995, while gas production will continue throughout the projection period. The specific assumptions are:

- Oil royalties and production tax are from a Legislative Affairs Agency memo of July 14, 1977. Revenues were estimated through 1985; after that a 15 percent decline was assumed in the value of oil produced. The average production of the well was assumed

TABLE B.3. COOK INLET REVENUES[1]

Fiscal Year	Oil Royalties (Millions)	Oil Production Tax (Millions)	Gas Royalties (Millions)	Gas Production Tax (Millions)
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	20.1	3.0	9.4	4.9
1987	19.1	2.0	9.4	4.9
1988	18.2	1.0	9.4	4.9
1989	17.3	0	8.5	4.4
1990	16.4	0	7.7	3.9
1991	0	0	6.9	3.5
1992	0	0	6.2	3.2
1993	0	0	5.6	2.9
1994	0	0	5.0	2.6
1995	0	0	4.5	2.3
1996	0	0	4.1	2.1
1997	0	0	3.7	1.9
1998	0	0	3.3	1.7
1999	0	0	3.0	1.5
2000	0	0	2.6	1.4

[1] Same as The Permanent Fund and the Alaskan Economy (Goldsmith, 1977) study except oil royalties which are the same until 1985, then decline at 15 percent to be eliminated in 1996.

to decline below the taxable rate in 1989, and production was assumed to stop in 1995.

- Gas royalties and production tax are based on estimates of production through 1985 made by the Revenue Department in Revenue Journal, Vol. 1, No. 2, October 1976. Decline after 1985 was assumed by the author to be at a rate of 10 percent per year. The 1977 ratio of royalties and production taxes to production was assumed to hold throughout the projection period.

PRUDHOE BAY REVENUES

Prudhoe Bay will produce the major petroleum revenues for the state in the projection period. To arrive at revenue estimates, estimates of production and the wellhead value are needed. These estimates are shown in Table B.4 and Table B.5.

- Production of oil was assumed to equal estimates made in Technical Report No. 6 (Alaska OCS Socioeconomic Studies Program, 1978).

- The wellhead value per barrel of oil was calculated based on discussion with BLM-OCS. These assumptions reflect those made with respect to N. Gulf oil.

  1. West Coast market price is $12/bbl. This reflects a $1.50 discount from a $13.50/bbl Gulf Coast price. The discount is for transport costs. The real market price stays constant.

  2. Vessel costs equal $1.00/bbl from Valdez to the West Coast and $.75/bbl processing costs. These costs remain constant in real terms.

  3. The TAPS tariff is $5.25 in 1978. The nominal tariff remains constant until 1990 when it is assumed the increased

TABLE B.4. PRUDHOE BAY OIL[1]

Fiscal Year	Production (Million Bbls)	Wellhead Price ($/Bbl)	Total Wellhead Value (Million$)	Royalties (Million$)	Production Tax (Million$)
1978	237.3	5.00	1186.5	148.3	124.6
1979	474.5	5.56	2638.2	329.8	277.0
1980	584.0	6.16	3597.4	449.7	377.7
1981	595.7	6.79	4044.8	505.6	424.7
1982	607.5	7.45	4525.9	565.7	475.2
1983	619.6	8.15	5049.7	631.2	530.2
1984	631.5	8.88	5607.7	701.0	588.8
1985	641.5	9.66	6196.9	774.6	650.7
1986	613.2	10.48	6426.3	803.3	674.8
1987	545.7	11.35	6193.7	774.2	650.3
1988	511.9	12.25	6270.8	783.9	658.4
1989	475.4	13.22	6284.8	785.6	659.9
1990	409.7	14.24	5834.1	729.3	561.5
1991	367.7	15.02	5522.9	690.4	531.6
1992	347.7	15.85	5511.0	688.9	530.4
1993	329.4	16.72	5507.6	688.5	530.1
1994	299.3	17.64	5279.7	660.0	508.2
1995	268.3	18.61	4993.1	624.1	480.6
1996	246.4	19.63	4836.8	604.6	465.5
1997	228.1	20.71	4724.0	590.5	454.7
1998	211.7	21.85	4625.6	578.2	445.2
1999	197.5	23.05	4552.4	569.1	438.2
2000	183.8	24.32	4470.0	558.8	430.2

[1] See text for explanation.

TABLE B.5. PRUDHOE BAY GAS[1]

Fiscal Year	Production (Billion C. Ft)	Wellhead Price ($/MCF)	Wellhead Value (Million$)	Royalties (Million$)	Production Tax (Million$)
1978	3.9	1.00	3.9	.5	.4
1979	5.1	1.06	5.4	.7	.6
1980	5.9	1.11	6.5	.8	.7
1981	28	1.17	32.8	4.1	3.4
1982	43	1.24	53.3	6.7	5.6
1983	50	1.31	65.5	8.2	6.9
1984	780	1.38	1076.4	134.6	113.0
1985	830	1.45	1203.5	150.4	126.4
1986	870	1.53	1331.1	166.4	139.8
1987	912	1.62	1477.4	184.7	155.1
1988	912	1.71	1559.5	194.9	163.7
1989	912	1.80	1641.6	205.2	172.4
1990	912	1.90	1732.8	216.6	181.9
1991	912	2.01	1833.1	229.1	192.5
1992	912	2.12	1933.4	241.7	203.0
1993	912	2.23	2033.8	254.2	213.5
1994	912	2.36	2152.3	269.0	226.0
1995	912	2.48	2261.8	282.7	237.5
1996	912	2.62	2389.4	298.7	250.9
1997	912	2.77	2526.2	315.8	265.3
1998	912	2.92	2663.0	332.9	279.6
1999	912	3.08	2809.0	351.1	294.9
2000	912	3.25	2964.0	370.5	311.2

[1]See text for explanation.

operating costs dominate the decreasing capital costs. After 1990, the tariff remains constant in real terms.

This assumption reflects only one of a number which could be made concerning oil wellhead values.

- Production of gas at Prudhoe is assumed to increase following the Department of Revenue assumed production until 1987 when the peak production assumed by Dames and Moore (Beaufort OCS Petroleum Scenarios, 1978) is reached. This production level is assumed to remain throughout the period.

- The wellhead value of gas was calculated assuming the compromise energy bill is adopted so that Prudhoe gas could sell at a wellhead value of $1.45 per MCF. This assumes the ability to roll this gas with other gas. It is assumed that producers pay $.45 processing costs for a net of $1.00 wellhead. A constant real price of gas is assumed.[1]

Revenues from these are determined based upon state laws. Royalties are 12.5 percent of the wellhead value of oil and gas. The production tax in each case is a fraction of the nonroyalty value. This fraction depends upon the productivity of the average well in the field. The production tax on oil was assumed to equal 12 percent through 1989 when production declines and the rate falls to 11 percent. The production tax on gas is assumed to equal 12 percent throughout the projection period.

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[1]Base case was selected prior to final adoption of Federal Energy Act of 1978 which set a ceiling for Alaskan gas wellhead price.

MISCELLANEOUS REVENUES

There are three important miscellaneous petroleum revenues: the property tax, the reserves taxes, and the corporate income tax. Table B.6 shows the assumed value of these taxes.

- The property tax taxes all petroleum-related property except oil refining and gas processing property and leases at a rate of twenty mills. We used the property tax revenue series estimated by the Department of Revenue in <u>Alaska Oil and Gas Structure</u>. This assumed construction of the TAPS and ALCAN lines.
- The reserves tax involves the repayment by the state of taxes paid by petroleum producers in 1976 and 1977. Credits of up to 50 percent of the production taxes are given until the $499 million collected is repaid. This tax affects only producers at Prudhoe.
- The Alaskan corporate income tax was changed in the last legislative session so that no state projection of this revenue stream is available. The corporate income tax on petroleum is 9.4 percent of taxable petroleum income. Taxable income is gross income minus capital and operating costs and Alaskan taxes. The figure is not net of federal taxes. The tax was based on estimates of net income determined by the following procedure.

    1. ALCAN and TAPS income was based on an assumption that these lines would be guaranteed a 20 percent after-tax return on their equity by the rate structure. It

TABLE B.6. OTHER REVENUES

Fiscal Year	Property Tax[1] (Million$)	Reserves Tax[2] (Million$)	ANCSA[3] (Million$)	Corporate Income Tax[4] (Million$)
1978	173.0	(83.3)	(23.8)	33.5
1979	185.0	(166.4)	(52.9)	127.8
1980	193.2	(204.8)	(72.1)	167.3
1981	226.7	(44.8)	(81.6)	188.5
1982	251.8	0	(91.6)	212.8
1983	257.0	0	(102.3)	265.1
1984	261.4	0	(68.8)	348.9
1985	295.9	0	0	384.8
1986	281.1	0	0	405.1
1987	267.0	0	0	407.2
1988	253.7	0	0	421.6
1989	241.0	0	0	428.7
1990	229.0	0	0	421.4
1991	217.5	0	0	409.7
1992	206.6	0	0	416.5
1993	196.3	0	0	425.7
1994	186.5	0	0	418.8
1995	177.2	0	0	410.1
1996	168.3	0	0	410.7
1997	159.9	0	0	409.9
1998	151.9	0	0	411.0
1999	144.3	0	0	416.6
2000	137.1	0	0	418.5

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[1] Based on estimates in Alaska Oil and Gas Tax Structure, Department of Revenue.

[2] 50 percent of Prudhoe production taxes.

[3] 2.0 percent of wellhead value at Prudhoe until $500 million is paid to the fund.

[4] Actual fiscal year 78 value; afterwards estimated as explained in the text.

was assumed that 15 percent of the capital cost of both projects was equity. The TAPS project was assumed to cost $10.5 billion and the Alaskan portion of the ALCAN line was assumed to cost $4.3 billion. The equity portion was depreciated in a straightline return on the remaining equity adjusted for an assumed 48 percent Federal tax rate.

2. Corporate taxable income for Prudhoe Bay gas and oil production was derived by estimating the components of revenues and costs. Revenues are derived above. The cost assumptions were derived from Technical Report No. 6 (Alaska OCS Socioeconomic Studies Program, 1978). The assumptions are shown below:

	Prudhoe Oil	Prudhoe Gas
Total Costs	$9.45 billion	$2.6 billion
Debt Proportion	25 %	25 %
Interest on Debt	9.0%	9.0%
Project Life	25 years	26 years
Total Throughput	10.5 billion bbls	26 billion MCF

Capital costs per barrel were found with this information. Per barrel costs were used to account for the flow of investment over the life of the field. Capital costs equalled debt service plus depreciation costs. Operating costs were added for total costs. These costs were:

	Prudhoe Oil	Prudhoe Gas
Capital Costs	$1.24/bbl	$.14/MCF
Operating Costs	$1.00/bbl	$.08/MCF

In addition, $.12 per barrel and $.02 per MCF were allowed for overhead as per the legislation. Taxable income was found by subtracting these costs and allowable Alaska taxes from revenues.

3. The ratio of oil and gas taxable income to severance taxes at Prudhoe Bay was applied to Cook Inlet to estimate taxable income from this production.

4. Estimated corporate income tax was found by applying the .094 rate to this income.

5. A final portion of the tax includes a redistribution of multistate corporate profits. This portion allocates

worldwide corporate profits based on three factors: non-production property in Alaska as a percent of worldwide property, nonproduction payroll in Alaska as a percent of worldwide payroll, and Alaskan sales as a percent of worldwide sales. The average of these was taken as the proportion of worldwide profits which were taxed at 9.4 percent. Conversation with Alaska Department of Revenue led us to the conclusion that this component would be extremely small, so it was ignored in this study.

BEAUFORT OCS REVENUES

Tables B.7 through B.9 show the revenues associated with each of three Beaufort scenarios. Revenues are based on production estimates provided by the Alaska OCS Office of BLM. Wellhead values are determined by the wellhead value at Prudhoe minus transport costs from the Beaufort. These real 1978 transport costs were $.60 per barrel for oil and $.15 per MCF for gas. Other assumptions included:

1. Half of the production and offshore capital facilities would be located in state waters.

2. A conventional scheme of bonus bidding was used with $100 million being bid.

3. Discoveries on state-owned properties will be subject to state royalties and production taxes at current rates.

4. Oil and gas production from the Beaufort is transported via TAPS and ALCAN rather than new pipelines or alternate modes.

TABLE B.7. BEAUFORT MINIMUM SCENARIO
DIRECT REVENUE EFFECTS

(Millions of Nominal Dollars)

	Bonus[1]	Royalties[2]	Production Tax[3]	Property Tax[4]	Corporate Income Tax[5]
1979	50	0	0	0	0
1980	0	0	0	0	0
1981	0	0	0	.31	0
1982	0	0	0	.44	0
1983	0	0	0	.70	0
1984	0	0	0	.71	0
1985	0	0	0	.48	0
1986	0	0	0	2.01	0
1987	0	0	0	4.75	0
1988	0	0	0	8.92	0
1989	0	9.10	7.60	13.29	.42
1990	0	24.10	20.30	15.05	3.77
1991	0	33.00	27.70	16.77	5.66
1992	0	42.80	35.90	17.58	7.84
1993	0	45.10	37.90	19.04	9.27
1994	0	44.00	40.00	20.43	9.10
1995	0	50.20	42.20	20.92	9.06
1996	0	50.60	42.50	20.37	9.21
1997	0	50.70	42.60	19.70	8.72
1998	0	49.40	41.50	18.89	8.18
1999	0	46.30	38.90	17.94	7.14
2000	0	42.80	35.90	16.82	5.81

[1] BLM-Alaska OCS Office.

[2] Royalties estimated at 12.5 percent of total wellhead value.

[3] Production tax equals 12 percent of the nonroyalty portion of total wellhead value.

[4] Tax at 20 mills of petroleum property value.

[5] Corporate income tax at 9.4 percent of taxable petroleum income.

TABLE B.8. BEAUFORT MODERATE SCENARIO DIRECT REVENUE EFFECTS

(Millions of Nominal Dollars)

	Bonus[1]	Royalties[2]	Production[3] Tax	Property[4] Tax	Corporate[5] Income Tax
1979	50	0	0	0	0
1980	0	0	0	0	0
1981	0	0	0	.31	0
1982	0	0	0	.44	0
1983	0	0	0	.70	0
1984	0	0	0	.71	0
1985	0	0	0	.82	0
1986	0	0	0	3.03	0
1987	0	0	0	6.21	0
1988	0	0	0	11.01	0
1989	0	12.50	10.50	16.22	.43
1990	0	33.10	30.10	18.49	7.12
1991	0	51.00	42.90	20.69	10.41
1992	0	54.70	46.00	22.06	11.13
1993	0	57.80	48.50	24.18	11.96
1994	0	61.00	51.20	26.37	12.74
1995	0	63.20	53.00	27.60	11.29
1996	0	65.40	55.00	28.03	12.41
1997	0	67.70	56.80	28.00	12.77
1998	0	65.90	55.40	27.81	11.79
1999	0	62.20	52.30	27.50	9.87
2000	0	58.10	48.80	27.08	7.63

[1] BLM-Alaska OCS Office.

[2] Royalties estimated at 12.5 percent of total wellhead value.

[3] Production tax equals 12 percent of the nonroyalty portion of total wellhead value.

[4] Tax at 20 mills of petroleum property value.

[5] Corporate income tax at 9.4 percent of taxable petroleum income.

TABLE B.9. BEAUFORT HIGH SCENARIO DIRECT REVENUE EFFECTS

(Millions of Nominal Dollars)

	Bonus[1]	Royalties[2]	Production Tax[3]	Property Tax[4]	Corporate Income Tax[5]
1979	50	0	0	0	0
1980	0	0	0	0	0
1981	0	0	0	.31	0
1982	0	0	0	.44	0
1983	0	0	0	.70	0
1984	0	0	0	.71	0
1985	0	0	0	.82	0
1986	0	0	0	3.78	0
1987	0	0	0	9.21	0
1988	0	0	0	16.71	0
1989	0	37.50	31.40	24.88	4.51
1990	0	67.10	56.40	28.60	15.54
1991	0	85.10	71.40	32.35	19.48
1992	0	90.70	76.20	34.72	20.43
1993	0	95.60	80.30	38.43	21.95
1994	0	100.80	84.70	42.18	23.09
1995	0	106.40	89.30	44.34	21.97
1996	0	112.20	94.30	45.13	23.18
1997	0	115.90	97.30	45.23	23.90
1998	0	112.70	94.60	45.21	20.42
1999	0	101.50	85.20	45.04	17.62
2000	0	91.70	77.00	44.73	13.19

[1] BLM-Alaska OCS Office.

[2] Royalties estimated at 12.5 percent of total wellhead value.

[3] Production tax equals 12 percent of the nonroyalty portion of total wellhead value.

[4] Tax at 20 mills of petroleum property value.

[5] Corporate income tax at 9.4 percent of taxable petroleum income.

APPENDIX C

A Procedure to Determine the Share of OCS Employment to Alaskan Residents

The direct total employment estimates made by Dames and Moore in the Northern Gulf OCS petroleum scenarios (Dames and Moore, 1978) have been refined to reflect resident/nonresident composition of this employment. Resident, in the context of these refinements, refers to an individual that resides in Alaska for the duration of employment (including offsite). Resident employees do not need to live in Alaska before the project begins. Resident employment is assumed to have full impact on the Alaska economy, while the impact of nonresident employees is assumed to be negligible. To assist in the determination of the share of employment to Alaska residents (SEAR), a cross section of information regarding the classification, structure, duration, and impact of OCS petroleum development-related employment is presented in Table C.1, "Characteristics of OCS Employment by Task," which accompanies this appendix.

A brief outline of the table's format and information content will precede a discussion of the assumptions used to provide consistency and accuracy in the interpretation of this information.

TABLE FORMAT

Columns one and two categorize employment by sector (or task) and by phase of development, respectively. Column three lists the rotation factor

TABLE C.1. CHARACTERISTICS OF OCS EMPLOYMENT BY TASK

1 Employment Sectors For Petroleum Operations[1]	2 Phase of Development[2]	3 Rotation Factor[3]	4 Duration[4]	5 Potential AK Resident Share from Industry[5]	6 Employment Multiplier[6]		7 Payments Allocation Coefficients Share to AK Residents[8] In Years: 1	5	10	8 Estimate Share of Employment To Alaskan Residents (SEAR) 1979-84	1985-89	1990 +
ONSHORE												
1. Service Base	Exploration	1		.15[a]						1.0	1.0	1.0
	Development	1	P	.2	1.5	1[7]		NA		1.0	1.0	1.0
	Production	1		1.0						1.0	1.0	1.0
2. Helicopter Service	Exploration	2								.5	.525	.578
	Development	1.5[a]	P	.2 (.3)[b]	1.5	1		NA		.5	.525	.578
	Production	1								1.0	1.0	1.0
3. Service Base Const.	Development	1.11	T	.5	1.5	1	.25	.25	.25	.5	.525	.578
4. Pipe Coating	Development	1.11	T	.2	1.1	.2	.25	.25	.25	.2	.21	.231
5. Onshore Pipeline Const.	Development	1.11	T	.2	1.1	.2	.25	.25	.25	.2	.21	.231
6. Oil Terminal Const.	Development	1.11	T	.5	1.1	.2	.25	.25	.25	.5	.525	.578
7. LNG Plant Const.	Development	1.11	T	NA	1.1	.2	.25	.25	.25	.5	.525	.578
8. Concrete Platform Const.[10]	Development	NA	NA	NA	NA	NA	.25	.25	.25	NA	NA	NA
9. Oil Terminal Operations	Production	1	P	1.0	1.5	1	.75	.75	.75[9]	1.0	1.0	1.0
10. LNG Plant Operations	Production	1	P	1.0	1.5	1	.75	.75	.75[9]	1.0	1.0	1.0
OFFSHORE												
11. Surveys	Exploration	1	T	.2	1.1	.2	.15	.55	.55	.2	.21	.231
12. Rigs	Exploration	2	T	.1	1.1	.2	.15	.55	.55	.2	.21	.231
13. Platforms	Development	2	P	.1 (.3)[b]	1.2[c]	.4	.75	.75	.75[9]	.1	.3	.33
	Production	1		1.0	1.4[d]	.8				1.0	1.0	1.0
14. Platform Installation	Development	2	T	.1	1.1	.2	.25	.25	.25	.1	.105	.116
15. Offshore Pipeline Const.	Development	2	T	.1	1.1	.2	.25	.25	.25	.1	.105	.116
16. Supply-Anchor-Tugboats	Exploration	1.5		.15	1.2[c]	.4				.4	.42	.462
	Development	1.5	T	.15	1.4[d]	.8		NA		.8	.88	.968
	Production	1.5		.5	1.4[d]	.8				.8	.88	.968

[a]Approximation [b]Numbers in parentheses indicate second 5-year period

[c]First three years [d]Thereafter NA = not applicable

TABLE NOTES

Characteristics of OCS Employment by Task

1. These are the employment sectors (or tasks) requested by Tom Smythe of Alaska Consultants in his November 21 correspondence with Richard Schmidt of Peat, Marwick, Mitchell and Co.

2. Dames and Moore, "Alaska OCS Socioeconomic Studies Program, Northern Gulf of Alaska, Petroleum Development Scenarios," Draft Report, Task 9BA, October 24, 1978, Table 5-4, pages 119-122.

3. Ibid.

4. Based on discussions found in Planning for Offshore Oil Development, Gulf of Alaska OCS Handbook, Division of Community Planning, ADCRA, 1978, pages 40-41 and 223-224. Note: P = permanent; T = temporary.

5. Interview: Max Beazley, Staff Engineer at Mobil Oil Corporation, Exploration and Producing. Mr. Beazley is currently working in the Prudhoe Unit, a planning team for future development in Prudhoe Bay.

6. "Planning for Offshore Oil Development," Division of Community Planning, Alaska Department of Community and Regional Affairs, October 1977, Table 12, pages 17-18.

7. Column 6 shows the task-specific employment multipliers assumed by Community and Regional Affairs (lefthand number). The right-hand number in this column is the implicit proportion of resident employment when a resident multiplier of 1.5 is assumed.

8. "A Social and Economic Impact Study of Offshore Petroleum and Natural Gas Development in Alaska: Phase II," Mathematics Science Northwest, Inc., and Alaska Consultants, Inc., for BLM, October 1976, page 19.

9. Amendments suggested by Ed Phillips, Alaska DNR.

10. Concrete Platform Construction is not considered feasible in the Gulf of Alaska.

associated with each task. The rotation factors are taken from Dames and Moore (see Table Note 2) and are calculated as follows:

$$1 + \frac{\text{Number of days off duty}}{\text{Number of days on duty}}$$

They are used to determine the on- and offsite employment for a given task. Employment duration (permanent or temporary) by task is listed in column four. The information in columns one through four characterize employment by task. They are intended to provide qualitative limits for the SEAR estimates.

The SEAR estimates shown in column eight of Table C.1 are based partly on other estimates of the resident share of OCS employment. Columns five through seven provide alternative implicit and explicit estimates of the SEAR. Column five includes an industry perspective on the resident potential of Alaska OCS employment. Column six provides estimates of the share of resident employment implicit in multipliers estimated by Community and Regional Affairs. The lefthand numbers are the task-specific OCS employment multipliers. The implicit SEAR (righthand number) is found by comparing these task-specific numbers with the resident multiplier (1.5) assumed in the study. The payment allocation coefficients found in column seven were developed for use in a regional input-output analysis designed to capture the socioeconomic impacts of OCS petroleum development in the Yakutat area. (See Table Note 8.) An even distribution of skills across resident and nonresident groups is required in order to reinterpret the payment allocation coefficients in the context of employment and residency. This assumption is, perhaps, unrealistic during exploration and petroleum field development. Under this interpretation, the payment allocation coefficients will overstate the SEAR for tasks relevant to those phases of development.

METHODOLOGY AND ASSUMPTIONS

The task-specific information just outlined has been mapped into a final SEAR estimate (in column eight) for each task using the following methodology:

1. The SEAR estimates contained in columns five, six, and seven are used to bracket a reasonable SEAR range for each task. For example, the SEAR range for offshore platform installation (task 14) extends from .1 to .25.

2. In the interest of consistency, an additional set of general, phase-specific SEAR guidelines are developed. Here, a given employment task is examined in the context of its phase of development.

Tasks subsumed under exploration (Onshore: service base, helicopter service; Offshore: surveys, rigs, supply-anchor-tugboats) are temporary, require "extreme specialization," and usually embrace a reparatory work crew having "international character."[1] These conditions imply a low SEAR (of approximately .1 to .2) for exploration employment. Of course, exceptions to these guidelines occur. For example, helicopter service during exploration may be contracted through Anchorage-based firms.[2]

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[1]Dames and Moore, "Alaska OCS Socioeconomic Studies Program, Northern Gulf of Alaska, Petroleum Development Scenarios," Draft Report, Task 9BA, October 24, 1978, pp. 106-107.

[2]Dames and Moore, "Alaska OCS Socioeconomic Studies Program, Monitoring Petroleum Activities in the Gulf of Alaska and the Lower Cook Inlet Between April 1975 and June 1978," Technical Report #17, August 1978, p. 38.

The offshore development phase, including platform installation (14) and operation (13) offshore pipeline construction (15), and supply-anchor-tug boats (16), is assumed to retain the descriptive and structural characteristics mentioned above for the case of exploration.

Onshore development includes various types of construction employment. Although the work force is generally seasonal (not unusual in the Alaska construction industry), the potential for civil construction work by Alaska-based contractors is more likely than that of offshore development or of exploration, particularly as the overall sphere of OCS development broadens. It is assumed that a SEAR of about .4 to .5 is consistent with these conditions.

During production, employment is generally permanent and oriented toward less specialized, more routine entry-level positions. These employment characteristics appear to be compatible with Alaska residency. Overall, we attach a SEAR of 1.0 to tasks subsumed under the production phase.

Table C.2 summarizes the general SEAR guidlines outlined above.

TABLE C.2. PHASE-SPECIFIC SEAR GUIDELINE

	Onshore	Offshore
Exploration	.1 - .2	.1 - .2
Development	.4 - .5	.1 - .2
Production	1.0	1.0

Additionally, there are two principal relationships which influence the trend in the share of OCS employment to Alaska residents (SEAR). First, the internal supply of labor that is qualified to perform the variety of tasks delineated in column one of Table C.1 is assumed to increase in response to earlier "layers" of OCS petroleum development, as a function of other mining activity, and to more general growth in the Alaska economy. Second, for those OCS employees that initially accept nonresident status, it is likely that a certain percentage shift to Alaska residency over time. We consolidate the combined effects of these employment dynamics into an assumption calling for a one percent annual average rate of growth in the SEAR for all tasks having an initial SEAR of less than one. For simplicity, the continuous compounding of growth per period is replaced by a five percent increase between 1985 and 1989 and a ten percent increase thereafter. This assumption corresponds to the figures in the three subcolumns under column eight.

APPENDIX D

Selected Model Output

Variable Definitions

POP	Population (10^3 persons)
MIGNET	Net migration (10^3 persons)
NINCTOT	Natural increase (10^3 persons)
EM99	Total employment (10^3 persons)
EMSPP	Proportion of employment in the support sector
EMG9P	Proportion of employment in the government sector
EMNSP	Proportion of employment in the basic sector
EMA9	Employment in agriculture-forestry-fisheries (10^3 persons)
EMGF	Employment in federal government (10^3 persons)
EMP9	Employment in mining (10^3 persons)
EMT9	Employment in transportation (10^3 persons)
EMS9	Employment in services (10^3 persons)
EMPU	Employment in utilities (10^3 persons)
EMM9	Employment in manufacturing (10^3 persons)
EMFI	Employment in finance-insurance-real estate (10^3 persons)
EMD9	Employment in trade (10^3 persons)
EMCN	Employment in construction (10^3 persons)
EMCN1	Employment in local construction (10^3 persons)
EMGA	Employment in state and local government (10^3 persons)
EMOT	Other employment (10^3 persons)
PI	Personal income (millions of nominal dollars)
PIRPC	Real per capita personal income
RPI	Relative price index ($1957 US = 100)
E99S	Total state expenditures (millions of nominal dollars)
EXOPS	Total state operating expenditures (millions of nominal dollars)
EXCAP	Total state capital expenditures (millions of nominal dollars)
E99SRPC	Real per capita state expenditures
REVGF	Total general fund revenue (millions of nominal dollars)
RP9S	Total petroleum revenues (millions of nominal dollars)
RT98	Total nonpetroleum tax revenues (millions of nominal dollars)
RENS	Total endogenous revenues (millions of nominal dollars)

Variable Definitions (continued)

GFBAL	General fund balance (millions of nominal dollars)
PFBAL	Permanent fund balance (millions of nominal dollars)
RINS	Fund balance interest (millions of nominal dollars)
FUND	Total fund balance (millions of nominal dollars)
FUND77	Real fund balance (millions of real 1977 dollars)
SIMP	General fund revenues minus general fund expenditures (millions of nominal dollars)
EXBITES	State total expenditure as a percentage of personal income
VIABL2	Nonpetroleum revenues as a percentage of general fund expenditures
RENSRAT	Endogenous revenues as a percentage of personal income

MODERATE BASE CASE

SIMULATION OUTPUT BY DSET

BNM

	POP	MIGNET	NINCTOT	EM99	EMSPP	EMG9P	EMNSP	EMA9
1977	41[illegible].66	-24.935	6.383	185.508	0.363	0.378	0.259	1.1
1978	406.667	-11.241	7.202	178.526	0.373	0.386	0.242	1.2
1979	418.656	5.268	6.697	185.225	0.383	0.374	0.243	1.2
1980	434.173	8.65	6.87	194.054	0.395	0.36	0.245	1.2
1981	456.078	14.768	7.144	206.859	0.408	0.341	0.251	1.3
1982	487.441	23.727	7.654	225.394	0.423	0.318	0.259	1.3
1983	504.694	8.784	8.501	231.506	0.425	0.322	0.253	1.4
1984	503.802	-9.582	8.697	224.632	0.421	0.337	0.242	1.4
1985	513.372	1.383	8.163	227.742	0.429	0.327	0.243	1.4
1986	530.903	9.4	8.127	236.983	0.439	0.316	0.245	1.5
1987	551.736	12.437	8.403	248.235	0.449	0.306	0.245	1.5
1988	573.044	12.531	8.788	259.246	0.456	0.299	0.245	1.6
1989	593.59	11.392	9.165	269.355	0.463	0.293	0.245	1.6
1990	612.523	9.453	9.491	278.055	0.468	0.288	0.244	1.7
1991	626.14	3.888	9.735	282.828	0.472	0.287	0.241	1.7
1992	639.242	3.344	9.754	287.596	0.477	0.282	0.241	1.8
1993	655.575	6.561	9.767	295.033	0.484	0.275	0.24	1.8
1994	672.781	7.288	9.918	303.083	0.491	0.269	0.24	1.8
1995	692.017	9.14	10.097	312.619	0.498	0.262	0.24	1.9
1996	713.324	10.959	10.351	323.534	0.505	0.255	0.24	2.
1997	734.418	10.423	10.676	334.057	0.511	0.249	0.24	2.1
1998	756.187	10.801	10.972	344.923	0.518	0.242	0.24	2.1
1999	780.692	13.23	11.28	357.663	0.525	0.235	0.24	2.2
2000	805.725	13.357	11.682	370.496	0.532	0.229	0.24	2.2

	EMGP	EMP9	EMT9	EMS9	EMPU	EMOT	EMM9	EMFI
1977	42.921	4.514	9.842	22.649	1.184	14.55	11.356	5.779
1978	42.921	4.351	10.294	21.9	1.194	14.269	11.906	5.738
1979	42.921	4.563	10.774	23.693	1.249	14.538	12.411	6.176
1980	42.921	5.104	11.393	25.945	1.321	14.886	12.896	6.758
1981	42.921	5.036	12.26	29.095	1.405	15.377	13.37	7.516
1982	42.921	4.747	13.358	33.696	1.511	16.06	13.843	8.563
1983	42.921	4.546	13.747	34.655	1.548	16.279	14.32	8.906
1984	42.921	4.699	13.464	32.756	1.534	16.033	14.867	8.652
1985	42.921	4.63	13.89	33.939	1.57	16.145	15.364	8.98
1986	42.921	4.598	14.614	36.442	1.635	16.473	15.877	9.617
1987	42.921	4.704	15.297	39.471	1.713	16.864	16.403	10.397
1988	42.921	5.219	15.956	42.25	1.781	17.238	16.947	11.107
1989	42.921	5.618	16.638	44.921	1.846	17.574	17.542	11.794
1990	42.921	5.967	17.126	47.229	1.903	17.858	18.12	12.404
1991	42.921	5.541	17.51	48.628	1.936	18.012	18.744	12.764
1992	42.921	5.356	17.683	50.188	1.972	18.164	19.367	13.169
1993	42.921	5.11	18.226	52.596	2.026	18.4	20.003	13.782
1994	42.921	4.96	18.751	55.055	2.08	18.651	20.66	14.411
1995	42.921	4.988	19.369	57.989	2.143	18.944	21.339	15.166
1996	42.921	5.09	20.047	61.3	2.212	19.274	22.041	16.004
1997	42.921	5.091	20.704	64.505	2.279	19.587	22.766	16.834
1998	42.921	5.093	21.374	67.868	2.346	19.905	23.515	17.691
1999	42.921	5.093	22.157	71.873	2.424	20.271	24.289	18.71
2000	42.921	5.094	22.924	75.869	2.5	20.633	25.089	19.725

	EMD9	EMCN	EMCN1	EMGA	PI	PIRPC	RPI	EXOPS
1977	24.819	16.559	11.189	27.256	4072.38	3924.32	252.71	810.
1978	24.766	11.434	11.307	25.941	4236.48	3723.81	279.75	944.
1979	26.405	12.277	11.972	26.373	4743.19	3862.07	293.358	1019.
1980	28.562	13.526	13.001	26.862	5395.29	4029.44	308.4	1120.35
1981	31.305	16.804	14.161	27.623	6419.62	4322.83	325.623	1247.59
1982	35.003	22.374	15.835	28.837	7958.32	4721.45	345.814	1435.16
1983	36.231	22.083	16.626	31.681	8644.94	4736.66	361.631	1703.05
1984	35.424	17.253	16.614	32.803	8360.41	4448.3	373.054	1859.66
1985	36.6	17.871	17.391	31.625	9008.04	4510.79	388.998	1918.4
1986	38.851	19.663	18.699	31.93	10154.8	4686.78	408.122	2101.17
1987	41.586	21.354	19.979	33.116	11535.2	4872.56	429.085	2370.06
1988	44.047	22.578	21.208	34.642	12978.7	5025.95	450.642	2686.92
1989	46.415	23.525	22.344	35.964	14452.9	5150.7	472.727	3020.64
1990	48.511	24.2	23.376	37.116	15918.8	5249.5	495.08	3364.35
1991	49.736	24.187	23.896	38.13	17081.8	5281.79	516.516	3701.41
1992	51.112	24.59	24.464	38.241	18420.4	5346.79	538.943	3985.63
1993	53.179	25.638	25.433	38.28	20170.9	5460.54	563.47	4293.68
1994	55.293	26.674	26.468	38.721	22121.4	5578.84	589.385	4667.79
1995	57.813	27.826	27.697	39.08	24366.6	5705.99	617.095	5070.97
1996	60.583	29.335	29.062	39.531	27050.8	5864.31	646.663	5519.27
1997	63.322	30.56	30.507	40.169	29784.8	5987.96	677.294	6030.96
1998	66.124	32.079	32.024	40.645	32888.1	6131.6	709.319	6558.54
1999	69.434	33.893	33.837	41.087	36514.4	6289.92	743.612	7141.71
2000	72.709	35.721	35.663	41.748	40496.4	6448.28	779.458	7810.61

	EXCAP	E99S	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL
1977	270.326	1160.82	1118.56	796.27	197.201	214.301	278.522	668.165
1978	280.	1311.13	1152.49	1053.8	471.4	206.916	240.272	617.209
1979	290.	1414.71	1151.9	1440.77	860.7	274.373	222.549	814.761
1980	331.395	1566.76	1170.1	1624.51	996.3	312.909	230.856	1054.02
1981	372.128	1743.59	1174.06	1988.55	1278.41	355.609	264.314	1500.87
1982	444.685	2018.89	1197.69	2330.77	1475.74	438.457	338.533	2055.49
1983	523.263	2379.64	1303.82	2655.01	1642.7	554.402	422.537	2627.34
1984	564.766	2594.65	1380.53	3230.48	2121.71	654.15	452.302	3550.23
1985	656.147	2762.46	1383.3	3638.62	2422.22	688.497	457.94	4737.79
1986	787.626	3098.81	1430.18	3832.81	2430.98	751.246	515.097	5852.35
1987	850.323	3454.3	1459.1	4100.44	2482.07	819.668	603.624	6947.33
1988	925.417	3873.39	1499.93	4377.05	2523.13	913.609	710.544	7971.75
1989	977.05	4287.93	1528.1	4664.6	2570.9	1006.07	824.565	8933.78
1990	1028.17	4713.48	1554.33	4803.72	2467.	1094.69	944.659	9686.79
1991	1036.81	5092.2	1574.53	4975.19	2414.02	1171.84	1062.99	10293.7
1992	1045.73	5419.18	1572.99	5202.18	2438.18	1257.98	1168.59	10843.6
1993	1086.45	5796.66	1569.22	5456.95	2467.08	1364.31	1296.13	11329.9
1994	1139.32	6254.34	1577.28	5685.61	2435.11	1481.71	1459.13	11667.1
1995	1178.86	6732.74	1576.6	5910.88	2381.26	1614.27	1646.58	11832.6
1996	1227.64	7268.04	1575.62	6212.98	2373.27	1789.26	1872.21	11851.2
1997	1299.15	7887.97	1585.79	6555.09	2374.39	1990.75	2135.58	11695.3
1998	1402.94	8560.98	1596.07	6911.39	2371.9	2213.05	2424.36	11341.6
1999	1519.83	9295.53	1601.21	7316.43	2377.55	2478.03	2760.51	10790.
2000	1653.84	10134.9	1613.77	7772.99	2378.55	2790.07	3161.16	10006.3

	PFBAL	RINS	FUND	FUND77	EXBITEL	R99L	E99L	SIMP
1977	2.4	35.343	670.6	671.369	0.131	531.912	557.16	-137.452
1978	48.975	46.954	666.184	602.483	0.134	568.508	595.271	-4.416
1979	153.275	46.878	968.037	834.862	0.131	622.528	650.896	301.853
1980	275.	68.529	1329.02	1090.28	0.133	718.529	748.6	360.987
1981	411.475	94.407	1912.34	1485.84	0.126	806.186	838.061	583.318
1982	563.425	135.921	2618.92	1916.02	0.115	912.631	946.418	706.579
1983	731.699	186.141	3359.04	2350.01	0.121	1045.	1080.82	740.128
1984	948.649	238.792	4498.88	3051.08	0.135	1131.33	1169.3	1139.84
1985	1187.55	319.665	5925.34	3853.77	0.131	1176.98	1217.22	1426.47
1986	1437.35	420.712	7289.7	4518.98	0.125	1270.34	1312.99	1364.36
1987	1684.2	517.466	8631.53	5089.38	0.122	1403.26	1448.48	1341.83
1988	1935.8	612.628	9907.55	5562.31	0.121	1565.81	1613.73	1276.02
1989	2193.07	703.207	11126.9	5955.01	0.12	1729.57	1780.37	1219.31
1990	2444.52	789.845	12131.3	6199.44	0.119	1902.28	1956.13	1004.46
1991	2688.87	861.414	12982.6	6359.14	0.122	2077.4	2134.49	851.285
1992	2936.75	922.226	13780.4	6469.01	0.121	2221.62	2282.13	797.754
1993	3188.27	979.308	14518.2	6518.7	0.118	2382.65	2446.79	737.805
1994	3437.02	1032.21	15104.1	6483.62	0.117	2584.86	2652.85	585.992
1995	3680.52	1074.48	15513.1	6360.15	0.115	2805.93	2877.99	408.973
1996	3923.72	1104.32	15775.	6171.79	0.113	3063.2	3139.59	261.844
1997	4168.14	1123.87	15863.5	5925.71	0.113	3352.5	3433.47	88.488
1998	4413.22	1131.28	15754.8	5619.43	0.111	3662.82	3748.65	-108.613
1999	4659.57	1124.9	15449.6	5256.42	0.11	3999.05	4090.04	-305.27
2000	4907.07	1104.77	14913.3	4840.63	0.108	4389.92	4486.36	-536.238

	EXBITES	VIABL2	RENSRAT
1977	0.229	0.604	0.068
1978	0.25	0.506	0.057
1979	0.24	0.468	0.047
1980	0.234	0.443	0.043
1981	0.219	0.438	0.041
1982	0.204	0.443	0.043
1983	0.222	0.431	0.049
1984	0.25	0.416	0.054
1985	0.246	0.405	0.051
1986	0.243	0.397	0.051
1987	0.239	0.399	0.052
1988	0.239	0.4	0.055
1989	0.238	0.404	0.057
1990	0.239	0.407	0.059
1991	0.241	0.412	0.062
1992	0.239	0.418	0.063
1993	0.234	0.426	0.064
1994	0.231	0.435	0.066
1995	0.226	0.446	0.068
1996	0.22	0.46	0.069
1997	0.217	0.473	0.072
1998	0.213	0.485	0.074
1999	0.209	0.5	0.076
2000	0.205	0.516	0.078

MEAN WESTERN GULF DEVELOPMENT SCENARIO

(Levels and Differences from the Moderate Base Case)

SIMULATION OUTPUT BY DSET

NWM

	POP	MIGNET	NINCTOT	EM99	EMSPP	EMG9P	EMNSP	EMA9
1977	410.66	-24.935	6.383	185.508	0.363	0.378	0.259	1.1
1978	406.667	-11.241	7.202	178.526	0.373	0.386	0.242	1.2
1979	418.656	5.268	6.697	185.225	0.383	0.374	0.243	1.2
1980	434.173	8.65	6.87	194.054	0.395	0.36	0.245	1.2
1981	456.474	15.165	7.144	207.152	0.408	0.34	0.251	1.3
1982	488.072	23.946	7.67	225.826	0.423	0.318	0.259	1.3
1983	505.23	8.665	8.525	231.825	0.425	0.322	0.253	1.4
1984	505.702	-8.237	8.715	225.936	0.423	0.335	0.242	1.4
1985	514.895	0.937	8.236	228.576	0.43	0.327	0.243	1.4
1986	532.225	9.147	8.176	237.589	0.439	0.315	0.246	1.5
1987	552.646	11.986	8.441	248.49	0.449	0.306	0.245	1.5
1988	573.779	12.339	8.806	259.371	0.456	0.299	0.246	1.6
1989	594.13	11.187	9.176	269.347	0.463	0.293	0.245	1.6
1990	612.961	9.347	9.493	277.993	0.468	0.288	0.244	1.7
1991	626.609	3.92	9.733	282.815	0.472	0.286	0.241	1.7
1992	639.724	3.358	9.754	287.614	0.477	0.282	0.241	1.8
1993	656.069	6.573	9.767	295.075	0.484	0.275	0.241	1.8
1994	673.284	7.295	9.92	303.145	0.491	0.269	0.24	1.8
1995	692.525	9.142	10.099	312.695	0.498	0.262	0.24	1.9
1996	713.813	10.937	10.354	323.608	0.505	0.255	0.24	2.
1997	734.91	10.424	10.679	334.142	0.512	0.248	0.24	2.1
1998	756.641	10.76	10.975	344.988	0.518	0.242	0.24	2.1
1999	781.069	13.15	11.282	357.679	0.525	0.235	0.24	2.2
2000	805.744	13.091	11.682	370.26	0.532	0.228	0.24	2.2

	EMGF	EMP9	EMT9	EMS9	EMPU	EMOT	EMM9	EMFI
1977	42.921	4.514	9.842	22.649	1.184	14.55	11.356	5.779
1978	42.921	4.351	10.294	21.9	1.194	14.269	11.906	5.738
1979	42.921	4.563	10.774	23.693	1.249	14.538	12.411	6.176
1980	42.921	5.104	11.393	25.945	1.321	14.886	12.896	6.758
1981	42.921	5.128	12.316	29.151	1.407	15.388	13.37	7.531
1982	42.921	4.84	13.42	33.782	1.513	16.076	13.843	8.586
1983	42.921	4.588	13.784	34.718	1.55	16.291	14.32	8.923
1984	42.921	4.709	13.553	33.112	1.543	16.08	14.867	8.744
1985	42.921	4.68	13.969	34.124	1.575	16.175	15.364	9.028
1986	42.921	4.716	14.677	36.581	1.639	16.494	15.877	9.653
1987	42.921	4.785	15.321	39.528	1.715	16.873	16.403	10.412
1988	42.921	5.299	15.985	42.281	1.782	17.242	16.947	11.115
1989	42.921	5.659	16.66	44.924	1.846	17.574	17.542	11.795
1990	42.921	6.096	17.146	47.22	1.903	17.856	18.12	12.402
1991	42.921	5.605	17.533	48.63	1.936	18.011	18.744	12.764
1992	42.921	5.42	17.707	50.196	1.972	18.165	19.367	13.171
1993	42.921	5.174	18.251	52.609	2.026	18.401	20.003	13.785
1994	42.921	5.024	18.776	55.073	2.08	18.653	20.66	14.416
1995	42.921	5.052	19.396	58.01	2.144	18.946	21.339	15.172
1996	42.921	5.154	20.073	61.319	2.212	19.276	22.041	16.008
1997	42.921	5.155	20.731	64.528	2.279	19.589	22.766	16.84
1998	42.921	5.157	21.399	67.886	2.346	19.906	23.515	17.696
1999	42.921	5.145	22.18	71.879	2.424	20.271	24.289	18.711
2000	42.921	5.094	22.913	75.812	2.499	20.626	25.089	19.71

	EMDO	EMCN	EMCN1	EMGA	PI	PIRPC	RPI	EXOPS
1977	24.819	16.559	11.189	27.256	4072.38	3924.32	252.71	810.
1978	24.766	11.434	11.307	25.941	4236.48	3723.81	279.75	944.
1979	26.405	12.277	11.972	26.373	4743.19	3862.07	293.358	1019.
1980	28.562	13.526	13.001	26.862	5395.29	4029.44	308.4	1120.35
1981	31.358	16.827	14.184	27.606	6434.18	4327.29	325.742	1247.59
1982	35.084	22.413	15.874	28.866	7982.23	4727.18	345.986	1437.49
1983	36.29	22.112	16.655	31.739	8663.23	4739.95	361.761	1706.73
1984	35.752	17.641	16.742	32.781	8460.77	4478.54	373.581	1862.45
1985	36.77	18.01	17.481	31.75	9063.43	4521.09	389.342	1923.29
1986	38.977	19.756	18.76	31.935	10198.4	4692.34	408.369	2099.21
1987	41.637	21.389	20.014	33.099	11553.4	4871.16	429.179	2365.31
1988	44.075	22.6	21.23	34.565	12988.6	5022.96	450.679	2677.17
1989	46.418	23.537	22.356	35.874	14452.6	5146.16	472.705	3008.7
1990	48.523	24.206	23.382	37.01	15913.9	5244.62	495.034	3350.
1991	49.737	24.198	23.907	38.016	17081.1	5277.87	516.49	3685.69
1992	51.118	24.604	24.478	38.139	18422.4	5343.47	538.929	3970.36
1993	53.191	25.655	25.45	38.186	20175.5	5457.69	563.467	4278.59
1994	55.308	26.692	26.486	38.635	22128.2	5576.34	589.392	4652.67
1995	57.83	27.845	27.716	39.	24375.4	5703.74	617.108	5055.67
1996	60.599	29.352	29.079	39.456	27059.5	5862.14	646.672	5503.56
1997	63.341	30.578	30.524	40.095	29795.6	5986.02	677.308	6014.3
1998	66.139	32.088	32.033	40.572	32896.3	6129.43	709.322	6540.52
1999	69.438	33.896	33.84	41.012	36515.5	6287.26	743.588	7121.4
2000	72.661	35.696	35.638	41.676	40456.3	6443.03	779.3	7787.01

	EXCAP	E99S	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL
1977	270.326	1160.82	1118.56	796.27	197.201	214.301	278.522	668.165
1978	280.	1311.13	1152.49	1053.8	471.4	206.916	240.272	617.209
1979	290.	1414.71	1151.9	1440.77	860.7	274.373	222.549	814.761
1980	331.395	1566.76	1170.1	1624.51	996.3	312.909	230.856	1054.02
1981	372.128	1743.59	1172.61	1988.99	1278.41	355.842	264.547	1501.3
1982	445.501	2022.03	1197.41	2332.23	1475.74	439.31	339.619	2054.88
1983	524.186	2384.26	1304.49	2656.78	1642.7	555.524	424.045	2624.75
1984	565.159	2597.87	1375.11	3234.06	2121.71	656.507	454.961	3548.49
1985	660.851	2772.12	1382.81	3645.62	2422.22	693.052	464.147	4735.84
1986	789.283	3098.7	1425.71	3837.2	2430.98	753.998	518.802	5855.14
1987	853.619	3453.07	1455.86	4103.88	2482.07	821.565	606.285	6955.3
1988	927.999	3866.55	1495.24	4379.27	2523.13	914.427	711.703	7988.3
1989	980.742	4280.09	1523.99	4666.63	2570.9	1006.38	825.063	8959.86
1990	1031.85	4703.33	1550.02	4805.68	2467.	1094.49	944.474	9724.29
1991	1040.68	5080.97	1569.96	4977.76	2414.02	1171.5	1062.58	10344.2
1992	1050.01	5408.93	1568.87	5205.98	2438.18	1257.87	1168.49	10907.6
1993	1090.88	5786.87	1565.4	5461.96	2467.08	1364.38	1296.26	11408.1
1994	1143.92	6244.82	1573.68	5691.87	2435.11	1481.96	1459.49	11760.7
1995	1183.34	6723.05	1573.15	5918.45	2381.26	1614.69	1647.15	11942.9
1996	1231.91	7257.87	1572.32	6221.87	2373.27	1789.79	1872.94	11980.
1997	1303.11	7876.66	1582.42	6565.33	2374.39	1991.31	2136.33	11844.7
1998	1403.2	8544.73	1592.08	6923.2	2371.9	2213.71	2425.27	11516.4
1999	1519.98	9276.89	1597.28	7329.6	2377.55	2478.38	2761.05	10993.6
2000	1653.71	10112.7	1610.52	7786.31	2378.55	2789.08	3160.21	10241.8

	PFBAL	RINS	FUND	FUND77	EXBITEL	R99L	E99L	SIMP
1977	2.4	35.343	670.6	671.369	0.131	531.912	557.16	-137.452
1978	48.975	46.954	666.184	602.483	0.134	568.508	595.271	-4.416
1979	153.275	46.878	968.037	834.862	0.131	622.528	650.896	301.853
1980	275.	68.529	1329.02	1090.28	0.133	718.529	748.6	360.987
1981	411.475	94.407	1912.78	1485.63	0.125	806.206	838.081	583.753
1982	563.425	135.952	2618.31	1914.62	0.115	914.112	947.899	705.536
1983	731.699	186.099	3356.45	2347.35	0.121	1047.38	1083.19	738.138
1984	948.649	238.61	4497.14	3045.6	0.134	1133.23	1171.2	1140.7
1985	1187.55	319.543	5923.39	3849.1	0.131	1186.93	1227.17	1426.25
1986	1437.35	420.575	7292.49	4517.97	0.125	1276.01	1318.66	1369.11
1987	1684.2	517.661	8639.5	5092.96	0.122	1407.59	1452.81	1347.01
1988	1935.8	613.186	9924.1	5571.14	0.121	1567.63	1615.55	1284.6
1989	2193.07	704.365	11152.9	5969.24	0.12	1730.53	1781.33	1228.84
1990	2444.52	791.67	12168.8	6219.19	0.12	1902.24	1956.09	1015.88
1991	2688.87	864.039	13033.1	6384.19	0.122	2076.92	2134.	864.27
1992	2936.75	925.76	13844.3	6499.2	0.121	2221.54	2282.05	811.23
1993	3188.27	983.785	14596.4	6553.87	0.118	2382.83	2446.97	752.098
1994	3437.02	1037.69	15197.7	6523.73	0.117	2585.31	2653.3	601.34
1995	3680.52	1081.03	15623.5	6405.25	0.115	2806.58	2878.65	425.715
1996	3923.72	1112.04	15903.7	6222.06	0.113	3064.04	3140.43	280.242
1997	4168.14	1132.88	16012.8	5981.38	0.113	3353.28	3434.25	109.094
1998	4413.22	1141.74	15929.6	5681.76	0.111	3663.82	3749.66	-83.168
1999	4659.57	1137.14	15653.2	5325.87	0.11	3999.79	4090.77	-276.453
2000	4907.07	1119.02	15148.9	4918.09	0.109	4389.95	4486.39	-504.281

	EXBITES	VIABL2	RENSRAT
1977	0.229	0.604	0.068
1978	0.25	0.506	0.057
1979	0.24	0.468	0.047
1980	0.234	0.443	0.043
1981	0.218	0.438	0.041
1982	0.204	0.443	0.043
1983	0.221	0.432	0.049
1984	0.247	0.417	0.054
1985	0.245	0.407	0.051
1986	0.242	0.399	0.051
1987	0.239	0.401	0.052
1988	0.238	0.402	0.055
1989	0.238	0.405	0.057
1990	0.238	0.408	0.059
1991	0.241	0.413	0.062
1992	0.239	0.419	0.063
1993	0.233	0.427	0.064
1994	0.23	0.436	0.066
1995	0.225	0.447	0.068
1996	0.22	0.461	0.069
1997	0.217	0.474	0.072
1998	0.213	0.487	0.074
1999	0.208	0.502	0.076
2000	0.205	0.517	0.078

SIMULATION OUTPUT BY DSET - ERROR

NWM_ER

	POP	MIGNET	NINCTOT	EM99	EMA9	EMGF	EMP9	EMT9
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.396	0.397	0.	0.293	0.	0.	0.092	0.056
1982	0.631	0.219	0.016	0.432	0.	0.	0.093	0.063
1983	0.536	-0.118	0.024	0.319	0.	0.	0.042	0.037
1984	1.9	1.346	0.018	1.304	0.	0.	0.01	0.089
1985	1.523	-0.446	0.072	0.834	0.	0.	0.05	0.079
1986	1.321	-0.253	0.049	0.606	0.	0.	0.118	0.063
1987	0.909	-0.451	0.038	0.255	0.	0.	0.081	0.023
1988	0.735	-0.192	0.018	0.125	0.	0.	0.08	0.029
1989	0.541	-0.205	0.01	-0.008	0.	0.	0.041	0.023
1990	0.438	-0.105	0.002	-0.062	0.	0.	0.039	0.02
1991	0.469	0.033	-0.002	-0.013	0.	0.	0.064	0.022
1992	0.482	0.013	-0.	0.017	0.	0.	0.064	0.024
1993	0.494	0.012	0.001	0.042	0.	0.	0.064	0.025
1994	0.503	0.007	0.002	0.061	0.	0.	0.064	0.026
1995	0.508	0.002	0.002	0.075	0.	0.	0.064	0.026
1996	0.489	-0.022	0.003	0.074	0.	0.	0.064	0.026
1997	0.492	0.001	0.003	0.085	0.	0.	0.064	0.027
1998	0.454	-0.041	0.003	0.064	0.	0.	0.064	0.026
1999	0.376	-0.08	0.002	0.015	0.	0.	0.052	0.023
2000	0.019	-0.357	-0.001	-0.236	0.	0.	0.	-0.011

	EMS9	EMPU	EMOT	EMM9	EMFI	EMD9	EMCM	EMCN
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.057	0.002	0.011	0.	0.015	0.054	0.001	0.023
1982	0.087	0.002	0.016	0.	0.022	0.08	0.001	0.039
1983	0.064	0.002	0.011	0.	0.016	0.058	0.001	0.03
1984	0.356	0.01	0.047	0.	0.092	0.328	0.006	0.388
1985	0.185	0.005	0.03	0.	0.048	0.17	0.003	0.139
1986	0.139	0.004	0.021	0.	0.036	0.126	0.002	0.092
1987	0.057	0.001	0.009	0.	0.015	0.051	0.001	0.035
1988	0.031	0.001	0.004	0.	0.008	0.028	0.	0.021
1989	0.003	0.	-0.	0.	0.001	0.002	0.	0.012
1990	-0.009	-0.	-0.002	0.	-0.002	-0.008	-0.	0.007
1991	0.002	0.	-0.	0.	0.	0.002	0.	0.011
1992	0.008	0.	0.001	0.	0.002	0.007	0.	0.014
1993	0.014	0.	0.001	0.	0.003	0.012	0.	0.016
1994	0.018	0.	0.002	0.	0.005	0.015	0.	0.018
1995	0.021	0.	0.002	0.	0.005	0.018	0.	0.018
1996	0.019	0.	0.002	0.	0.005	0.016	0.	0.017
1997	0.023	0.	0.003	0.	0.006	0.019	0.	0.017
1998	0.018	0.	0.002	0.	0.005	0.015	0.	0.008
1999	0.006	0.	0.	0.	0.001	0.005	0.	0.003
2000	-0.058	-0.001	-0.007	0.	-0.015	-0.047	-0.001	-0.025

	FMCNT	EMGA	PI	PINPC	RPI	EXOPS	EXCAP	E99S
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.023	-0.017	14.562	4.461	0.119	0.	0.	0.
1982	0.039	0.029	23.914	5.727	0.172	2.324	0.816	3.14
1983	0.03	0.058	13.297	3.231	0.13	3.678	0.923	4.624
1984	0.128	-0.022	100.363	30.23	0.527	2.785	0.393	3.226
1985	0.09	0.125	55.391	10.297	0.344	4.893	4.703	9.655
1986	0.061	0.005	43.512	5.559	0.247	-1.966	1.657	-0.118
1987	0.035	-0.017	18.215	-1.402	0.094	-4.755	3.296	-1.223
1988	0.021	-0.078	9.973	-2.992	0.037	-9.753	2.582	-6.841
1989	0.012	-0.089	-0.246	-4.539	-0.022	-11.932	3.692	-7.836
1990	0.007	-0.106	-4.941	-4.883	-0.047	-14.344	3.679	-10.152
1991	0.011	-0.114	-0.746	-3.922	-0.026	-15.716	3.866	-11.227
1992	0.014	-0.102	1.926	-3.32	-0.014	-15.269	4.281	-10.25
1993	0.016	-0.093	4.586	-2.848	-0.002	-15.09	4.436	-9.789
1994	0.018	-0.086	6.828	-2.5	0.006	-15.117	4.594	-9.527
1995	0.019	-0.08	8.781	-2.246	0.013	-15.297	4.478	-9.688
1996	0.017	-0.075	8.695	-2.168	0.009	-15.707	4.271	-10.176
1997	0.017	-0.075	10.828	-1.945	0.014	-16.652	3.956	-11.305
1998	0.008	-0.073	8.195	-2.172	0.002	-18.02	0.265	-16.25
1999	0.003	-0.075	1.031	-2.664	-0.024	-20.309	0.147	-18.645
2000	-0.025	-0.072	-40.117	-5.246	-0.158	-23.594	-0.136	-22.215

	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL	PFBAL	RINS
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	-1.448	0.44	0.	0.233	0.233	0.435	0.	0.
1982	-0.282	1.457	0.	0.853	1.086	-0.609	0.	0.03
1983	0.677	1.764	0.	1.122	1.508	-2.598	0.	-0.043
1984	-5.418	3.574	0.	2.357	2.66	-1.738	0.	-0.182
1985	-0.495	7.001	0.	4.556	6.207	-1.957	0.	-0.122
1986	-4.468	4.391	0.	2.752	3.705	2.789	0.	-0.137
1987	-3.236	3.445	0.	1.897	2.662	7.969	0.	0.195
1988	-4.689	2.211	0.	0.818	1.159	16.547	0.	0.558
1989	-4.111	2.031	0.	0.302	0.498	26.078	0.	1.158
1990	-4.31	1.957	0.	-0.204	-0.185	37.5	0.	1.825
1991	-4.568	2.57	0.	-0.338	-0.41	50.484	0.	2.625
1992	-4.118	3.809	0.	-0.108	-0.104	63.961	0.	3.534
1993	-3.824	5.008	0.	0.071	0.124	78.254	0.	4.477
1994	-3.596	6.266	0.	0.256	0.362	93.602	0.	5.478
1995	-3.456	7.574	0.	0.419	0.569	110.344	0.	6.552
1996	-3.306	8.895	0.	0.532	0.721	128.742	0.	7.724
1997	-3.366	10.234	0.	0.563	0.75	149.348	0.	9.012
1998	-3.991	11.812	0.	0.667	0.901	174.793	0.	10.454
1999	-3.929	13.172	0.	0.359	0.538	203.609	0.	12.235
2000	-3.249	13.324	0.	-0.99	-0.952	235.566	0.	14.253

	FUND	FUND77	R99L	E99L
1977	0.	0.	0.	0.
1978	0.	0.	0.	0.
1979	0.	0.	0.	0.
1980	0.	0.	0.	0.
1981	0.435	-0.205	0.02	0.02
1982	-0.609	-1.396	1.481	1.481
1983	-2.598	-2.664	2.372	2.372
1984	-1.738	-5.481	1.901	1.901
1985	-1.957	-4.679	9.944	9.944
1986	2.789	-1.008	5.67	5.67
1987	7.969	3.582	4.334	4.334
1988	16.547	8.832	1.82	1.82
1989	26.078	14.23	0.96	0.96
1990	37.5	19.746	-0.041	-0.041
1991	50.484	25.051	-0.489	-0.489
1992	63.961	30.195	-0.075	-0.075
1993	78.254	35.164	0.183	0.183
1994	93.602	40.109	0.446	0.446
1995	110.344	45.105	0.656	0.656
1996	128.742	50.277	0.835	0.835
1997	149.348	55.668	0.779	0.779
1998	174.793	62.328	1.003	1.003
1999	203.609	69.449	0.736	0.736
2000	235.566	77.457	0.023	0.023

MEAN WESTERN GULF DEVELOPMENT SCENARIO
CONSTANT STATE EXPENDITURE CASE

(Levels and Diferences from the Moderate Base Case)

SIMULATION OUTPUT BY DSET

XNWM

	POP	MIGNET	NINCTOT	EM99	EMA9	EMGF	EMP9	EMT9
1977	410.66	-24.935	6.383	185.508	1.1	42.921	4.514	9.842
1978	406.667	-11.241	7.202	178.526	1.2	42.921	4.351	10.294
1979	418.656	5.268	6.697	185.225	1.2	42.921	4.563	10.774
1980	434.173	8.65	6.87	194.054	1.2	42.921	5.104	11.393
1981	456.474	15.165	7.144	207.152	1.3	42.921	5.128	12.316
1982	487.969	23.844	7.67	225.75	1.3	42.921	4.84	13.417
1983	505.06	8.602	8.521	231.707	1.4	42.921	4.588	13.778
1984	505.555	-8.206	8.708	225.846	1.4	42.921	4.709	13.549
1985	514.616	0.809	8.231	228.395	1.4	42.921	4.68	13.96
1986	532.168	9.379	8.166	237.589	1.5	42.921	4.716	14.677
1987	552.679	12.077	8.441	248.555	1.5	42.921	4.785	15.323
1988	573.971	12.494	8.81	259.546	1.6	42.921	5.299	15.993
1989	594.393	11.248	9.185	269.558	1.6	42.921	5.659	16.67
1990	613.296	9.408	9.504	278.24	1.7	42.921	6.006	17.157
1991	626.988	3.952	9.746	283.075	1.7	42.921	5.605	17.544
1992	640.107	3.347	9.768	287.856	1.8	42.921	5.42	17.718
1993	656.451	6.559	9.78	295.3	1.8	42.921	5.174	18.261
1994	673.667	7.285	9.932	303.357	1.8	42.921	5.024	18.786
1995	692.914	9.137	10.11	312.899	1.9	42.921	5.052	19.405
1996	714.221	10.946	10.364	323.815	2.	42.921	5.154	20.082
1997	735.332	10.427	10.689	334.349	2.1	42.921	5.155	20.74
1998	757.114	10.802	10.985	345.223	2.1	42.921	5.157	21.41
1999	781.596	13.193	11.294	357.941	2.2	42.921	5.145	22.192
2000	806.32	13.036	11.694	370.545	2.2	42.921	5.094	22.926

	EMS9	EMPU	EMOT	EMM9	EMFI	EMD9	EMCM	EMCN
1977	22.649	1.184	14.55	11.356	5.779	24.819	2.979	16.559
1978	21.9	1.194	14.269	11.906	5.738	24.766	2.612	11.434
1979	23.693	1.249	14.538	12.411	6.176	26.405	2.645	12.277
1980	25.945	1.321	14.886	12.896	6.758	28.562	2.679	13.526
1981	29.151	1.407	15.388	13.37	7.531	31.358	2.848	16.827
1982	33.768	1.513	16.073	13.843	8.582	35.07	3.183	22.403
1983	34.696	1.549	16.286	14.32	8.917	36.269	3.19	22.099
1984	33.095	1.543	16.077	14.867	8.74	35.737	2.83	17.633
1985	34.088	1.574	16.168	15.364	9.018	36.737	2.81	17.977
1986	36.58	1.639	16.494	15.877	9.653	38.976	2.864	19.749
1987	39.539	1.715	16.875	16.403	10.415	41.647	2.909	21.382
1988	42.315	1.783	17.248	16.947	11.123	44.105	2.961	22.605
1989	44.965	1.847	17.58	17.542	11.805	46.455	2.998	23.544
1990	47.27	1.904	17.864	18.12	12.414	48.547	3.002	24.217
1991	48.683	1.937	18.02	18.744	12.778	49.784	3.021	24.21
1992	50.247	1.973	18.173	19.367	13.184	51.163	3.036	24.614
1993	52.657	2.027	18.408	20.003	13.797	53.232	3.076	25.664
1994	55.119	2.081	18.659	20.66	14.428	55.347	3.109	26.701
1995	58.055	2.145	18.952	21.339	15.183	57.869	3.141	27.855
1996	61.367	2.213	19.282	22.041	16.021	60.639	3.198	29.364
1997	64.576	2.28	19.595	22.766	16.852	63.381	3.219	30.591
1998	67.942	2.347	19.913	23.515	17.71	66.185	3.263	32.112
1999	71.944	2.425	20.279	24.289	18.728	69.491	3.314	33.923
2000	75.882	2.5	20.634	25.089	19.728	72.719	3.363	35.727

	EMCN1	EMGA	PI	PIIPC	RPI	EXOPS	EXCAP	E99S
1977	11.189	27.256	4072.38	3924.32	252.71	810.	270.326	1160.82
1978	11.307	25.941	4236.48	3723.81	279.75	944.	280.	1311.13
1979	11.972	26.373	4743.19	3862.07	293.358	1019.	290.	1414.71
1980	13.001	26.862	5395.29	4029.44	308.4	1120.35	331.395	1566.76
1981	14.184	27.606	6434.18	4327.29	325.742	1247.59	372.128	1743.59
1982	15.864	28.838	7978.23	4726.21	345.956	1435.16	444.685	2018.89
1983	16.642	31.694	8656.65	4738.56	361.714	1703.05	523.263	2379.64
1984	16.734	32.745	8455.74	4477.63	373.542	1859.66	564.766	2594.65
1985	17.448	31.699	9052.3	4518.89	389.264	1918.4	656.147	2762.46
1986	18.753	31.944	10198.1	4692.73	408.369	2101.17	787.626	3098.81
1987	20.007	33.141	11557.4	4872.22	429.207	2370.06	850.323	3454.3
1988	21.235	34.646	13001.1	5025.23	450.755	2686.92	925.417	3873.39
1989	22.363	35.971	14468.6	5148.57	472.798	3020.64	977.05	4287.93
1990	23.393	37.119	15934.	5247.21	495.144	3364.35	1028.17	4713.48
1991	23.919	38.128	17103.6	5280.42	516.609	3701.41	1036.81	5092.2
1992	24.488	38.242	18444.7	5345.61	539.043	3985.63	1045.73	5419.18
1993	25.459	38.281	20197.5	5459.43	563.575	4293.68	1086.45	5796.66
1994	26.495	38.723	22150.4	5577.77	589.495	4667.79	1139.32	6254.34
1995	27.726	39.082	24398.2	5704.96	617.209	5070.97	1178.86	6732.74
1996	29.091	39.533	27084.5	5863.26	646.777	5519.27	1227.64	7268.04
1997	30.537	40.171	29822.2	5986.98	677.414	6030.96	1299.15	7887.97
1998	32.057	40.648	32929.1	6130.65	709.444	6558.54	1402.94	8560.98
1999	33.867	41.091	36554.9	6288.62	743.727	7141.71	1519.83	9295.53
2000	35.669	41.761	40502.	6444.45	779.453	7810.61	1653.84	10134.9

	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL	PFBAL	RINS
1977	1118.56	796.27	197.201	214.301	278.522	668.165	2.4	35.343
1978	1152.49	1053.8	471.4	206.916	240.272	617.209	48.975	46.954
1979	1151.9	1440.77	860.7	274.373	222.549	814.761	153.275	46.878
1980	1170.1	1624.51	996.3	312.909	230.856	1054.02	275.	68.529
1981	1172.61	1988.99	1278.41	355.842	264.547	1501.3	411.475	94.407
1982	1195.91	2332.11	1475.74	439.242	339.552	2057.25	563.425	135.952
1983	1302.57	2656.53	1642.7	555.268	423.724	2630.59	731.699	186.264
1984	1373.95	3233.95	2121.71	656.182	454.529	3556.91	948.649	239.019
1985	1379.01	3645.59	2422.22	692.683	463.691	4751.37	1187.55	320.132
1986	1425.92	3837.65	2430.98	753.579	518.191	5870.69	1437.35	421.662
1987	1456.2	4105.05	2482.07	821.632	606.347	6970.24	1684.2	518.749
1988	1497.13	4380.9	2523.13	914.821	712.165	7998.47	1935.8	614.231
1989	1525.8	4668.59	2570.9	1007.21	826.12	8964.45	2193.07	705.078
1990	1552.17	4807.62	2467.	1095.58	945.856	9721.34	2444.52	791.992
1991	1572.11	4979.57	2414.02	1172.86	1064.31	10332.6	2688.87	863.833
1992	1570.57	5207.39	2438.18	1259.36	1170.4	10887.7	2936.75	924.949
1993	1566.84	5462.81	2467.08	1365.89	1298.19	11379.8	3188.27	982.394
1994	1574.91	5692.18	2435.11	1483.5	1461.45	11723.6	3437.02	1035.71
1995	1574.27	5918.24	2381.26	1616.3	1649.19	11896.4	3680.52	1078.43
1996	1573.37	6221.2	2373.27	1791.53	1875.14	11923.2	3923.72	1108.78
1997	1583.53	6564.23	2374.39	1993.27	2138.8	11776.3	4168.14	1128.9
1998	1593.84	6921.7	2371.9	2215.96	2428.06	11432.9	4413.22	1136.95
1999	1599.11	7327.86	2377.55	2481.24	2764.61	10892.7	4659.57	1131.29
2000	1612.59	7784.24	2378.55	2792.59	3164.57	10120.1	4907.07	1111.95

	FUND	FUND77	EXBITEL	R99L	E99L	SIMP	EXBITES	VIABL2
1977	679.6	671.369	0.131	531.912	557.16	-137.452	0.229	0.604
1978	666.184	602.483	0.134	568.508	595.271	-4.416	0.25	0.506
1979	968.037	834.862	0.131	622.528	650.896	301.853	0.24	0.468
1980	1329.02	1099.28	0.133	718.529	748.6	360.987	0.234	0.443
1981	1912.78	1485.63	0.125	806.206	838.081	583.753	0.218	0.438
1982	2620.67	1916.52	0.115	914.106	947.894	707.896	0.204	0.444
1983	3362.29	2351.74	0.121	1046.98	1082.79	741.621	0.221	0.432
1984	4505.55	3051.61	0.134	1132.59	1170.55	1143.27	0.247	0.418
1985	5938.92	3859.96	0.131	1186.41	1226.65	1433.37	0.244	0.408
1986	7308.04	4527.61	0.125	1274.91	1317.56	1369.12	0.242	0.399
1987	8654.44	5101.43	0.122	1407.57	1452.78	1346.4	0.239	0.4
1988	9934.27	5575.91	0.121	1568.03	1615.96	1279.83	0.239	0.401
1989	11157.5	5970.53	0.12	1731.75	1782.55	1223.26	0.238	0.404
1990	12165.9	6216.3	0.119	1903.82	1957.67	1008.34	0.238	0.408
1991	13021.5	6377.05	0.122	2078.88	2135.96	855.633	0.241	0.413
1992	13824.4	6488.49	0.121	2223.73	2284.24	802.937	0.239	0.419
1993	14568.1	6539.89	0.118	2385.	2449.14	743.629	0.234	0.427
1994	15169.6	6506.63	0.117	2587.43	2655.42	592.523	0.23	0.436
1995	15576.9	6385.11	0.115	2808.71	2880.78	416.289	0.226	0.447
1996	15846.9	6198.83	0.113	3066.22	3142.61	270.012	0.22	0.46
1997	15944.5	5954.93	0.113	3355.67	3436.64	97.586	0.217	0.473
1998	15846.1	5651.	0.111	3666.35	3752.18	-98.355	0.213	0.486
1999	15552.2	5290.53	0.11	4002.9	4093.88	-293.887	0.209	0.501
2000	15027.2	4877.62	0.108	4393.68	4490.12	-525.031	0.205	0.517

	RENSRAT	EMSPP	EMG9P	EMNSP
1977	0.068	0.363	0.378	0.259
1978	0.057	0.373	0.386	0.242
1979	0.047	0.383	0.374	0.243
1980	0.043	0.395	0.36	0.245
1981	0.041	0.408	0.34	0.251
1982	0.043	0.423	0.318	0.259
1983	0.049	0.425	0.322	0.253
1984	0.054	0.423	0.335	0.242
1985	0.051	0.43	0.327	0.243
1986	0.051	0.439	0.315	0.246
1987	0.052	0.449	0.306	0.245
1988	0.055	0.456	0.299	0.245
1989	0.057	0.463	0.293	0.245
1990	0.059	0.468	0.288	0.244
1991	0.062	0.472	0.286	0.241
1992	0.063	0.477	0.282	0.241
1993	0.064	0.484	0.275	0.241
1994	0.066	0.491	0.269	0.24
1995	0.068	0.498	0.262	0.24
1996	0.069	0.505	0.255	0.24
1997	0.072	0.512	0.249	0.24
1998	0.074	0.518	0.242	0.24
1999	0.076	0.525	0.235	0.24
2000	0.078	0.532	0.229	0.239

SIMULATION OUTPUT BY DSET - ERROR

XNWM_ER

	POP	MIGNET	NINCTOT	EM99	EMA9	EMGF	EMP9	EMT9
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.396	0.397	0.	0.293	0.	0.	0.092	0.056
1982	0.528	0.116	0.016	0.357	0.	0.	0.093	0.059
1983	0.366	-0.182	0.02	0.2	0.	0.	0.042	0.031
1984	1.753	1.376	0.011	1.214	0.	0.	0.01	0.085
1985	1.245	-0.574	0.067	0.654	0.	0.	0.05	0.07
1986	1.264	-0.021	0.039	0.606	0.	0.	0.118	0.062
1987	0.943	-0.359	0.038	0.32	0.	0.	0.081	0.026
1988	0.927	-0.037	0.022	0.3	0.	0.	0.08	0.037
1989	0.803	-0.144	0.02	0.203	0.	0.	0.041	0.032
1990	0.772	-0.044	0.013	0.185	0.	0.	0.039	0.031
1991	0.848	0.064	0.011	0.247	0.	0.	0.064	0.034
1992	0.865	0.003	0.014	0.26	0.	0.	0.064	0.035
1993	0.876	-0.002	0.014	0.267	0.	0.	0.064	0.035
1994	0.886	-0.003	0.013	0.274	0.	0.	0.064	0.035
1995	0.897	-0.003	0.013	0.28	0.	0.	0.064	0.036
1996	0.897	-0.013	0.013	0.281	0.	0.	0.064	0.036
1997	0.914	0.004	0.013	0.292	0.	0.	0.064	0.036
1998	0.926	0.001	0.013	0.3	0.	0.	0.064	0.037
1999	0.904	-0.036	0.013	0.278	0.	0.	0.052	0.036
2000	0.595	-0.321	0.012	0.049	0.	0.	0.	0.002

	EMS9	EMPU	EMOT	EMM9	EMFI	EMD9	EMCM	EMCN
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.057	0.002	0.011	0.	0.015	0.054	0.001	0.023
1982	0.073	0.002	0.013	0.	0.019	0.067	0.001	0.03
1983	0.041	0.001	0.007	0.	0.011	0.037	0.001	0.017
1984	0.339	0.009	0.044	0.	0.088	0.313	0.005	0.379
1985	0.149	0.004	0.023	0.	0.039	0.137	0.002	0.106
1986	0.138	0.004	0.021	0.	0.036	0.125	0.002	0.086
1987	0.068	0.002	0.011	0.	0.017	0.061	0.001	0.028
1988	0.065	0.002	0.01	0.	0.017	0.058	0.001	0.027
1989	0.044	0.001	0.007	0.	0.011	0.039	0.001	0.019
1990	0.041	0.001	0.006	0.	0.01	0.036	0.001	0.017
1991	0.055	0.001	0.008	0.	0.014	0.048	0.001	0.023
1992	0.059	0.001	0.008	0.	0.015	0.051	0.001	0.025
1993	0.061	0.001	0.008	0.	0.016	0.053	0.001	0.026
1994	0.064	0.001	0.008	0.	0.016	0.055	0.001	0.027
1995	0.066	0.001	0.009	0.	0.017	0.056	0.001	0.028
1996	0.066	0.001	0.008	0.	0.017	0.056	0.001	0.029
1997	0.071	0.001	0.009	0.	0.018	0.059	0.001	0.031
1998	0.074	0.001	0.009	0.	0.019	0.061	0.001	0.032
1999	0.07	0.001	0.008	0.	0.018	0.058	0.001	0.031
2000	0.012	0.	0.001	0.	0.003	0.01	0.	0.006

	EMCN1	EMGA	PI	PIRPC	RPI	EXOPS	EXCAP	E99S
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.023	-0.017	14.562	4.461	0.119	0.	0.	0.
1982	0.03	0.001	19.914	4.762	0.141	0.	0.	0.
1983	0.017	0.013	11.715	1.898	0.083	0.	0.	0.
1984	0.119	-0.058	95.336	29.328	0.488	0.	0.	0.
1985	0.057	0.074	44.262	8.094	0.266	0.	0.	0.
1986	0.054	0.014	43.262	5.953	0.247	0.	0.	0.
1987	0.028	0.025	22.199	-0.34	0.122	0.	0.	0.
1988	0.027	0.004	22.387	-0.719	0.113	0.	0.	0.
1989	0.019	0.008	15.742	-2.125	0.071	0.	0.	0.
1990	0.017	0.002	15.148	-2.239	0.063	0.	0.	0.
1991	0.023	-0.002	21.781	-1.371	0.093	0.	0.	0.
1992	0.025	0.001	24.27	-1.18	0.1	0.	0.	0.
1993	0.026	0.002	26.625	-1.105	0.105	0.	0.	0.
1994	0.027	0.002	29.008	-1.074	0.11	0.	0.	0.
1995	0.028	0.002	31.66	-1.027	0.114	0.	0.	0.
1996	0.029	0.003	33.707	-1.055	0.114	0.	0.	0.
1997	0.031	0.002	37.41	-0.984	0.12	0.	0.	0.
1998	0.032	0.002	41.035	-0.945	0.125	0.	0.	0.
1999	0.031	0.004	40.477	-1.297	0.115	0.	0.	0.
2000	0.006	0.014	5.602	-3.832	-0.005	0.	0.	0.

	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL	PFBAL	RINS
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	-1.448	0.44	0.	0.233	0.233	0.435	0.	0.
1982	-1.786	1.334	0.	0.786	1.019	1.752	0.	0.03
1983	-1.243	1.514	0.	0.865	1.187	3.244	0.	0.123
1984	-6.586	3.466	0.	2.032	2.227	6.676	0.	0.227
1985	-4.29	6.968	0.	4.186	5.751	13.578	0.	0.467
1986	-4.261	4.832	0.	2.332	3.094	18.34	0.	0.95
1987	-2.903	4.617	0.	1.964	2.723	22.906	0.	1.284
1988	-2.8	3.848	0.	1.212	1.621	26.719	0.	1.604
1989	-2.294	3.984	0.	1.133	1.555	30.672	0.	1.87
1990	-2.156	3.906	0.	0.886	1.197	34.551	0.	2.147
1991	-2.411	4.379	0.	1.015	1.32	38.898	0.	2.418
1992	-2.417	5.215	0.	1.384	1.812	44.082	0.	2.723
1993	-2.388	5.863	0.	1.583	2.062	49.906	0.	3.086
1994	-2.368	6.57	0.	1.794	2.323	56.437	0.	3.493
1995	-2.332	7.359	0.	2.025	2.612	63.754	0.	3.951
1996	-2.255	8.215	0.	2.272	2.924	71.922	0.	4.463
1997	-2.251	9.141	0.	2.524	3.223	81.02	0.	5.034
1998	-2.233	10.309	0.	2.912	3.7	91.277	0.	5.671
1999	-2.097	11.437	0.	3.212	4.091	102.66	0.	6.389
2000	-1.18	11.25	0.	2.524	3.407	113.867	0.	7.186

	FUND	FUND77	R99L	E99L
1977	0.	0.	0.	0.
1978	0.	0.	0.	0.
1979	0.	0.	0.	0.
1980	0.	0.	0.	0.
1981	0.435	-0.205	0.02	0.02
1982	1.752	0.499	1.475	1.475
1983	3.244	1.73	1.974	1.974
1984	6.676	0.533	1.253	1.253
1985	13.578	6.19	9.428	9.428
1986	18.34	8.629	4.573	4.573
1987	22.906	12.055	4.305	4.305
1988	26.719	13.598	2.227	2.227
1989	30.672	15.52	2.184	2.184
1990	34.551	16.859	1.536	1.536
1991	38.898	17.91	1.477	1.477
1992	44.082	19.484	2.116	2.116
1993	49.906	21.184	2.35	2.35
1994	56.437	23.012	2.568	2.568
1995	63.754	24.957	2.786	2.786
1996	71.922	27.047	3.021	3.021
1997	81.02	29.211	3.17	3.17
1998	91.277	31.562	3.533	3.533
1999	102.66	34.109	3.844	3.844
2000	113.867	36.988	3.762	3.762

5% WESTERN GULF OCS DEVELOPMENT SCENARIO - MODERATE BASE CASE

(Levels and Differences from the Base Case)

SIMULATION OUTPUT BY DSET

NWH

	POP	MIGNET	NINCTOT	EM99	EMSPP	EMG9P	EMNSP	EMA9
1977	410.66	-24.935	6.383	185.508	0.363	0.378	0.259	1.1
1978	406.667	-11.241	7.202	178.526	0.373	0.386	0.242	1.2
1979	418.656	5.268	6.697	185.225	0.383	0.374	0.243	1.2
1980	434.173	8.65	6.87	194.054	0.395	0.36	0.245	1.2
1981	456.46	15.15	7.144	207.142	0.409	0.34	0.251	1.3
1982	488.438	24.327	7.669	226.099	0.424	0.317	0.259	1.3
1983	507.968	11.023	8.54	233.822	0.427	0.319	0.254	1.4
1984	511.073	-5.709	8.825	229.616	0.427	0.331	0.242	1.4
1985	523.415	3.885	8.441	234.154	0.436	0.32	0.244	1.4
1986	540.19	8.283	8.49	242.103	0.443	0.312	0.245	1.5
1987	562.074	13.187	8.704	253.672	0.453	0.301	0.246	1.5
1988	583.412	12.242	9.109	264.202	0.459	0.295	0.246	1.6
1989	603.852	10.99	9.461	273.886	0.465	0.289	0.246	1.6
1990	622.824	9.222	9.759	282.362	0.47	0.284	0.246	1.7
1991	635.923	3.12	9.984	286.549	0.474	0.284	0.243	1.7
1992	648.675	2.785	9.963	290.936	0.478	0.279	0.242	1.8
1993	663.878	5.249	9.948	297.456	0.486	0.273	0.241	1.8
1994	680.385	6.464	10.042	304.994	0.492	0.268	0.241	1.8
1995	699.74	9.166	10.187	314.665	0.499	0.26	0.241	1.9
1996	721.223	11.043	10.444	325.749	0.506	0.253	0.241	2.
1997	742.428	10.438	10.773	336.375	0.513	0.247	0.241	2.1
1998	764.178	10.682	11.071	347.241	0.519	0.24	0.241	2.1
1999	788.707	13.156	11.377	360.009	0.526	0.233	0.24	2.2
2000	813.749	13.271	11.779	372.859	0.533	0.227	0.24	2.2

	EMGF	EMP9	EMT9	EMS9	EMPU	EMOT	EMM9	EMFI
1977	42.921	4.514	9.842	22.649	1.184	14.55	11.356	5.779
1978	42.921	4.351	10.294	21.9	1.194	14.269	11.906	5.738
1979	42.921	4.563	10.774	23.693	1.249	14.538	12.411	6.176
1980	42.921	5.104	11.393	25.945	1.321	14.886	12.896	6.758
1981	42.921	5.107	12.334	29.149	1.406	15.388	13.37	7.53
1982	42.921	4.881	13.516	33.837	1.515	16.086	13.843	8.6
1983	42.921	4.667	14.011	35.228	1.564	16.361	14.32	9.053
1984	42.921	4.868	14.198	33.951	1.566	16.212	14.867	8.961
1985	42.921	4.771	14.894	35.47	1.611	16.373	15.364	9.375
1986	42.921	4.741	15.334	37.6	1.665	16.652	15.877	9.916
1987	42.921	4.942	15.918	40.825	1.747	17.049	16.403	10.746
1988	42.921	5.77	16.504	43.396	1.809	17.403	16.947	11.401
1989	42.921	6.331	17.145	45.95	1.871	17.722	17.592	12.058
1990	42.921	6.775	17.599	48.205	1.926	17.997	18.17	12.654
1991	42.921	6.281	17.948	49.454	1.955	18.131	18.794	12.975
1992	42.921	6.034	18.11	50.94	1.989	18.27	19.417	13.361
1993	42.921	5.472	18.608	53.15	2.038	18.475	20.053	13.923
1994	42.921	5.265	19.108	55.501	2.089	18.71	20.71	14.525
1995	42.921	5.401	19.734	58.476	2.154	19.006	21.389	15.291
1996	42.921	5.528	20.419	61.834	2.223	19.34	22.091	16.14
1997	42.921	5.529	21.08	65.071	2.29	19.655	22.816	16.978
1998	42.921	5.531	21.749	68.44	2.357	19.972	23.565	17.836
1999	42.921	5.531	22.534	72.462	2.435	20.337	24.339	18.859
2000	42.921	5.532	23.301	76.469	2.511	20.699	25.139	19.877

	EMD9	EMCN	EMCN1	EMGA	PI	PIRPC	RPI	EXOPS
1977	24.819	16.559	11.189	27.256	4072.38	3924.32	252.71	810.
1978	24.766	11.434	11.307	25.941	4236.48	3723.81	279.75	944.
1979	26.405	12.277	11.972	26.373	4743.19	3862.07	293.358	1019.
1980	28.562	13.526	13.001	26.862	5395.29	4029.44	308.4	1120.35
1981	31.356	16.826	14.183	27.607	6433.52	4327.04	325.738	1247.59
1982	35.134	22.435	15.896	28.848	7997.3	4731.06	346.095	1437.39
1983	36.75	22.674	16.853	31.674	8805.99	4781.75	362.544	1709.03
1984	36.525	18.317	17.091	32.987	8703.16	4540.33	375.066	1883.39
1985	38.003	19.146	18.019	31.996	9466.65	4617.89	391.66	1948.44
1986	39.901	20.489	19.21	32.628	10522.2	4748.08	410.252	2148.2
1987	42.8	22.429	20.524	33.463	11983.9	4942.85	431.354	2400.12
1988	45.064	23.302	21.727	35.109	13382.7	5067.02	452.712	2724.83
1989	47.321	24.085	22.806	36.279	14834.8	5176.1	474.629	3049.18
1990	49.364	24.703	23.825	37.334	16299.9	5266.81	496.909	3386.2
1991	50.455	24.583	24.292	38.32	17418.9	5286.64	518.129	3719.92
1992	51.763	24.95	24.824	38.336	18740.6	5345.94	540.422	3994.82
1993	53.656	25.917	25.712	38.362	20415.6	5447.29	564.544	4297.22
1994	55.674	26.899	26.693	38.68	22326.2	5559.58	590.231	4654.92
1995	58.226	28.069	27.94	38.952	24601.9	5689.01	618.017	5047.5
1996	61.032	29.601	29.328	39.417	27323.6	5849.47	647.675	5496.48
1997	63.794	30.842	30.788	40.074	30088.4	5974.25	678.369	6009.12
1998	66.598	32.348	32.293	40.555	33210.9	6117.67	710.406	6534.67
1999	69.917	34.169	34.113	40.985	36863.4	6276.12	744.722	7113.13
2000	73.198	36.003	35.945	41.638	40871.6	6434.54	780.586	7777.16

	EXCAP	E99S	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL
1977	270.326	1160.82	1118.56	796.27	197.201	214.301	278.522	668.165
1978	280.	1311.13	1152.49	1053.8	471.4	206.916	240.272	617.209
1979	290.	1414.71	1151.9	1440.77	860.7	274.373	222.549	814.761
1980	331.395	1566.76	1170.1	1624.51	996.3	312.909	230.856	1054.02
1981	372.128	1743.59	1172.66	1988.97	1278.41	355.831	264.537	1501.28
1982	445.465	2021.89	1196.06	2332.65	1475.74	439.543	339.843	2055.39
1983	525.019	2387.39	1296.36	2661.58	1642.7	558.518	427.282	2627.53
1984	572.112	2625.79	1369.84	3248.93	2121.71	665.833	466.52	3543.85
1985	669.474	2806.11	1368.83	3670.05	2422.22	708.64	483.783	4728.31
1986	804.473	3163.33	1427.4	3868.97	2431.	774.471	546.115	5827.37
1987	857.328	3492.47	1440.47	4140.16	2488.5	841.613	631.979	6930.36
1988	944.007	3931.17	1488.42	4422.28	2529.49	938.73	743.629	7954.43
1989	990.516	4331.75	1511.4	4707.68	2577.16	1029.58	855.431	8924.53
1990	1044.07	4753.41	1535.9	4846.94	2473.14	1117.83	974.909	9689.64
1991	1054.62	5131.14	1557.3	5018.79	2420.	1194.63	1093.02	10310.3
1992	1062.46	5448.23	1554.16	5244.	2443.96	1278.93	1196.05	10880.3
1993	1104.42	5821.78	1553.35	5497.26	2472.62	1383.44	1321.54	11388.9
1994	1154.71	6260.98	1559.07	5721.73	2440.37	1497.05	1479.38	11759.2
1995	1195.14	6730.1	1556.27	5947.73	2386.2	1628.67	1665.17	11966.7
1996	1246.33	7268.96	1556.13	6256.31	2377.82	1806.45	1894.28	12031.2
1997	1318.84	7891.39	1566.87	6605.73	2378.51	2011.2	2161.73	11926.5
1998	1414.25	8554.54	1575.78	6969.05	2375.52	2236.4	2454.15	11637.2
1999	1531.62	9285.19	1580.81	7381.41	2380.6	2503.86	2793.3	11160.7
2000	1666.33	10120.7	1593.31	7846.85	2380.97	2819.07	3197.79	10464.2

	PREAL	RINS	FUND	FUND77	EXBITEL	R99L	E99L	SIMP
1977	2.4	35.343	670.6	671.369	0.131	531.912	557.16	-137.452
1978	48.975	46.954	666.184	602.483	0.134	568.508	595.271	-4.416
1979	153.275	46.878	968.037	834.862	0.131	622.528	650.896	301.853
1980	275.	68.529	1329.02	1090.28	0.133	718.529	748.6	360.987
1981	411.475	94.407	1912.76	1485.64	0.125	806.205	838.08	583.735
1982	563.425	135.95	2618.81	1914.38	0.114	914.066	947.854	706.054
1983	731.699	186.134	3359.23	2344.23	0.119	1048.99	1084.81	740.424
1984	948.649	238.805	4492.5	3030.4	0.132	1146.99	1184.96	1133.27
1985	1187.55	319.218	5915.86	3821.46	0.128	1211.44	1251.68	1423.36
1986	1437.35	420.048	7264.72	4480.1	0.125	1316.44	1359.1	1348.86
1987	1684.2	515.717	8614.56	5052.65	0.12	1440.24	1485.45	1349.84
1988	1935.8	611.44	9890.23	5527.19	0.12	1610.28	1658.21	1275.67
1989	2193.07	701.995	11117.6	5926.21	0.119	1769.48	1820.29	1227.37
1990	2444.52	789.197	12134.2	6178.09	0.119	1939.76	1993.61	1016.57
1991	2688.87	861.614	12999.2	6347.45	0.121	2114.52	2171.6	865.047
1992	2936.75	923.389	13817.1	6468.5	0.12	2254.34	2314.85	817.871
1993	3188.27	981.88	14577.1	6532.72	0.118	2413.44	2477.58	760.035
1994	3437.02	1036.34	15196.3	6513.81	0.117	2608.32	2676.31	619.145
1995	3680.52	1080.92	15647.2	6405.56	0.115	2825.41	2897.47	450.953
1996	3923.72	1113.71	15955.	6232.46	0.113	3085.49	3161.88	307.754
1997	4168.14	1136.47	16094.7	6002.55	0.112	3378.18	3459.15	139.691
1998	4413.22	1147.47	16050.4	5716.11	0.111	3691.37	3777.2	-44.23
1999	4659.57	1145.6	15820.2	5374.51	0.109	4029.21	4120.2	-230.199
2000	4907.07	1130.71	15371.3	4982.07	0.108	4422.38	4518.82	-448.937

	EXBITES	VIABL2	RENSRAT
1977	0.229	0.604	0.068
1978	0.25	0.506	0.057
1979	0.24	0.468	0.047
1980	0.234	0.443	0.043
1981	0.218	0.438	0.041
1982	0.203	0.443	0.042
1983	0.218	0.433	0.049
1984	0.243	0.42	0.054
1985	0.237	0.413	0.051
1986	0.24	0.404	0.052
1987	0.233	0.407	0.053
1988	0.235	0.407	0.056
1989	0.235	0.41	0.058
1990	0.235	0.414	0.06
1991	0.238	0.418	0.063
1992	0.236	0.424	0.064
1993	0.232	0.431	0.065
1994	0.229	0.44	0.066
1995	0.223	0.451	0.068
1996	0.218	0.465	0.069
1997	0.215	0.478	0.072
1998	0.211	0.491	0.074
1999	0.206	0.506	0.076
2000	0.203	0.523	0.078

SIMULATION OUTPUT BY DSET - ERROR

NWH_ER

	POP	MIGNET	NINCTOT	EM99	EMA9	EMGF	EMP9	EMT9
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.383	0.382	0.	0.283	0.	0.	0.071	0.073
1982	0.997	0.6	0.016	0.705	0.	0.	0.134	0.159
1983	3.274	2.239	0.039	2.316	0.	0.	0.121	0.264
1984	7.271	3.873	0.128	4.984	0.	0.	0.169	0.733
1985	10.043	2.502	0.277	6.412	0.	0.	0.141	1.004
1986	9.286	-1.117	0.363	5.119	0.	0.	0.143	0.719
1987	10.338	0.75	0.3	5.436	0.	0.	0.238	0.621
1988	10.368	-0.289	0.321	4.956	0.	0.	0.551	0.548
1989	10.262	-0.402	0.295	4.531	0.	0.	0.713	0.507
1990	10.301	-0.23	0.268	4.307	0.	0.	0.808	0.473
1991	9.783	-0.768	0.249	3.721	0.	0.	0.74	0.438
1992	9.433	-0.56	0.209	3.339	0.	0.	0.678	0.427
1993	8.303	-1.311	0.181	2.423	0.	0.	0.362	0.382
1994	7.604	-0.824	0.123	1.911	0.	0.	0.305	0.357
1995	7.723	0.026	0.09	2.045	0.	0.	0.413	0.364
1996	7.899	0.084	0.093	2.214	0.	0.	0.438	0.372
1997	8.01	0.015	0.097	2.319	0.	0.	0.438	0.376
1998	7.991	-0.119	0.099	2.317	0.	0.	0.438	0.376
1999	8.015	-0.074	0.097	2.345	0.	0.	0.438	0.377
2000	8.025	-0.087	0.097	2.363	0.	0.	0.438	0.377

	EMS9	EMPU	EMOT	EMM9	EMFI	EMD9	EMCM	EMCN
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.054	0.002	0.011	0.	0.014	0.051	0.001	0.022
1982	0.141	0.004	0.025	0.	0.037	0.131	0.002	0.061
1983	0.573	0.015	0.082	0.	0.146	0.519	0.011	0.591
1984	1.195	0.033	0.179	0.	0.309	1.1	0.018	1.064
1985	1.531	0.041	0.228	0.	0.396	1.403	0.022	1.274
1986	1.158	0.03	0.179	0.	0.299	1.051	0.017	0.825
1987	1.354	0.034	0.186	0.	0.349	1.213	0.02	1.075
1988	1.146	0.028	0.166	0.	0.295	1.017	0.016	0.723
1989	1.029	0.024	0.149	0.05	0.264	0.906	0.014	0.56
1990	0.976	0.023	0.139	0.05	0.25	0.853	0.013	0.504
1991	0.827	0.019	0.119	0.05	0.212	0.719	0.011	0.396
1992	0.752	0.017	0.106	0.05	0.193	0.651	0.01	0.361
1993	0.554	0.012	0.076	0.05	0.142	0.477	0.007	0.278
1994	0.446	0.01	0.059	0.05	0.114	0.381	0.006	0.225
1995	0.487	0.01	0.062	0.05	0.124	0.413	0.006	0.243
1996	0.533	0.011	0.066	0.05	0.136	0.449	0.007	0.266
1997	0.566	0.011	0.068	0.05	0.144	0.472	0.007	0.281
1998	0.572	0.011	0.067	0.05	0.145	0.474	0.007	0.268
1999	0.588	0.011	0.067	0.05	0.149	0.483	0.007	0.276
2000	0.6	0.011	0.066	0.05	0.152	0.489	0.007	0.282

	EMCN1	EMGA	PI	PIRPC	RPI	EXOPS	EXCAP	E99S
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.022	-0.016	13.906	4.211	0.115	0.	0.	0.
1982	0.061	0.011	38.984	9.613	0.281	2.228	0.78	3.008
1983	0.227	-0.007	161.055	45.086	0.913	5.975	1.756	7.753
1984	0.477	0.184	342.758	92.023	2.012	23.73	7.346	31.147
1985	0.627	0.371	458.613	107.098	2.662	30.042	13.326	43.645
1986	0.51	0.698	367.398	61.297	2.131	47.023	16.846	64.515
1987	0.545	0.347	448.684	70.289	2.27	30.06	7.006	38.177
1988	0.518	0.466	403.988	41.062	2.071	37.905	18.59	57.787
1989	0.462	0.316	381.937	25.402	1.903	28.544	13.465	43.82
1990	0.45	0.217	381.051	17.305	1.828	21.853	15.896	39.93
1991	0.396	0.19	337.059	4.848	1.613	18.505	17.807	38.937
1992	0.361	0.095	320.105	-0.855	1.479	9.188	16.729	29.043
1993	0.278	0.082	244.777	-13.246	1.074	3.547	17.972	25.121
1994	0.225	-0.041	204.812	-19.258	0.846	-12.871	15.387	6.633
1995	0.243	-0.128	235.27	-16.98	0.922	-23.465	16.276	-2.637
1996	0.266	-0.114	272.797	-14.84	1.012	-22.785	18.685	0.922
1997	0.281	-0.096	303.613	-13.707	1.075	-21.832	19.688	3.418
1998	0.268	-0.09	322.832	-13.93	1.087	-23.867	11.306	-6.434
1999	0.276	-0.102	348.992	-13.797	1.11	-28.574	11.782	-10.344
2000	0.282	-0.109	375.266	-13.738	1.128	-33.445	12.483	-14.187

	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL	PFBAL	RINS
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	-1.397	0.422	0.	0.223	0.223	0.417	0.	0.
1982	-1.635	1.876	0.	1.086	1.309	-0.107	0.	0.029
1983	-7.456	6.567	0.	4.116	4.744	0.19	0.	-0.008
1984	-10.692	18.444	0.	11.684	14.219	-6.379	0.	0.013
1985	-14.475	31.43	0.	20.143	25.844	-9.484	0.	-0.447
1986	-2.774	36.16	0.02	23.224	31.018	-24.984	0.	-0.664
1987	-18.626	39.723	6.43	21.944	28.355	-16.969	0.	-1.749
1988	-11.515	45.223	6.36	25.121	33.085	-17.316	0.	-1.188
1989	-16.701	43.078	6.26	23.51	30.866	-9.254	0.	-1.212
1990	-18.429	43.219	6.14	23.136	30.25	2.859	0.	-0.648
1991	-17.23	43.598	5.98	22.792	30.027	16.621	0.	0.2
1992	-18.832	41.82	5.78	20.949	27.459	36.738	0.	1.163
1993	-15.873	40.312	5.54	19.133	25.404	58.969	0.	2.572
1994	-18.211	36.121	5.26	15.338	20.249	92.121	0.	4.128
1995	-20.335	36.855	4.94	14.395	18.596	134.102	0.	6.448
1996	-19.494	43.328	4.55	17.191	22.067	180.012	0.	9.387
1997	-18.918	50.633	4.12	20.457	26.158	231.215	0.	12.601
1998	-20.292	57.668	3.62	23.352	29.785	295.598	0.	16.185
1999	-20.394	64.988	3.05	25.836	32.782	370.668	0.	20.692
2000	-20.456	73.859	2.42	29.01	36.635	457.969	0.	25.947

	FUND	FUND77	R99L	E99L
1977	0.	0.	0.	0.
1978	0.	0.	0.	0.
1979	0.	0.	0.	0.
1980	0.	0.	0.	0.
1981	0.417	-0.199	0.02	0.02
1982	-0.107	-1.634	1.435	1.435
1983	0.19	-5.785	3.987	3.987
1984	-6.379	-20.674	15.661	15.661
1985	-9.484	-32.319	34.454	34.454
1986	-24.984	-38.879	46.108	46.108
1987	-16.969	-36.73	36.979	36.979
1988	-17.316	-35.117	44.474	44.474
1989	-9.254	-28.805	39.917	39.917
1990	2.859	-21.355	37.481	37.481
1991	16.621	-11.684	37.111	37.111
1992	36.738	-0.504	32.723	32.723
1993	58.969	14.02	30.793	30.793
1994	92.121	30.195	23.454	23.454
1995	134.102	45.41	19.482	19.482
1996	180.012	60.672	22.289	22.289
1997	231.215	76.84	25.682	25.682
1998	295.598	96.68	28.55	28.55
1999	370.668	118.09	30.159	30.159
2000	457.969	141.437	32.461	32.461

95% WESTERN GULF OCS DEVELOPMENT SCENARIO -
MODERATE BASE CASE

(Levels and Differences from the Base Case)

SIMULATION OUTPUT BY DSET

NWL

	POP	MIGNET	NINCTOT	EM99	EMSPP	EMG9P	EMNSP	EMA9
1977	410.66	-24.935	6.383	185.508	0.363	0.378	0.259	1.1
1978	406.667	-11.241	7.202	178.526	0.373	0.386	0.242	1.2
1979	418.656	5.268	6.697	185.225	0.383	0.374	0.243	1.2
1980	434.173	8.65	6.87	194.054	0.395	0.36	0.245	1.2
1981	456.53	15.22	7.144	207.193	0.409	0.34	0.251	1.3
1982	488.154	23.97	7.672	225.883	0.423	0.318	0.259	1.3
1983	505.236	8.586	8.528	231.82	0.425	0.322	0.253	1.4
1984	504.109	-9.834	8.715	224.746	0.421	0.337	0.241	1.4
1985	513.623	1.319	8.17	227.811	0.429	0.327	0.243	1.4
1986	531.12	9.36	8.131	237.028	0.439	0.316	0.245	1.5
1987	551.933	12.415	8.406	248.27	0.449	0.306	0.245	1.5
1988	573.226	12.515	8.789	259.274	0.456	0.299	0.245	1.6
1989	593.76	11.379	9.166	269.379	0.463	0.293	0.244	1.6
1990	612.683	9.441	9.491	278.075	0.468	0.288	0.244	1.7
1991	626.291	3.878	9.735	282.846	0.472	0.287	0.241	1.7
1992	639.383	3.335	9.754	287.613	0.477	0.282	0.241	1.8
1993	655.707	6.552	9.767	295.047	0.484	0.275	0.24	1.8
1994	672.906	7.281	9.918	303.095	0.491	0.269	0.24	1.8
1995	692.136	9.134	10.096	312.63	0.498	0.262	0.24	1.9
1996	713.438	10.955	10.351	323.544	0.505	0.255	0.24	2.
1997	734.527	10.418	10.676	334.066	0.511	0.249	0.24	2.1
1998	756.294	10.799	10.971	344.935	0.518	0.242	0.24	2.1
1999	780.797	13.227	11.28	357.676	0.525	0.235	0.24	2.2
2000	805.825	13.354	11.682	370.508	0.532	0.229	0.24	2.2

	EMGF	EMP9	EMT9	EMS9	EMPU	EMOT	EMM9	EMFI
1977	42.921	4.514	9.842	22.649	1.184	14.55	11.356	5.779
1978	42.921	4.351	10.294	21.9	1.194	14.269	11.906	5.738
1979	42.921	4.563	10.774	23.693	1.249	14.538	12.411	6.176
1980	42.921	5.104	11.393	25.945	1.321	14.886	12.896	6.758
1981	42.921	5.127	12.339	29.159	1.407	15.39	13.37	7.533
1982	42.921	4.838	13.444	33.793	1.514	16.078	13.843	8.588
1983	42.921	4.577	13.783	34.717	1.55	16.29	14.32	8.922
1984	42.921	4.699	13.47	32.779	1.534	16.037	14.867	8.658
1985	42.921	4.63	13.893	33.953	1.57	16.147	15.364	8.983
1986	42.921	4.598	14.617	36.451	1.635	16.474	15.877	9.619
1987	42.921	4.704	15.299	39.478	1.713	16.865	16.403	10.399
1988	42.921	5.219	15.958	42.256	1.782	17.239	16.947	11.108
1989	42.921	5.618	16.639	44.926	1.846	17.575	17.542	11.795
1990	42.921	5.967	17.127	47.233	1.903	17.859	18.12	12.405
1991	42.921	5.541	17.511	48.632	1.936	18.012	18.744	12.765
1992	42.921	5.356	17.684	50.192	1.972	18.165	19.367	13.17
1993	42.921	5.11	18.227	52.599	2.026	18.4	20.003	13.783
1994	42.921	4.96	18.751	55.058	2.08	18.651	20.66	14.412
1995	42.921	4.988	19.37	57.992	2.143	18.944	21.339	15.167
1996	42.921	5.09	20.048	61.304	2.212	19.274	22.041	16.004
1997	42.921	5.091	20.705	64.508	2.279	19.587	22.766	16.835
1998	42.921	5.093	21.374	67.872	2.346	19.905	23.515	17.692
1999	42.921	5.093	22.158	71.877	2.424	20.271	24.289	18.711
2000	42.921	5.094	22.925	75.873	2.5	20.633	25.089	19.726

	EMD9	EMCN	EMCN1	EMGA	PI	PIRPC	RPI	EXOPS
1977	24.819	16.559	11.189	27.256	4072.38	3924.32	252.71	810.
1978	24.766	11.434	11.307	25.941	4236.48	3723.81	279.75	944.
1979	26.405	12.277	11.972	26.373	4743.19	3862.07	293.358	1019.
1980	28.562	13.526	13.001	26.862	5395.29	4029.44	308.4	1120.35
1981	31.366	16.83	14.187	27.604	6436.11	4327.84	325.758	1247.59
1982	35.094	22.417	15.879	28.87	7985.23	4727.86	346.008	1437.8
1983	36.288	22.112	16.655	31.749	8662.82	4739.69	361.76	1707.19
1984	35.445	17.264	16.625	32.848	8367.06	4448.43	373.112	1862.36
1985	36.613	17.875	17.395	31.654	9012.38	4510.27	389.04	1920.81
1986	38.859	19.665	18.701	31.95	10157.9	4685.94	408.153	2103.08
1987	41.593	21.355	19.98	33.131	11537.8	4871.63	429.113	2371.69
1988	44.052	22.579	21.209	34.654	12981.1	5025.02	450.668	2688.42
1989	46.42	23.526	22.345	35.973	14455.2	5149.79	472.752	3022.02
1990	48.515	24.2	23.376	37.125	15921.1	5248.63	495.104	3365.62
1991	49.739	24.187	23.896	38.136	17084.	5280.95	516.54	3702.59
1992	51.115	24.59	24.464	38.246	18422.6	5346.02	538.967	3986.72
1993	53.182	25.639	25.434	38.284	20173.	5459.79	563.493	4294.67
1994	55.295	26.675	26.469	38.725	22123.5	5578.11	589.409	4668.69
1995	57.815	27.827	27.698	39.082	24368.8	5705.31	617.12	5071.79
1996	60.585	29.336	29.063	39.533	27053.1	5863.65	646.688	5520.04
1997	63.325	30.561	30.507	40.171	29787.2	5987.34	677.32	6031.69
1998	66.127	32.081	32.026	40.646	32891.	6131.03	709.347	6559.29
1999	69.437	33.895	33.839	41.088	36517.7	6289.4	743.642	7142.52
2000	72.712	35.723	35.665	41.749	40500.	6447.79	779.489	7811.48

	EXCAP	E99S	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL
1977	270.326	1160.82	1118.56	796.27	197.201	214.301	278.522	668.165
1978	280.	1311.13	1152.49	1053.8	471.4	206.916	240.272	617.209
1979	290.	1414.71	1151.9	1440.77	860.7	274.373	222.549	814.761
1980	331.395	1566.76	1170.1	1624.51	996.3	312.909	230.856	1054.02
1981	372.128	1743.59	1172.41	1989.05	1278.41	355.873	264.578	1501.36
1982	445.61	2022.45	1197.39	2332.42	1475.74	439.419	339.76	2054.8
1983	524.298	2384.84	1304.8	2656.92	1642.7	555.617	424.187	2624.33
1984	565.063	2597.7	1381.1	3231.48	2121.71	654.886	453.334	3545.64
1985	655.837	2764.62	1383.56	3638.86	2422.22	688.793	458.354	4731.51
1986	786.941	3100.09	1430.07	3832.79	2430.98	751.441	515.375	5844.77
1987	849.71	3455.35	1458.93	4100.24	2482.07	819.815	603.827	6938.48
1988	924.8	3874.28	1499.71	4376.74	2523.13	913.742	710.729	7961.67
1989	976.471	4288.73	1527.86	4664.19	2570.9	1006.2	824.743	8922.46
1990	1027.61	4714.18	1554.08	4803.22	2467.	1094.82	944.834	9674.23
1991	1036.35	5092.88	1574.29	4974.6	2414.02	1171.97	1063.17	10279.9
1992	1045.32	5419.8	1572.75	5201.5	2438.18	1258.11	1168.77	10828.4
1993	1086.06	5797.19	1568.99	5456.18	2467.08	1364.44	1296.31	11313.4
1994	1138.96	6254.81	1577.04	5684.73	2435.11	1481.84	1459.31	11649.3
1995	1178.57	6733.18	1576.37	5909.92	2381.26	1614.41	1646.76	11813.4
1996	1227.43	7268.51	1575.41	6211.94	2373.27	1789.41	1872.42	11830.5
1997	1299.	7888.45	1585.59	6553.96	2374.39	1990.91	2135.79	11673.
1998	1403.1	8561.78	1595.93	6910.18	2371.9	2213.24	2424.61	11317.5
1999	1520.02	9296.43	1601.08	7315.13	2377.55	2478.25	2760.8	10763.9
2000	1654.05	10135.9	1613.66	7771.61	2378.55	2790.34	3161.5	9977.97

	PFBAL	RINS	FUND	FUND77	EXBITEL	R99L	E99L	SIMP
1977	2.4	35.343	670.6	671.369	0.131	531.912	557.16	-137.452
1978	48.975	46.954	666.184	602.483	0.134	568.508	595.271	-4.416
1979	153.275	46.878	968.037	834.862	0.131	622.528	650.896	301.853
1980	275.	68.529	1329.02	1090.28	0.133	718.529	748.6	360.987
1981	411.475	94.407	1912.83	1485.6	0.125	806.209	838.084	583.811
1982	563.425	135.956	2618.22	1914.44	0.114	914.308	948.096	705.389
1983	731.699	186.093	3356.03	2347.06	0.121	1047.67	1083.48	737.808
1984	948.649	238.58	4494.29	3347.49	0.135	1133.1	1171.06	1136.27
1985	1187.55	319.344	5919.06	3849.28	0.131	1177.65	1217.89	1424.77
1986	1437.35	420.272	7282.12	4513.93	0.125	1270.76	1313.42	1363.06
1987	1684.2	516.935	8622.68	5083.83	0.122	1403.56	1448.77	1340.57
1988	1935.8	612.009	9897.47	5556.33	0.121	1566.06	1613.99	1274.79
1989	2193.07	702.502	11115.5	5948.64	0.12	1729.8	1780.61	1218.07
1990	2444.52	789.052	12118.8	6192.72	0.119	1902.51	1956.36	1003.22
1991	2688.87	860.535	12968.7	6352.05	0.122	2077.62	2134.7	849.992
1992	2936.75	921.256	13765.2	6461.61	0.121	2221.33	2282.34	796.445
1993	3188.27	978.247	14501.7	6511.03	0.118	2382.85	2446.99	736.477
1994	3437.02	1031.06	15086.3	6475.7	0.117	2585.06	2653.05	584.641
1995	3680.52	1073.23	15493.9	6352.01	0.115	2806.12	2878.18	407.574
1996	3923.72	1102.97	15754.2	6163.44	0.113	3063.39	3139.78	260.359
1997	4168.14	1122.42	15841.2	5917.16	0.113	3352.7	3433.67	86.918
1998	4413.22	1129.72	15730.7	5610.61	0.111	3663.03	3748.86	-110.461
1999	4659.57	1123.21	15423.4	5247.32	0.11	3999.31	4090.29	-307.277
2000	4907.07	1102.94	14885.	4831.26	0.108	4390.21	4486.65	-538.383

	EXBITES	VIABL2	RENSPAT
1977	0.229	0.604	0.068
1978	0.25	0.506	0.057
1979	0.24	0.468	0.047
1980	0.234	0.443	0.043
1981	0.218	0.439	0.041
1982	0.204	0.443	0.043
1983	0.222	0.432	0.049
1984	0.25	0.416	0.054
1985	0.246	0.405	0.051
1986	0.243	0.397	0.051
1987	0.239	0.399	0.052
1988	0.239	0.4	0.055
1989	0.238	0.404	0.057
1990	0.239	0.407	0.059
1991	0.241	0.412	0.062
1992	0.239	0.418	0.063
1993	0.234	0.426	0.064
1994	0.231	0.435	0.066
1995	0.226	0.446	0.068
1996	0.22	0.46	0.069
1997	0.217	0.473	0.072
1998	0.213	0.486	0.074
1999	0.209	0.5	0.076
2000	0.205	0.516	0.078

SIMULATION OUTPUT BY DSET - ERROR

NWL_ER

	POP	MIGNET	NINCTOT	EM99	EMA9	EMGF	EMP9	EMT9
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.452	0.452	0.	0.334	0.	0.	0.091	0.079
1982	0.712	0.243	0.018	0.489	0.	0.	0.091	0.087
1983	0.542	-0.198	0.027	0.313	0.	0.	0.031	0.036
1984	0.307	-0.252	0.018	0.115	0.	0.	0.	0.006
1985	0.251	-0.063	0.007	0.069	0.	0.	0.	0.003
1986	0.216	-0.04	0.004	0.044	0.	0.	0.	0.002
1987	0.197	-0.022	0.003	0.034	0.	0.	0.	0.002
1988	0.183	-0.016	0.002	0.028	0.	0.	0.	0.001
1989	0.17	-0.013	0.001	0.024	0.	0.	0.	0.001
1990	0.16	-0.012	0.001	0.021	0.	0.	0.	0.001
1991	0.151	-0.01	0.	0.018	0.	0.	0.	0.001
1992	0.141	-0.009	-0.	0.016	0.	0.	0.	0.001
1993	0.132	-0.009	-0.	0.014	0.	0.	0.	0.001
1994	0.125	-0.007	-0.	0.012	0.	0.	0.	0.001
1995	0.119	-0.006	-0.	0.01	0.	0.	0.	0.001
1996	0.114	-0.005	-0.	0.01	0.	0.	0.	0.001
1997	0.109	-0.005	-0.	0.01	0.	0.	0.	0.001
1998	0.106	-0.002	-0.	0.011	0.	0.	0.	0.001
1999	0.104	-0.002	-0.	0.012	0.	0.	0.	0.001
2000	0.101	-0.003	-0.	0.012	0.	0.	0.	0.001

	EMS9	EMPU	EMOT	EMM9	EMFI	EMD9	EMCM	EMCN
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.064	0.002	0.013	0.	0.017	0.061	0.001	0.026
1982	0.098	0.003	0.018	0.	0.025	0.09	0.001	0.044
1983	0.062	0.002	0.011	0.	0.016	0.057	0.001	0.029
1984	0.022	0.001	0.004	0.	0.006	0.02	0.	0.01
1985	0.014	0.	0.002	0.	0.004	0.013	0.	0.004
1986	0.009	0.	0.002	0.	0.002	0.008	0.	0.001
1987	0.007	0.	0.001	0.	0.002	0.006	0.	0.001
1988	0.006	0.	0.001	0.	0.002	0.005	0.	0.
1989	0.005	0.	0.001	0.	0.001	0.005	0.	0.
1990	0.005	0.	0.001	0.	0.001	0.004	0.	0.
1991	0.004	0.	0.001	0.	0.001	0.004	0.	0.001
1992	0.004	0.	0.001	0.	0.001	0.003	0.	0.001
1993	0.004	0.	0.	0.	0.001	0.003	0.	0.
1994	0.003	0.	0.	0.	0.001	0.003	0.	0.
1995	0.003	0.	0.	0.	0.001	0.003	0.	0.001
1996	0.003	0.	0.	0.	0.001	0.002	0.	0.001
1997	0.003	0.	0.	0.	0.001	0.003	0.	0.001
1998	0.004	0.	0.	0.	0.001	0.003	0.	0.002
1999	0.004	0.	0.	0.	0.001	0.003	0.	0.002
2000	0.004	0.	0.	0.	0.001	0.003	0.	0.002

	EMCN1	EMGA	PI	PIRPC	RPI	EXOPS	EXCAP	E99S
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.026	-0.019	16.488	5.012	0.135	0.	0.	0.
1982	0.044	0.032	26.914	6.406	0.194	2.637	0.925	3.562
1983	0.029	0.068	17.887	3.023	0.129	4.141	1.035	5.202
1984	0.01	0.045	6.656	0.121	0.059	2.704	0.297	3.055
1985	0.004	0.029	4.344	-0.52	0.042	2.405	-0.31	2.157
1986	0.001	0.02	3.094	-0.844	0.031	1.909	-0.685	1.277
1987	0.001	0.015	2.672	-0.93	0.028	1.631	-0.612	1.051
1988	0.	0.012	2.469	-0.93	0.026	1.491	-0.617	0.888
1989	0.	0.01	2.363	-0.914	0.025	1.381	-0.579	0.797
1990	0.	0.008	2.266	-0.875	0.024	1.275	-0.554	0.699
1991	0.001	0.007	2.203	-0.84	0.024	1.185	-0.46	0.684
1992	0.001	0.006	2.188	-0.777	0.024	1.085	-0.411	0.617
1993	0.	0.004	2.137	-0.754	0.024	0.992	-0.389	0.535
1994	0.	0.003	2.09	-0.734	0.024	0.902	-0.361	0.465
1995	0.001	0.003	2.211	-0.676	0.024	0.82	-0.291	0.438
1996	0.001	0.002	2.285	-0.664	0.025	0.777	-0.213	0.465
1997	0.001	0.002	2.441	-0.621	0.026	0.734	-0.148	0.48
1998	0.002	0.001	2.887	-0.566	0.028	0.75	0.164	0.805
1999	0.002	0.001	3.277	-0.523	0.029	0.813	0.188	0.898
2000	0.002	0.001	3.625	-0.488	0.031	0.875	0.205	0.977

	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL	PFBAL	RINS
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	-1.651	0.5	0.	0.264	0.264	0.494	0.	0.
1982	-0.309	1.646	0.	0.963	1.227	-0.695	0.	0.035
1983	0.984	1.904	0.	1.215	1.65	-3.017	0.	-0.049
1984	0.566	1.	0.	0.736	1.032	-4.586	0.	-0.211
1985	0.256	0.245	0.	0.296	0.414	-6.281	0.	-0.321
1986	-0.104	-0.027	0.	0.195	0.278	-7.586	0.	-0.44
1987	-0.172	-0.199	0.	0.146	0.204	-8.848	0.	-0.531
1988	-0.22	-0.313	0.	0.133	0.185	-10.078	0.	-0.619
1989	-0.236	-0.41	0.	0.129	0.178	-11.32	0.	-0.705
1990	-0.251	-0.5	0.	0.128	0.175	-12.559	0.	-0.792
1991	-0.24	-0.59	0.	0.126	0.176	-13.852	0.	-0.879
1992	-0.237	-0.68	0.	0.129	0.177	-15.16	0.	-0.97
1993	-0.238	-0.773	0.	0.133	0.178	-16.488	0.	-1.061
1994	-0.24	-0.875	0.	0.131	0.174	-17.84	0.	-1.154
1995	-0.231	-0.961	0.	0.142	0.182	-19.238	0.	-1.249
1996	-0.213	-1.039	0.	0.153	0.202	-20.723	0.	-1.347
1997	-0.199	-1.133	0.	0.163	0.212	-22.293	0.	-1.451
1998	-0.137	-1.211	0.	0.19	0.24	-24.141	0.	-1.561
1999	-0.122	-1.297	0.	0.227	0.284	-26.148	0.	-1.69
2000	-0.11	-1.375	0.	0.278	0.346	-28.293	0.	-1.83

	FUND	FUND77	R99L	E99L
1977	0.	0.	0.	0.
1978	0.	0.	0.	0.
1979	0.	0.	0.	0.
1980	0.	0.	0.	0.
1981	0.494	-0.235	0.023	0.023
1982	-0.695	-1.582	1.677	1.677
1983	-3.017	-2.949	2.665	2.665
1984	-4.586	-3.588	1.768	1.768
1985	-6.281	-4.495	0.671	0.671
1986	-7.586	-5.051	0.427	0.427
1987	-8.848	-5.547	0.3	0.3
1988	-10.078	-5.977	0.258	0.258
1989	-11.32	-6.375	0.236	0.236
1990	-12.559	-6.723	0.226	0.226
1991	-13.852	-7.082	0.216	0.216
1992	-15.16	-7.398	0.212	0.212
1993	-16.488	-7.676	0.205	0.205
1994	-17.84	-7.922	0.196	0.196
1995	-19.238	-8.141	0.192	0.192
1996	-20.723	-8.348	0.193	0.193
1997	-22.293	-8.551	0.203	0.203
1998	-24.141	-8.828	0.21	0.21
1999	-26.148	-9.105	0.251	0.251
2000	-28.293	-9.375	0.285	0.285

HIGH BASE CASE

SIMULATION OUTPUT BY DSET

NH

	POP	MIGNET	NINCTOT	EM99	EMSPP	EMG9P	EMNSP	EMA9
1977	410.66	-24.935	6.383	185.508	0.363	0.378	0.259	1.1
1978	406.709	-11.199	7.202	178.557	0.373	0.386	0.242	1.2
1979	417.661	4.23	6.699	184.486	0.382	0.376	0.242	1.2
1980	431.495	7.005	6.829	192.187	0.394	0.363	0.244	1.2
1981	454.273	15.744	7.04	205.895	0.408	0.341	0.251	1.3
1982	486.141	24.292	7.595	224.856	0.423	0.319	0.258	1.3
1983	509.747	15.172	8.466	235.658	0.428	0.315	0.257	1.4
1984	520.191	1.538	8.923	236.585	0.432	0.321	0.248	1.4
1985	540.357	11.336	8.824	245.927	0.444	0.308	0.249	1.4
1986	560.731	11.233	9.152	255.065	0.45	0.302	0.248	1.5
1987	582.34	12.168	9.45	264.996	0.458	0.295	0.247	1.5
1988	605.1	12.991	9.781	275.525	0.465	0.288	0.247	1.6
1989	623.917	8.69	10.139	283.001	0.468	0.285	0.247	1.6
1990	639.451	5.224	10.315	288.328	0.471	0.282	0.247	1.7
1991	656.425	6.614	10.358	295.235	0.478	0.276	0.246	1.7
1992	670.49	3.596	10.471	300.08	0.481	0.273	0.245	1.8
1993	686.752	5.794	10.463	306.934	0.488	0.267	0.245	1.8
1994	704.358	7.042	10.561	314.864	0.494	0.262	0.244	1.8
1995	723.291	8.219	10.714	323.807	0.501	0.256	0.244	1.9
1996	742.659	8.452	10.918	333.013	0.507	0.25	0.243	2.
1997	764.683	10.893	11.133	344.153	0.514	0.243	0.243	2.1
1998	787.251	11.124	11.449	355.465	0.52	0.236	0.243	2.1
1999	812.471	13.456	11.768	368.566	0.528	0.229	0.243	2.2
2000	837.888	13.245	12.179	381.508	0.534	0.223	0.243	2.2

	EMGF	EMP9	EMT9	EMS9	EMPU	EMOT	EMM9	EMFI
1977	42.921	4.514	9.842	22.649	1.184	14.55	11.356	5.779
1978	42.921	4.365	10.296	21.905	1.194	14.27	11.906	5.739
1979	42.921	4.368	10.728	23.533	1.244	14.509	12.411	6.133
1980	42.921	4.692	11.284	25.552	1.308	14.813	12.896	6.654
1981	42.921	4.778	12.235	28.945	1.4	15.34	13.37	7.477
1982	42.921	4.325	13.397	33.628	1.509	16.041	13.843	8.545
1983	42.921	5.377	14.036	35.676	1.576	16.426	14.32	9.167
1984	42.921	5.801	14.277	35.751	1.615	16.459	14.867	9.426
1985	42.921	5.65	15.244	38.451	1.689	16.784	15.424	10.145
1986	42.921	5.392	15.704	40.827	1.747	17.097	15.937	10.742
1987	42.921	5.398	16.353	43.569	1.812	17.43	16.548	11.435
1988	42.921	6.005	17.225	46.277	1.876	17.776	17.092	12.122
1989	42.921	7.067	17.549	48.131	1.919	18.017	17.737	12.601
1990	42.921	7.99	17.965	49.415	1.953	18.188	18.315	12.959
1991	42.921	7.76	18.462	51.649	2.004	18.406	18.91	13.532
1992	42.921	7.568	18.64	53.108	2.037	18.557	19.527	13.913
1993	42.921	7.39	19.099	55.37	2.086	18.77	20.163	14.485
1994	42.921	7.208	19.642	57.846	2.139	19.012	20.82	15.119
1995	42.921	7.037	20.229	60.66	2.199	19.282	21.499	15.845
1996	42.921	7.023	20.805	63.478	2.258	19.556	22.201	16.569
1997	42.921	7.102	21.505	66.97	2.328	19.882	22.926	17.462
1998	42.921	7.148	22.194	70.473	2.397	20.208	23.675	18.353
1999	42.921	7.149	22.993	74.61	2.476	20.579	24.449	19.405
2000	42.921	7.105	23.751	78.671	2.552	20.938	25.249	20.435

	EMD9	EMCN	EMCN1	EMGA	PI	PIRPC	RPI	EXOPS
1977	24.819	16.559	11.189	27.256	4072.38	3924.32	252.71	810.
1978	24.771	11.436	11.309	25.941	4237.42	3724.25	279.75	944.
1979	26.247	12.129	11.912	26.421	4707.	3845.78	293.049	1019.
1980	28.18	13.203	12.84	26.81	5301.84	3994.15	307.633	1114.32
1981	31.163	16.822	14.074	27.297	6380.53	4318.76	325.232	1232.22
1982	34.938	22.515	15.801	28.712	7939.13	4725.5	345.607	1427.79
1983	37.157	23.024	17.024	31.37	8932.54	4824.14	363.253	1698.96
1984	38.171	20.065	17.803	32.962	9218.75	4690.48	377.827	1902.13
1985	40.71	21.886	19.242	32.75	10367.6	4839.89	396.434	2021.75
1986	42.783	23.27	20.532	34.211	11554.4	4958.54	415.572	2279.21
1987	45.176	24.621	21.63	35.238	12919.7	5088.48	436.01	2548.91
1988	47.531	25.653	22.828	36.4	14413.	5207.65	457.398	2854.31
1989	49.168	25.545	23.698	37.677	15659.3	5245.99	478.435	3186.37
1990	50.397	25.128	24.383	38.359	16784.6	5255.81	499.423	3490.25
1991	52.335	25.966	25.215	38.52	18314.9	5346.07	521.904	3772.17
1992	53.622	26.162	25.847	39.146	19673.2	5388.71	544.503	4108.25
1993	55.537	27.041	26.737	39.152	21421.4	5483.3	568.865	4419.69
1994	57.649	28.087	27.782	39.467	23441.6	5595.18	594.817	4789.73
1995	60.061	29.16	28.981	39.836	25688.	5707.02	622.32	5199.23
1996	62.451	30.273	30.184	40.269	28174.7	5826.64	651.114	5642.81
1997	65.376	31.754	31.7	40.577	31126.4	5967.6	682.106	6119.54
1998	68.278	33.3	33.245	41.123	34381.1	6113.12	714.414	6666.31
1999	71.677	35.178	35.122	41.583	38164.	6272.01	748.937	7260.07
2000	74.987	37.041	36.983	42.26	42275.	6428.27	784.892	7937.83

	EXCAP	E99S	E99SFPC	REVGF	RP9S	RT98	RENS	GFBAL
1977	270.326	1160.82	1118.56	796.27	197.201	214.301	278.522	668.165
1978	280.	1311.13	1152.37	1053.84	471.4	206.933	240.288	617.245
1979	290.	1414.71	1155.86	1439.75	860.7	273.822	222.013	813.789
1980	329.271	1558.6	1174.16	1620.	996.3	310.38	227.772	1055.05
1981	367.356	1723.39	1166.47	1982.8	1278.41	352.193	259.429	1512.33
1982	444.658	2011.3	1197.1	2328.74	1475.74	436.99	336.403	2071.52
1983	523.594	2375.68	1282.99	2663.09	1642.7	558.914	426.673	2654.9
1984	580.82	2652.99	1349.83	3271.59	2121.71	679.316	481.991	3572.66
1985	694.158	2904.1	1355.69	3725.62	2422.22	743.449	527.161	4734.48
1986	834.413	3324.98	1426.88	3951.56	2432.18	827.266	614.294	5784.29
1987	879.174	3664.62	1443.3	4221.02	2483.62	899.559	707.62	6824.99
1988	951.94	4070.68	1470.77	4500.99	2527.54	996.437	817.102	7808.97
1989	1009.56	4490.24	1504.25	4834.6	2623.32	1093.04	932.36	8767.47
1990	1061.13	4877.29	1527.22	4987.66	2553.11	1171.12	1034.11	9562.34
1991	1074.1	5206.08	1519.62	5161.2	2507.46	1242.04	1140.34	10256.3
1992	1114.03	5617.	1538.55	5427.12	2536.49	1347.	1271.58	10867.4
1993	1148.19	5993.24	1534.1	5697.41	2571.11	1456.98	1403.	11429.
1994	1204.15	6451.7	1539.92	5942.82	2544.81	1578.41	1569.69	11857.6
1995	1250.15	6944.72	1542.86	6191.76	2498.88	1717.27	1764.86	12125.9
1996	1300.76	7479.16	1546.7	6507.13	2497.39	1890.99	1989.86	12260.8
1997	1367.77	8061.7	1545.59	6858.41	2501.45	2090.04	2248.34	12260.4
1998	1453.52	8737.83	1553.6	7246.43	2494.58	2328.3	2559.35	12086.7
1999	1575.07	9489.05	1559.44	7671.37	2484.74	2608.46	2915.25	11723.3
2000	1713.66	10343.4	1572.78	8152.32	2473.12	2935.58	3337.05	11141.6

	PFBAL	RINS	FUND	FUND77	EXBITEL	R99L	E99L	SIMP
1977	2.4	35.343	670.6	671.369	0.131	531.912	557.16	-137.452
1978	48.975	46.954	666.22	602.515	0.134	568.509	595.272	-4.38
1979	153.275	46.88	967.064	834.901	0.132	622.581	650.949	300.844
1980	275.	68.461	1330.05	1093.85	0.135	714.74	744.811	362.987
1981	411.475	94.479	1923.8	1496.54	0.125	796.607	828.482	593.751
1982	563.425	136.724	2634.95	1928.9	0.114	908.502	942.29	711.145
1983	731.699	187.263	3386.6	2358.72	0.117	1043.25	1079.06	751.656
1984	948.649	240.721	4521.31	3027.56	0.126	1159.62	1197.58	1134.71
1985	1187.55	321.235	5922.03	3779.37	0.122	1263.45	1303.69	1400.72
1986	1437.35	420.48	7221.64	4396.53	0.122	1407.03	1449.68	1299.61
1987	1684.2	512.701	8509.19	4937.55	0.119	1541.75	1586.96	1287.55
1988	1935.8	604.064	9744.77	5390.11	0.118	1698.21	1746.14	1235.58
1989	2199.32	691.813	10966.8	5799.32	0.119	1864.43	1915.24	1222.03
1990	2458.6	778.672	12020.9	6089.62	0.12	2014.33	2068.69	1054.15
1991	2711.47	853.759	12967.8	6286.3	0.118	2160.01	2217.09	946.812
1992	2968.35	921.3	13835.8	6428.71	0.119	2338.85	2399.36	868.023
1993	3229.32	983.346	14658.3	6519.21	0.117	2502.67	2566.81	822.523
1994	3488.02	1042.23	15345.6	6527.11	0.115	2702.98	2770.97	687.297
1995	3742.45	1091.63	15868.4	6451.17	0.114	2929.73	3001.8	522.75
1996	3997.35	1129.5	16258.1	6317.34	0.113	3187.67	3264.06	389.789
1997	4253.82	1158.06	16514.2	6125.29	0.111	3463.92	3544.89	256.078
1998	4510.59	1177.26	16597.3	5877.7	0.11	3789.22	3875.05	83.055
1999	4766.77	1184.36	16490.1	5570.55	0.108	4139.03	4230.01	-107.172
2000	5022.66	1178.14	16164.3	5210.35	0.107	4543.98	4640.42	-325.805

	EXBITES	VIABL2	RENSRAT
1977	0.229	0.604	0.068
1978	0.25	0.506	0.057
1979	0.242	0.467	0.047
1980	0.237	0.442	0.043
1981	0.218	0.439	0.041
1982	0.204	0.443	0.042
1983	0.214	0.436	0.048
1984	0.232	0.425	0.052
1985	0.224	0.422	0.051
1986	0.23	0.414	0.053
1987	0.227	0.417	0.055
1988	0.227	0.419	0.057
1989	0.231	0.421	0.06
1990	0.234	0.421	0.062
1991	0.23	0.427	0.062
1992	0.232	0.432	0.065
1993	0.228	0.44	0.065
1994	0.224	0.448	0.067
1995	0.221	0.459	0.069
1996	0.217	0.471	0.071
1997	0.212	0.485	0.072
1998	0.208	0.499	0.074
1999	0.204	0.515	0.076
2000	0.201	0.531	0.079

5% WESTERN GULF OCS DEVELOPMENT SCENARIO -
HIGH BASE CASE

(Levels and Differences from the Base Case)

SIMULATION OUTPUT BY DSET

WH

	POP	MIGNET	NINCTOT	EM99	EMSPP	EMG9P	EMNSP	EMA9
1977	410.66	-24.935	6.383	185.508	0.363	0.378	0.259	1.1
1978	406.709	-11.199	7.202	178.557	0.373	0.386	0.242	1.2
1979	417.661	4.23	6.699	184.486	0.382	0.376	0.242	1.2
1980	431.495	7.005	6.829	192.187	0.394	0.363	0.244	1.2
1981	454.657	16.128	7.04	206.178	0.409	0.34	0.251	1.3
1982	487.141	24.893	7.611	225.563	0.424	0.318	0.258	1.3
1983	513.05	17.438	8.505	237.996	0.43	0.312	0.258	1.4
1984	527.58	5.499	9.052	241.64	0.437	0.315	0.248	1.4
1985	551.243	14.558	9.106	252.964	0.45	0.302	0.249	1.4
1986	571.026	10.251	9.549	260.921	0.454	0.299	0.247	1.5
1987	593.806	13.001	9.787	271.22	0.462	0.291	0.247	1.5
1988	616.654	12.719	10.141	281.274	0.468	0.285	0.248	1.6
1989	635.391	8.277	10.472	288.3	0.47	0.282	0.248	1.6
1990	650.925	4.92	10.618	293.324	0.473	0.279	0.248	1.7
1991	667.433	5.868	10.638	299.641	0.479	0.273	0.247	1.7
1992	681.148	3.004	10.711	304.06	0.483	0.271	0.246	1.8
1993	696.274	4.447	10.673	309.955	0.489	0.266	0.245	1.8
1994	713.195	6.206	10.711	317.35	0.495	0.26	0.245	1.8
1995	732.263	8.238	10.829	326.41	0.502	0.254	0.244	1.9
1996	751.834	8.538	11.035	335.773	0.508	0.248	0.244	2.
1997	774.043	10.957	11.254	347.04	0.515	0.241	0.244	2.1
1998	796.724	11.112	11.574	358.424	0.522	0.235	0.244	2.1
1999	822.055	13.44	11.895	371.59	0.529	0.228	0.244	2.2
2000	847.577	13.224	12.307	384.591	0.535	0.222	0.243	2.2

	EMGF	EMP9	EMT9	EMS9	EMPU	EMOT	EMM9	EMFI
1977	42.921	4.514	9.842	22.649	1.184	14.55	11.356	5.779
1978	42.921	4.365	10.296	21.905	1.194	14.27	11.906	5.739
1979	42.921	4.368	10.728	23.533	1.244	14.509	12.411	6.133
1980	42.921	4.692	11.284	25.552	1.308	14.813	12.896	6.654
1981	42.921	4.849	12.308	29.	1.402	15.351	13.37	7.491
1982	42.921	4.459	13.556	33.77	1.513	16.066	13.843	8.582
1983	42.921	5.498	14.301	36.258	1.591	16.508	14.32	9.316
1984	42.921	5.97	15.01	36.975	1.647	16.636	14.867	9.742
1985	42.921	5.791	16.267	40.125	1.731	17.025	15.424	10.576
1986	42.921	5.535	16.451	42.15	1.779	17.294	15.937	11.082
1987	42.921	5.636	17.003	45.098	1.849	17.635	16.548	11.827
1988	42.921	6.556	17.805	47.605	1.907	17.962	17.092	12.462
1989	42.921	7.78	18.088	49.331	1.947	18.187	17.787	12.909
1990	42.921	8.798	18.467	50.539	1.978	18.346	18.365	13.247
1991	42.921	8.5	18.929	52.631	2.025	18.544	18.96	13.783
1992	42.921	8.246	19.094	54.003	2.057	18.681	19.577	14.142
1993	42.921	7.752	19.507	56.059	2.1	18.863	20.213	14.661
1994	42.921	7.513	20.025	58.423	2.151	19.088	20.87	15.266
1995	42.921	7.45	20.617	61.276	2.212	19.36	21.549	16.002
1996	42.921	7.461	21.202	64.14	2.271	19.637	22.251	16.738
1997	42.921	7.54	21.908	67.676	2.342	19.966	22.976	17.641
1998	42.921	7.586	22.599	71.203	2.411	20.292	23.725	18.539
1999	42.921	7.587	23.401	75.368	2.49	20.663	24.499	19.597
2000	42.921	7.543	24.161	79.454	2.566	21.023	25.299	20.634

	EMD9	EMCN	EMCN1	EMGA	PI	PIRPC	RPI	EXOPS
1977	24.819	16.559	11.189	27.256	4072.38	3924.32	252.71	810.
1978	24.771	11.436	11.309	25.941	4237.42	3724.25	279.75	944.
1979	26.247	12.129	11.912	26.421	4707.	3845.78	293.049	1019.
1980	28.18	13.293	12.84	26.81	5301.84	3994.15	307.633	1114.32
1981	31.215	16.844	14.096	27.281	6394.47	4323.01	325.348	1232.22
1982	35.069	22.576	15.862	28.723	7978.25	4735.18	345.89	1430.02
1983	37.682	23.62	17.256	31.363	9097.1	4869.07	364.172	1704.93
1984	39.284	21.156	18.307	33.145	9576.59	4778.95	379.834	1926.
1985	42.215	23.242	19.951	33.349	10885.1	4946.	399.25	2075.63
1986	43.963	24.16	21.107	35.196	11987.6	5022.99	417.945	2356.23
1987	46.525	25.773	22.252	35.889	13441.7	5161.73	438.555	2612.11
1988	48.692	26.44	23.41	37.166	14894.3	5253.48	459.769	2927.52
1989	50.213	26.163	24.218	38.29	16116.2	5276.97	480.664	3252.18
1990	51.372	25.674	24.875	38.863	17232.7	5278.2	501.579	3550.35
1991	53.182	26.407	25.656	38.974	18725.2	5355.7	523.848	3828.86
1992	54.391	26.564	26.249	39.493	20064.4	5391.96	546.312	4156.16
1993	56.125	27.359	27.055	39.466	21735.2	5473.95	570.277	4461.74
1994	58.139	28.35	28.045	39.642	23716.6	5579.48	596.008	4815.68
1995	60.58	29.443	29.264	39.912	25996.	5693.09	623.587	5215.27
1996	63.095	30.583	30.494	40.348	28522.9	5814.45	652.479	5660.54
1997	65.961	32.086	32.032	40.665	31515.2	5956.37	683.555	6139.92
1998	68.879	33.645	33.59	41.219	34806.2	6102.24	715.92	6688.84
1999	72.296	35.535	35.479	41.677	38628.1	6261.26	750.493	7283.43
2000	75.622	37.411	37.353	42.35	42780.4	6417.62	786.498	7961.62

	EXCAP	E99S	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL
1977	270.326	1160.82	1118.56	796.27	197.201	214.301	278.522	668.165
1978	280.	1311.13	1152.37	1053.84	471.4	206.933	240.288	617.245
1979	290.	1414.71	1155.86	1439.75	860.7	273.822	222.013	813.789
1980	329.271	1558.6	1174.16	1620.	996.3	310.38	227.772	1055.05
1981	367.356	1723.39	1165.07	1983.22	1278.41	352.416	259.652	1512.75
1982	445.442	2014.31	1195.46	2330.62	1475.74	438.079	337.714	2071.42
1983	525.357	2383.44	1275.67	2669.76	1642.7	563.112	431.501	2655.19
1984	588.345	2684.45	1339.59	3290.76	2121.71	691.571	496.856	3566.87
1985	708.292	2972.39	1350.57	3760.24	2422.22	765.882	555.644	4707.99
1986	847.863	3416.12	1431.39	3992.92	2432.2	855.042	651.069	5723.91
1987	883.4	3733.08	1433.5	4265.2	2490.05	926.42	742.184	6750.55
1988	964.98	4158.05	1466.59	4549.93	2533.9	1027.06	857.128	7711.25
1989	1017.49	4565.46	1494.87	4880.01	2629.58	1122.16	970.346	8652.
1990	1069.87	4947.81	1515.46	5031.01	2559.25	1199.51	1071.08	9431.27
1991	1084.28	5274.86	1508.68	5202.62	2513.44	1269.8	1176.66	10109.5
1992	1123.13	5676.18	1525.36	5465.3	2542.27	1373.33	1305.88	10709.6
1993	1158.43	6047.96	1523.15	5731.83	2576.65	1481.4	1435.12	11260.5
1994	1211.63	6487.82	1526.29	5970.72	2550.07	1598.99	1596.58	11687.
1995	1259.09	6972.59	1526.97	6218.21	2503.82	1737.1	1790.33	11959.3
1996	1313.01	7512.29	1531.38	6537.91	2501.94	1913.99	2019.23	12098.7
1997	1381.99	8099.81	1530.86	6894.38	2505.57	2116.86	2282.46	12104.2
1998	1469.67	8780.41	1539.36	7287.94	2498.2	2359.27	2598.59	11938.4
1999	1591.33	9533.02	1545.19	7718.37	2487.79	2643.49	2959.47	11587.2
2000	1731.07	10389.4	1558.53	8205.8	2475.54	2975.29	3386.95	11022.6

	PFBAL	RINS	FUND	FUND77	EXBITEL	R99L	E99L	SIMP
1977	2.4	35.343	670.6	671.369	0.131	531.912	557.16	-137.452
1978	48.975	46.954	666.22	602.515	0.134	568.509	595.272	-4.38
1979	153.275	46.88	967.064	834.901	0.132	622.581	650.949	300.844
1980	275.	68.461	1330.05	1093.85	0.135	714.74	744.811	362.987
1981	411.475	94.479	1924.22	1496.33	0.125	796.626	828.501	594.169
1982	563.425	136.753	2634.84	1927.25	0.114	909.94	943.728	710.623
1983	731.699	187.256	3386.89	2352.96	0.115	1047.25	1083.06	752.046
1984	948.649	240.741	4515.52	3007.7	0.123	1175.64	1213.6	1128.64
1985	1187.55	320.83	5895.54	3735.93	0.119	1299.44	1339.68	1380.02
1986	1437.35	418.625	7161.26	4335.01	0.122	1458.8	1501.45	1265.72
1987	1684.2	508.474	8434.75	4865.96	0.118	1585.07	1630.29	1273.49
1988	1935.8	598.853	9647.05	5308.54	0.117	1749.64	1797.57	1212.31
1989	2199.32	684.973	10851.3	5711.65	0.119	1911.69	1962.49	1204.27
1990	2458.6	770.589	11889.9	5997.34	0.12	2059.43	2113.28	1038.55
1991	2711.47	844.584	12821.	6192.08	0.118	2203.51	2260.59	931.129
1992	2968.35	911.027	13678.	6334.36	0.119	2378.54	2439.05	856.996
1993	3229.32	972.301	14489.8	6428.32	0.117	2540.21	2604.35	811.816
1994	3488.02	1030.43	15175.1	6441.67	0.115	2732.98	2800.97	685.258
1995	3742.45	1079.69	15701.7	6370.46	0.114	2955.85	3027.91	526.676
1996	3997.35	1117.83	16096.	6241.27	0.113	3216.8	3293.19	394.301
1997	4253.82	1146.71	16358.	6054.47	0.111	3496.71	3577.68	261.926
1998	4510.59	1166.33	16449.	5812.92	0.11	3825.81	3911.64	90.996
1999	4766.77	1173.98	16354.	5513.11	0.108	4178.71	4269.69	-95.016
2000	5022.66	1168.61	16045.2	5161.41	0.107	4587.1	4683.54	-308.738

	EXBITES	VIABL2	RENSRAT
1977	0.229	0.604	0.068
1978	0.25	0.506	0.057
1979	0.242	0.467	0.047
1980	0.237	0.442	0.043
1981	0.217	0.439	0.041
1982	0.203	0.443	0.042
1983	0.211	0.438	0.047
1984	0.226	0.429	0.052
1985	0.219	0.427	0.051
1986	0.228	0.419	0.054
1987	0.223	0.423	0.055
1988	0.224	0.425	0.058
1989	0.228	0.426	0.06
1990	0.232	0.426	0.062
1991	0.228	0.432	0.063
1992	0.23	0.437	0.065
1993	0.226	0.444	0.066
1994	0.223	0.452	0.067
1995	0.219	0.463	0.069
1996	0.215	0.475	0.071
1997	0.21	0.489	0.072
1998	0.207	0.503	0.075
1999	0.202	0.519	0.077
2000	0.199	0.536	0.079

SIMULATION OUTPUT BY DSET - ERROR

WH_ER

	POP	MIGNET	NINCTOT	EM99	EMA9	EMP9	EMGF	EMT9
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.384	0.383	0.	0.283	0.	0.071	0.	0.073
1982	0.999	0.601	0.016	0.707	0.	0.134	0.	0.159
1983	3.303	2.266	0.039	2.338	0.	0.121	0.	0.264
1984	7.389	3.961	0.129	5.055	0.	0.169	0.	0.732
1985	10.886	3.221	0.282	7.036	0.	0.141	0.	1.023
1986	10.295	-0.982	0.397	5.856	0.	0.143	0.	0.747
1987	11.467	0.833	0.337	6.224	0.	0.238	0.	0.65
1988	11.554	-0.272	0.36	5.749	0.	0.551	0.	0.58
1989	11.474	-0.413	0.333	5.298	0.	0.713	0.	0.539
1990	11.473	-0.305	0.304	4.997	0.	0.808	0.	0.502
1991	11.008	-0.746	0.28	4.406	0.	0.74	0.	0.467
1992	10.658	-0.592	0.24	3.98	0.	0.678	0.	0.454
1993	9.522	-1.347	0.209	3.022	0.	0.362	0.	0.408
1994	8.837	-0.836	0.15	2.486	0.	0.305	0.	0.383
1995	8.972	0.019	0.115	2.603	0.	0.413	0.	0.389
1996	9.176	0.086	0.117	2.76	0.	0.438	0.	0.396
1997	9.36	0.064	0.121	2.887	0.	0.438	0.	0.402
1998	9.473	-0.011	0.125	2.959	0.	0.438	0.	0.405
1999	9.584	-0.016	0.126	3.024	0.	0.438	0.	0.408
2000	9.689	-0.022	0.128	3.083	0.	0.438	0.	0.41

	EMS9	EMPU	EMOT	EMM9	EMFI	EMD9	EMCM	EMCN
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.054	0.002	0.011	0.	0.014	0.051	0.001	0.022
1982	0.142	0.004	0.025	0.	0.037	0.131	0.002	0.061
1983	0.582	0.015	0.082	0.	0.148	0.525	0.011	0.596
1984	1.224	0.032	0.177	0.	0.316	1.113	0.018	1.09
1985	1.673	0.043	0.241	0.	0.431	1.505	0.024	1.356
1986	1.323	0.033	0.197	0.	0.34	1.18	0.019	0.89
1987	1.529	0.037	0.205	0.	0.392	1.349	0.022	1.152
1988	1.327	0.031	0.186	0.	0.34	1.162	0.018	0.787
1989	1.2	0.028	0.169	0.05	0.307	1.045	0.016	0.618
1990	1.124	0.026	0.158	0.05	0.288	0.975	0.015	0.546
1991	0.982	0.022	0.138	0.05	0.251	0.846	0.013	0.442
1992	0.896	0.02	0.124	0.05	0.229	0.769	0.012	0.403
1993	0.689	0.015	0.093	0.05	0.176	0.588	0.009	0.318
1994	0.577	0.012	0.075	0.05	0.147	0.49	0.008	0.263
1995	0.616	0.013	0.078	0.05	0.157	0.519	0.008	0.283
1996	0.662	0.013	0.081	0.05	0.169	0.554	0.009	0.309
1997	0.705	0.014	0.084	0.05	0.179	0.585	0.009	0.331
1998	0.73	0.014	0.084	0.05	0.185	0.601	0.009	0.345
1999	0.758	0.014	0.085	0.05	0.192	0.619	0.01	0.357
2000	0.784	0.014	0.085	0.05	0.199	0.635	0.01	0.37

	EMCN1	EMGA	PI	PIFPC	RPI	EXOPS	EXCAP	E99S
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.022	-0.016	13.941	4.25	0.116	0.	0.	0.
1982	0.061	0.011	39.121	9.68	0.282	2.227	0.784	3.011
1983	0.232	-0.007	164.559	44.926	0.919	5.977	1.763	7.762
1984	0.503	0.183	357.848	88.469	2.008	23.862	7.525	31.458
1985	0.709	0.599	517.504	106.109	2.816	53.373	14.134	68.29
1986	0.575	0.984	433.184	64.457	2.373	77.023	13.45	91.147
1987	0.622	0.651	522.004	73.242	2.545	63.196	4.226	68.457
1988	0.582	0.766	481.281	45.824	2.372	73.207	13.041	87.377
1989	0.52	0.614	456.871	30.98	2.229	65.817	7.932	75.227
1990	0.492	0.504	448.023	22.391	2.156	60.099	8.737	70.52
1991	0.442	0.454	410.277	9.629	1.945	56.688	10.178	68.777
1992	0.403	0.347	391.211	3.25	1.809	47.906	9.096	59.18
1993	0.318	0.313	313.852	-9.348	1.413	42.055	10.239	54.719
1994	0.263	0.175	275.012	-15.691	1.191	25.941	7.483	36.129
1995	0.283	0.076	307.992	-13.93	1.267	16.031	8.934	27.871
1996	0.309	0.079	348.129	-12.191	1.366	17.73	12.255	33.137
1997	0.331	0.088	388.863	-11.227	1.449	20.387	14.224	38.105
1998	0.345	0.096	425.051	-10.875	1.506	22.527	16.152	42.574
1999	0.357	0.094	464.055	-10.746	1.556	23.355	16.257	43.965
2000	0.37	0.09	505.383	-10.656	1.605	23.785	17.402	45.992

	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL	PFBAL	RINS
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	-1.398	0.423	0.	0.223	0.223	0.418	0.	0.
1982	-1.644	1.881	0.	1.088	1.312	-0.102	0.	0.029
1983	-7.324	6.668	0.	4.198	4.828	0.288	0.	-0.007
1984	-10.242	19.165	0.	12.255	14.865	-5.789	0.	0.02
1985	-5.117	34.617	0.	22.433	28.483	-26.488	0.	-0.405
1986	4.513	41.355	0.02	27.776	36.774	-60.383	0.	-1.854
1987	-9.796	44.184	6.43	26.861	34.564	-74.441	0.	-4.227
1988	-4.192	48.937	6.36	30.622	40.027	-97.715	0.	-5.211
1989	-9.38	45.414	6.26	29.111	37.987	-115.477	0.	-6.84
1990	-11.769	43.352	6.14	28.383	36.963	-131.074	0.	-8.083
1991	-10.941	41.43	5.98	27.755	36.312	-146.758	0.	-9.175
1992	-13.185	38.187	5.78	26.331	34.302	-157.785	0.	-10.273
1993	-10.947	34.418	5.54	24.423	32.126	-168.492	0.	-11.045
1994	-13.621	27.898	5.26	20.578	26.89	-170.531	0.	-11.794
1995	-15.897	26.457	4.94	19.838	25.474	-166.605	0.	-11.937
1996	-15.32	30.777	4.55	22.999	29.378	-162.094	0.	-11.662
1997	-14.725	35.969	4.12	26.823	34.125	-156.246	0.	-11.346
1998	-14.238	41.508	3.62	30.97	39.247	-148.305	0.	-10.937
1999	-14.25	47.008	3.05	35.036	44.217	-136.148	0.	-10.381
2000	-14.254	53.48	2.42	39.716	49.894	-119.082	0.	-9.531

	FUND	FUND77	R99L	F99L
1977	0.	0.	0.	0.
1978	0.	0.	0.	0.
1979	0.	0.	0.	0.
1980	0.	0.	0.	0.
1981	0.418	-0.207	0.02	0.02
1982	-0.192	-1.65	1.438	1.438
1983	0.288	-5.753	4.001	4.001
1984	-5.789	-19.861	16.017	16.017
1985	-26.488	-43.442	35.984	35.984
1986	-60.383	-61.516	51.772	51.772
1987	-74.441	-71.594	43.326	43.326
1988	-97.715	-81.574	51.433	51.433
1989	-115.477	-87.672	47.258	47.258
1990	-131.074	-92.289	44.592	44.592
1991	-146.758	-94.215	43.5	43.5
1992	-157.785	-94.355	39.688	39.688
1993	-168.492	-90.898	37.538	37.538
1994	-170.531	-85.434	29.999	29.999
1995	-166.605	-80.703	26.112	26.112
1996	-162.094	-76.074	29.132	29.132
1997	-156.246	-70.816	32.794	32.794
1998	-148.305	-64.773	36.586	36.586
1999	-136.148	-57.445	39.68	39.68
2000	-119.082	-48.941	43.121	43.121

LOW BASE CASE

SIMULATION OUTPUT BY DSET

NL

	POP	MIGNET	NINCTOT	EM99	EMSPP	EMG9P	EMNSP	EMA9
1977	410.66	-24.935	6.383	185.508	0.363	0.378	0.259	1.1
1978	406.709	-11.199	7.202	178.557	0.373	0.386	0.242	1.2
1979	417.661	4.23	6.699	184.486	0.382	0.376	0.242	1.2
1980	431.495	7.005	6.829	192.187	0.394	0.363	0.244	1.2
1981	452.241	13.712	7.04	204.393	0.407	0.344	0.249	1.3
1982	483.427	23.69	7.513	223.073	0.422	0.32	0.258	1.3
1983	500.077	8.316	8.365	228.948	0.423	0.325	0.252	1.4
1984	498.073	-10.545	8.547	221.443	0.42	0.341	0.239	1.4
1985	505.276	-0.802	7.981	223.064	0.426	0.333	0.241	1.4
1986	518.872	5.722	7.864	229.85	0.433	0.324	0.243	1.5
1987	534.66	7.786	8.004	238.1	0.441	0.316	0.242	1.5
1988	551.766	8.89	8.219	247.041	0.448	0.309	0.242	1.6
1989	569.539	9.302	8.476	256.222	0.456	0.303	0.242	1.6
1990	586.227	7.947	8.748	264.339	0.461	0.298	0.241	1.7
1991	601.891	6.706	8.961	271.666	0.468	0.293	0.239	1.7
1992	617.622	6.606	9.125	278.987	0.474	0.287	0.239	1.8
1993	635.402	8.492	9.289	287.82	0.482	0.28	0.238	1.8
1994	653.25	8.321	9.53	296.526	0.489	0.274	0.238	1.8
1995	672.192	9.184	9.759	305.953	0.496	0.267	0.237	1.9
1996	691.214	9.002	10.022	315.284	0.502	0.261	0.237	2.
1997	712.212	10.729	10.272	325.991	0.509	0.253	0.237	2.1
1998	733.838	11.041	10.59	336.928	0.516	0.247	0.237	2.1
1999	757.989	13.244	10.911	349.56	0.524	0.239	0.237	2.2
2000	782.602	13.305	11.315	362.233	0.53	0.233	0.237	2.2

	EMGF	EMP9	EMT9	EMS9	EMPU	EMOT	EMM9	EMFI
1977	42.921	4.514	9.842	22.649	1.184	14.55	11.356	5.779
1978	42.921	4.365	10.296	21.905	1.194	14.27	11.906	5.739
1979	42.921	4.368	10.728	23.533	1.244	14.509	12.411	6.133
1980	42.921	4.692	11.284	25.552	1.308	14.813	12.896	6.654
1981	42.921	4.485	12.141	28.593	1.39	15.284	13.37	7.385
1982	42.921	4.279	13.233	33.221	1.498	15.976	13.843	8.441
1983	42.921	3.95	13.533	34.134	1.534	16.188	14.32	8.772
1984	42.921	3.856	13.168	32.13	1.516	15.917	14.867	8.49
1985	42.921	3.753	13.458	32.901	1.541	15.976	15.364	8.711
1986	42.921	3.725	13.916	34.767	1.591	16.22	15.877	9.186
1987	42.921	3.835	14.455	36.982	1.649	16.512	16.403	9.756
1988	42.921	3.975	15.011	39.313	1.709	16.823	16.947	10.355
1989	42.921	4.151	15.592	41.794	1.771	17.136	17.507	10.994
1990	42.921	4.36	16.092	43.924	1.825	17.408	18.085	11.557
1991	42.921	3.968	16.591	46.125	1.878	17.65	18.68	12.123
1992	42.921	3.856	17.069	48.26	1.928	17.888	19.297	12.675
1993	42.921	3.809	17.654	50.937	1.989	18.171	19.933	13.359
1994	42.921	3.733	18.21	53.518	2.046	18.446	20.59	14.02
1995	42.921	3.661	18.823	56.4	2.109	18.739	21.269	14.762
1996	42.921	3.619	19.411	59.212	2.17	19.025	21.971	15.483
1997	42.921	3.6	20.093	62.54	2.239	19.347	22.696	16.334
1998	42.921	3.598	20.767	65.891	2.307	19.671	23.445	17.188
1999	42.921	3.595	21.546	69.837	2.385	20.039	24.219	18.193
2000	42.921	3.593	22.307	73.763	2.46	20.4	25.019	19.191

	EMD9	EMCN	EMCN1	EMGA	PI	PIRPC	RPI	EXOPS
1977	24.819	16.559	11.189	27.256	4072.38	3924.32	252.71	810.
1978	24.771	11.436	11.309	25.941	4237.42	3724.25	279.75	944.
1979	26.247	12.129	11.912	26.421	4707.	3845.78	293.049	1019.
1980	28.18	13.203	12.84	26.81	5301.84	3994.15	307.633	1114.32
1981	30.828	16.473	13.938	27.383	6292.12	4286.13	324.619	1232.22
1982	34.565	22.122	15.621	28.5	7829.1	4695.79	344.899	1414.43
1983	35.753	21.857	16.4	31.406	8496.34	4711.6	360.605	1682.58
1984	34.844	16.981	16.342	32.536	8177.23	4416.8	371.719	1836.3
1985	35.643	17.203	16.977	31.4	8696.63	4447.58	386.99	1892.89
1986	37.327	18.448	18.04	31.537	9627.34	4581.2	405.016	2056.95
1987	39.339	19.445	18.988	32.431	10712.6	4718.58	424.631	2294.02
1988	41.436	20.531	20.009	33.511	11949.2	4864.11	445.234	2567.84
1989	43.659	21.534	21.051	34.617	13297.	5001.02	466.851	2871.87
1990	45.609	22.166	21.987	35.739	14638.4	5107.99	488.857	3199.28
1991	47.551	22.939	22.759	36.556	16056.9	5217.3	511.332	3520.29
1992	49.438	23.703	23.588	37.145	17593.8	5326.19	534.843	3847.94
1993	51.752	24.864	24.682	37.581	19427.4	5460.17	559.97	4195.22
1994	53.98	25.943	25.76	38.234	21398.4	5588.55	586.146	4590.19
1995	56.465	27.069	26.958	38.718	23582.5	5716.21	613.755	5002.95
1996	58.865	28.21	28.139	39.247	25960.8	5845.94	642.477	5447.18
1997	61.677	29.63	29.576	39.621	28711.7	5988.0	673.145	5918.04
1998	64.482	31.15	31.095	40.172	31752.2	6136.17	705.149	6452.66
1999	67.756	32.935	32.879	40.648	35284.1	6296.2	739.342	7034.71
2000	70.988	34.731	34.673	41.324	39155.9	6455.52	775.054	7699.06

	EXCAP	E99S	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL
1977	270.326	1160.82	1118.56	796.269	197.2	214.301	278.522	668.165
1978	280.	1311.13	1152.37	1053.84	471.4	206.933	240.288	617.245
1979	290.	1414.71	1155.86	1439.75	860.7	273.822	222.013	813.789
1980	329.271	1558.6	1174.16	1620.	996.3	310.38	227.772	1055.05
1981	367.356	1723.39	1173.93	1980.3	1278.41	350.759	257.996	1509.86
1982	439.758	1993.03	1195.34	2321.01	1475.74	432.272	330.304	2075.8
1983	519.938	2355.51	1306.22	2644.87	1642.7	547.526	413.558	2657.56
1984	560.615	2566.71	1386.34	3218.67	2121.71	646.014	441.699	3591.76
1985	652.662	2732.94	1397.66	3621.77	2421.88	677.067	443.388	4787.25
1986	779.791	3046.14	1449.49	3802.25	2429.91	731.094	489.635	5914.89
1987	836.263	3363.37	1481.44	4047.14	2478.65	785.471	560.408	7031.64
1988	904.106	3731.79	1519.06	4298.99	2518.62	862.322	645.383	8094.95
1989	955.973	4116.31	1548.13	4558.2	2553.89	942.993	743.346	9094.44
1990	1003.13	4521.04	1577.58	4666.4	2430.95	1018.82	851.297	9873.15
1991	1000.29	4871.56	1582.88	4821.36	2364.37	1092.18	964.36	10512.2
1992	1020.61	5252.38	1590.04	5081.57	2400.58	1193.34	1087.91	11082.8
1993	1064.19	5671.28	1593.92	5349.46	2428.14	1309.64	1228.21	11568.2
1994	1113.34	6145.49	1604.98	5579.02	2393.23	1429.01	1395.48	11890.7
1995	1148.69	6628.55	1606.68	5802.57	2341.42	1561.29	1581.42	12034.6
1996	1192.5	7153.97	1610.93	6081.43	2327.77	1724.	1794.12	12016.4
1997	1254.65	7722.72	1610.84	6391.25	2323.5	1906.76	2034.42	11833.6
1998	1361.21	8404.27	1624.12	6740.42	2321.79	2126.12	2318.58	11439.5
1999	1476.48	9134.92	1630.03	7132.28	2329.04	2383.45	2644.48	10837.3
2000	1607.82	9965.87	1643.02	7571.07	2331.72	2684.89	3031.05	9991.92

	PFBAL	RINS	FUND	FUND77	EXBITEL	R99L	E99L	SIMP
1977	2.4	35.343	670.6	671.369	0.131	531.912	557.16	-137.453
1978	48.975	46.954	666.22	602.515	0.134	568.509	595.272	-4.38
1979	153.275	46.88	967.064	834.901	0.132	622.581	650.949	300.844
1980	275.	68.461	1330.05	1093.85	0.135	714.74	744.811	362.987
1981	411.475	94.479	1921.34	1497.44	0.127	796.503	828.378	591.285
1982	563.425	136.551	2639.23	1936.	0.115	899.646	933.433	717.895
1983	731.699	187.563	3389.26	2377.9	0.121	1032.1	1067.91	750.035
1984	948.649	240.907	4540.41	3090.3	0.137	1116.56	1154.52	1151.15
1985	1187.55	322.572	5974.8	3906.11	0.133	1158.42	1196.66	1434.39
1986	1437.35	424.174	7352.24	4592.7	0.129	1238.86	1281.51	1377.45
1987	1684.2	521.843	8715.84	5193.	0.126	1350.67	1395.89	1363.6
1988	1935.8	618.53	10030.7	5699.88	0.124	1483.88	1531.8	1314.91
1989	2192.22	711.831	11286.7	6116.57	0.122	1628.77	1679.57	1255.92
1990	2440.75	801.027	12313.9	6372.86	0.122	1789.6	1843.45	1027.23
1991	2680.6	874.176	13192.8	6527.61	0.122	1952.54	2009.63	878.906
1992	2925.5	936.899	14008.3	6626.41	0.121	2122.12	2182.63	815.453
1993	3173.85	995.205	14742.1	6660.62	0.119	2303.01	2367.15	733.844
1994	3419.25	1047.82	15310.	6608.29	0.117	2514.03	2582.02	567.891
1995	3659.62	1088.8	15694.2	6469.41	0.116	2737.5	2809.57	384.211
1996	3899.12	1116.89	15915.5	6267.34	0.115	2988.88	3065.27	221.309
1997	4139.3	1133.58	15972.9	6003.37	0.113	3254.64	3335.62	57.363
1998	4380.25	1138.8	15819.7	5675.95	0.112	3561.31	3647.14	-153.148
1999	4622.62	1129.28	15459.9	5290.32	0.11	3892.27	3983.25	-359.801
2000	4866.29	1105.31	14858.2	4850.15	0.109	4274.77	4371.21	-601.707

	EXBITES	VIABL2	RENSRAT
1977	0.229	0.604	0.068
1978	0.25	0.526	0.057
1979	0.242	0.467	0.047
1980	0.237	0.442	0.043
1981	0.221	0.437	0.041
1982	0.205	0.442	0.042
1983	0.223	0.43	0.049
1984	0.253	0.414	0.054
1985	0.252	0.401	0.051
1986	0.252	0.391	0.051
1987	0.251	0.39	0.052
1988	0.25	0.389	0.054
1989	0.248	0.391	0.056
1990	0.249	0.394	0.058
1991	0.246	0.401	0.06
1992	0.242	0.409	0.062
1993	0.238	0.417	0.063
1994	0.234	0.427	0.065
1995	0.23	0.438	0.067
1996	0.226	0.45	0.069
1997	0.221	0.463	0.071
1998	0.217	0.476	0.073
1999	0.212	0.49	0.075
2000	0.209	0.506	0.077

95% WESTERN GULF OCS DEVELOPMENT SCENARIO -
LOW BASE CASE

(Levels and Differences from the Base Case)

SIMULATION OUTPUT BY DSET

WL

	POP	MIGNET	NINCTOT	EM99	EMSPP	EMG9P	EMNSP	EMA9
1977	410.66	-24.935	6.383	185.508	0.363	0.378	0.259	1.1
1978	406.709	-11.199	7.202	178.557	0.373	0.386	0.242	1.2
1979	417.661	4.23	6.699	184.486	0.382	0.376	0.242	1.2
1980	431.495	7.005	6.829	192.187	0.394	0.363	0.244	1.2
1981	452.693	14.164	7.04	204.726	0.407	0.343	0.249	1.3
1982	484.141	23.934	7.531	223.563	0.422	0.32	0.258	1.3
1983	502.62	8.119	8.392	229.261	0.423	0.324	0.252	1.4
1984	498.385	-10.794	8.565	221.559	0.42	0.341	0.239	1.4
1985	505.529	-0.869	7.988	223.132	0.426	0.333	0.241	1.4
1986	519.088	5.681	7.868	229.893	0.433	0.324	0.243	1.5
1987	534.856	7.763	8.007	238.133	0.441	0.316	0.242	1.5
1988	551.946	8.873	8.221	247.067	0.448	0.309	0.242	1.6
1989	569.706	9.288	8.477	256.242	0.456	0.303	0.242	1.6
1990	586.384	7.935	8.748	264.356	0.461	0.298	0.241	1.7
1991	602.037	6.696	8.961	271.681	0.468	0.293	0.239	1.7
1992	617.758	6.596	9.125	279.001	0.475	0.287	0.239	1.8
1993	635.528	8.482	9.289	287.831	0.482	0.28	0.238	1.8
1994	653.368	8.313	9.53	296.535	0.489	0.274	0.238	1.8
1995	672.302	9.177	9.759	305.96	0.496	0.267	0.237	1.9
1996	691.325	9.004	10.021	315.295	0.502	0.261	0.237	2.
1997	712.318	10.725	10.272	326.001	0.509	0.253	0.237	2.1
1998	733.942	11.038	10.589	336.938	0.516	0.247	0.237	2.1
1999	758.089	13.241	10.911	349.571	0.524	0.239	0.237	2.2
2000	782.698	13.301	11.315	362.243	0.53	0.233	0.237	2.2

	EMGF	EMP9	EMT9	EMS9	EMPU	EMOT	EMM9	EMFI
1977	42.921	4.514	9.842	22.649	1.184	14.55	11.356	5.779
1978	42.921	4.365	10.296	21.905	1.194	14.27	11.906	5.739
1979	42.921	4.368	10.728	23.533	1.244	14.509	12.411	6.133
1980	42.921	4.692	11.284	25.552	1.308	14.813	12.896	6.654
1981	42.921	4.576	12.22	28.657	1.392	15.296	13.37	7.402
1982	42.921	4.37	13.32	33.319	1.5	15.994	13.843	8.466
1983	42.921	3.981	13.57	34.196	1.536	16.199	14.32	8.788
1984	42.921	3.856	13.174	32.152	1.517	15.921	14.867	8.496
1985	42.921	3.753	13.461	32.915	1.542	15.978	15.364	8.715
1986	42.921	3.725	13.918	34.776	1.591	16.222	15.877	9.188
1987	42.921	3.835	14.456	36.988	1.649	16.513	16.403	9.758
1988	42.921	3.975	15.012	39.319	1.709	16.824	16.947	10.356
1989	42.921	4.151	15.593	41.798	1.771	17.137	17.507	10.995
1990	42.921	4.36	16.093	43.928	1.825	17.408	18.085	11.558
1991	42.921	3.968	16.592	46.129	1.878	17.65	18.68	12.124
1992	42.921	3.856	17.07	48.264	1.928	17.888	19.297	12.676
1993	42.921	3.809	17.655	50.94	1.989	18.172	19.933	13.359
1994	42.921	3.733	18.211	53.52	2.046	18.447	20.59	14.02
1995	42.921	3.661	18.824	56.402	2.109	18.74	21.269	14.762
1996	42.921	3.619	19.411	59.216	2.17	19.025	21.971	15.484
1997	42.921	3.6	20.093	62.544	2.239	19.348	22.696	16.335
1998	42.921	3.598	20.768	65.895	2.307	19.672	23.445	17.189
1999	42.921	3.595	21.547	69.84	2.385	20.039	24.219	18.193
2000	42.921	3.593	22.307	73.767	2.46	20.401	25.019	19.192

	PFBAL	RINS	FUND	FUND77	EXBITEL	R99L	E99L	SIMP
1977	2.4	35.343	670.6	671.369	0.131	531.912	557.16	-137.453
1978	48.975	46.954	666.22	602.515	0.134	568.509	595.272	-4.38
1979	153.275	46.88	967.064	834.901	0.132	622.581	650.949	300.844
1980	275.	68.461	1330.05	1093.85	0.135	714.74	744.811	362.987
1981	411.475	94.479	1921.83	1497.2	0.126	796.526	828.401	591.776
1982	563.425	136.585	2638.52	1934.39	0.115	901.312	935.1	716.699
1983	731.699	187.514	3386.24	2374.92	0.122	1034.75	1070.57	747.714
1984	948.649	240.695	4535.83	3086.68	0.137	1118.32	1156.28	1149.6
1985	1187.55	322.251	5968.53	3901.59	0.133	1159.11	1199.35	1432.71
1986	1437.35	423.735	7344.71	4587.63	0.129	1239.27	1281.93	1376.18
1987	1684.2	521.316	8707.11	5187.46	0.126	1350.96	1396.18	1362.4
1988	1935.8	617.918	10020.9	5693.95	0.124	1484.11	1532.04	1313.77
1989	2192.22	711.14	11275.7	6110.3	0.122	1628.98	1679.78	1254.81
1990	2440.75	800.259	12301.8	6366.3	0.122	1789.8	1843.65	1026.14
1991	2680.6	873.331	13179.6	6520.78	0.122	1952.73	2009.81	877.77
1992	2925.5	935.974	13993.9	6619.34	0.121	2122.31	2182.82	814.301
1993	3173.85	994.199	14726.6	6653.34	0.119	2303.19	2367.33	732.691
1994	3419.25	1046.73	15293.3	6600.84	0.117	2514.2	2582.19	566.73
1995	3659.62	1087.63	15676.3	6461.8	0.116	2737.66	2809.73	383.
1996	3899.12	1115.64	15896.4	6259.55	0.115	2989.04	3065.43	220.07
1997	4139.3	1132.24	15952.2	5995.36	0.113	3254.88	3335.85	55.809
1998	4380.25	1137.35	15797.4	5667.7	0.112	3561.53	3647.37	-154.832
1999	4622.62	1127.72	15435.7	5281.84	0.11	3892.51	3983.49	-361.609
2000	4866.29	1103.62	14832.1	4841.43	0.109	4275.04	4371.48	-603.633

	EXBITES	VIABL2	RENSRAT
1977	0.229	0.604	0.068
1978	0.25	0.506	0.057
1979	0.242	0.467	0.047
1980	0.237	0.442	0.043
1981	0.22	0.438	0.041
1982	0.204	0.442	0.042
1983	0.223	0.43	0.049
1984	0.253	0.414	0.054
1985	0.252	0.401	0.051
1986	0.252	0.391	0.051
1987	0.251	0.39	0.052
1988	0.25	0.389	0.054
1989	0.248	0.391	0.056
1990	0.249	0.394	0.058
1991	0.246	0.401	0.06
1992	0.242	0.409	0.062
1993	0.238	0.417	0.063
1994	0.234	0.427	0.065
1995	0.23	0.438	0.067
1996	0.226	0.45	0.069
1997	0.221	0.463	0.071
1998	0.217	0.476	0.073
1999	0.212	0.49	0.075
2000	0.209	0.506	0.077

SIMULATION OUTPUT BY DSET - ERROR

WL_ER

	POP	MIGNET	NINCTOT	EM99	EMA9	EMGF	EMP9	EMT9
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.452	0.452	0.	0.334	0.	0.	0.091	0.079
1982	0.714	0.244	0.018	0.489	0.	0.	0.091	0.087
1983	0.543	-0.197	0.027	0.314	0.	0.	0.031	0.036
1984	0.312	-0.249	0.018	0.116	0.	0.	0.	0.006
1985	0.253	-0.067	0.007	0.069	0.	0.	0.	0.003
1986	0.216	-0.041	0.004	0.043	0.	0.	0.	0.002
1987	0.196	-0.023	0.003	0.032	0.	0.	0.	0.002
1988	0.18	-0.017	0.002	0.025	0.	0.	0.	0.001
1989	0.167	-0.014	0.001	0.021	0.	0.	0.	0.001
1990	0.156	-0.012	0.	0.017	0.	0.	0.	0.001
1991	0.146	-0.01	0.	0.015	0.	0.	0.	0.001
1992	0.136	-0.01	-0.	0.014	0.	0.	0.	0.001
1993	0.126	-0.009	-0.	0.011	0.	0.	0.	0.001
1994	0.117	-0.008	-0.	0.009	0.	0.	0.	0.001
1995	0.11	-0.007	-0.001	0.008	0.	0.	0.	0.001
1996	0.111	0.002	-0.001	0.011	0.	0.	0.	0.001
1997	0.106	-0.004	-0.	0.01	0.	0.	0.	0.001
1998	0.103	-0.003	-0.	0.01	0.	0.	0.	0.001
1999	0.1	-0.003	-0.	0.01	0.	0.	0.	0.001
2000	0.096	-0.004	-0.	0.01	0.	0.	0.	0.001

	EMS9	EMPU	EMOT	EMM9	EMFI	EMD9	EMCM	EMCN
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.064	0.002	0.013	0.	0.017	0.061	0.001	0.026
1982	0.098	0.003	0.018	0.	0.025	0.091	0.001	0.044
1983	0.062	0.002	0.011	0.	0.016	0.057	0.001	0.029
1984	0.023	0.001	0.004	0.	0.006	0.021	0.	0.01
1985	0.013	0.	0.002	0.	0.003	0.012	0.	0.004
1986	0.009	0.	0.002	0.	0.002	0.008	0.	0.001
1987	0.007	0.	0.001	0.	0.002	0.006	0.	0.
1988	0.005	0.	0.001	0.	0.001	0.005	0.	0.
1989	0.005	0.	0.001	0.	0.001	0.004	0.	0.
1990	0.004	0.	0.001	0.	0.001	0.004	0.	-0.
1991	0.004	0.	0.001	0.	0.001	0.003	0.	0.
1992	0.003	0.	0.	0.	0.001	0.003	0.	0.
1993	0.003	0.	0.	0.	0.001	0.003	0.	0.
1994	0.003	0.	0.	0.	0.001	0.002	0.	0.
1995	0.002	0.	0.	0.	0.001	0.002	0.	0.
1996	0.004	0.	0.	0.	0.001	0.003	0.	0.001
1997	0.003	0.	0.	0.	0.001	0.003	0.	0.002
1998	0.003	0.	0.	0.	0.001	0.003	0.	0.002
1999	0.003	0.	0.	0.	0.001	0.003	0.	0.002
2000	0.003	0.	0.	0.	0.001	0.003	0.	0.002

	EMCN1	EMGA	PT	PIRPC	RPI	EXOPS	EXCAP	E99S
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	0.026	-0.019	16.375	5.066	0.136	0.	0.	0.
1982	0.044	0.033	26.809	6.473	0.195	2.632	0.922	3.554
1983	0.029	0.068	17.824	3.066	0.13	4.136	1.02	5.182
1984	0.01	0.046	6.719	0.129	0.06	2.697	0.277	3.028
1985	0.004	0.029	4.242	-0.535	0.042	2.403	-0.322	2.142
1986	0.001	0.02	2.949	-0.859	0.031	1.866	-0.708	1.209
1987	0.	0.014	2.473	-0.941	0.027	1.558	-0.628	0.96
1988	0.	0.011	2.215	-0.965	0.025	1.381	-0.636	0.755
1989	0.	0.009	2.047	-0.957	0.024	1.24	-0.602	0.633
1990	-0.	0.007	1.914	-0.938	0.023	1.115	-0.568	0.52
1991	0.	0.005	1.93	-0.883	0.023	1.005	-0.464	0.5
1992	0.	0.005	1.887	-0.84	0.023	0.914	-0.411	0.445
1993	0.	0.003	1.824	-0.797	0.022	0.809	-0.378	0.359
1994	0.	0.002	1.727	-0.77	0.022	0.703	-0.333	0.285
1995	0.	0.002	1.746	-0.727	0.022	0.617	-0.258	0.266
1996	0.001	0.001	2.516	-0.621	0.026	0.539	-0.184	0.258
1997	0.002	0.001	2.613	-0.598	0.027	0.656	0.173	0.723
1998	0.002	0.001	2.734	-0.566	0.028	0.664	0.18	0.746
1999	0.002	0.001	3.141	-0.516	0.03	0.691	0.191	0.789
2000	0.002	0.001	3.273	-0.512	0.031	0.719	0.207	0.836

	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL	PFBAL	RINS
1977	0.	0.	0.	0.	0.	0.	0.	0.
1978	0.	0.	0.	0.	0.	0.	0.	0.
1979	0.	0.	0.	0.	0.	0.	0.	0.
1980	0.	0.	0.	0.	0.	0.	0.	0.
1981	-1.665	0.497	0.	0.261	0.261	0.491	0.	0.
1982	-0.31	1.634	0.	0.953	1.214	-0.705	0.	0.034
1983	0.982	1.891	0.	1.204	1.637	-3.028	0.	-0.049
1984	0.543	0.995	0.	0.731	1.025	-4.586	0.	-0.212
1985	0.245	0.244	0.	0.295	0.413	-6.27	0.	-0.321
1986	-0.141	-0.039	0.	0.185	0.265	-7.535	0.	-0.439
1987	-0.214	-0.211	0.	0.134	0.19	-8.734	0.	-0.527
1988	-0.273	-0.32	0.	0.116	0.169	-9.867	0.	-0.611
1989	-0.294	-0.418	0.	0.108	0.156	-10.98	0.	-0.691
1990	-0.314	-0.508	0.	0.103	0.147	-12.078	0.	-0.769
1991	-0.293	-0.594	0.	0.103	0.142	-13.211	0.	-0.845
1992	-0.283	-0.668	0.	0.108	0.147	-14.363	0.	-0.925
1993	-0.279	-0.754	0.	0.105	0.146	-15.516	0.	-1.006
1994	-0.275	-0.836	0.	0.112	0.148	-16.676	0.	-1.086
1995	-0.256	-0.926	0.	0.109	0.144	-17.887	0.	-1.167
1996	-0.266	-0.977	0.	0.136	0.17	-19.125	0.	-1.252
1997	-0.154	-0.992	0.	0.184	0.241	-20.68	0.	-1.339
1998	-0.15	-1.098	0.	0.196	0.245	-22.363	0.	-1.448
1999	-0.139	-1.187	0.	0.214	0.272	-24.172	0.	-1.565
2000	-0.128	-1.27	0.	0.244	0.313	-26.098	0.	-1.692

	FUND	FUND77	K99L	B99L
1977	0.	0.	0.	0.
1978	0.	0.	0.	0.
1979	0.	0.	0.	0.
1980	0.	0.	0.	0.
1981	0.491	-0.247	0.023	0.023
1982	-0.705	-1.613	1.667	1.667
1983	-3.028	-2.981	2.655	2.655
1984	-4.586	-3.619	1.762	1.762
1985	-6.27	-4.519	0.683	0.683
1986	-7.535	-5.066	0.415	0.415
1987	-8.734	-5.539	0.286	0.286
1988	-9.867	-5.93	0.239	0.239
1989	-10.98	-6.266	0.21	0.21
1990	-12.078	-6.555	0.197	0.197
1991	-13.211	-6.832	0.185	0.185
1992	-14.363	-7.074	0.184	0.184
1993	-15.516	-7.277	0.182	0.182
1994	-16.676	-7.449	0.169	0.169
1995	-17.857	-7.605	0.161	0.161
1996	-19.125	-7.785	0.158	0.158
1997	-20.68	-8.012	0.234	0.234
1998	-22.363	-8.25	0.228	0.228
1999	-24.172	-8.484	0.24	0.24
2000	-26.098	-8.715	0.262	0.262

	EMD9	EMCN	EMCN1	EMGA	PI	PIRPC	RPI	EXOPS
1977	24.819	16.559	11.189	27.256	4072.38	3924.32	252.71	810.
1978	24.771	11.436	11.309	25.941	4237.42	3724.25	279.75	944.
1979	26.247	12.129	11.912	26.421	4707.	3845.78	293.049	1019.
1980	28.18	13.203	12.84	26.81	5301.84	3994.15	307.633	1114.32
1981	30.889	16.499	13.964	27.364	6308.5	4291.2	324.755	1232.22
1982	34.655	22.166	15.665	28.533	7855.91	4702.26	345.094	1417.06
1983	35.81	21.886	16.429	31.474	8514.16	4714.66	360.735	1686.71
1984	34.865	16.991	16.352	32.582	8183.95	4416.93	371.779	1838.99
1985	35.656	17.207	16.981	31.429	8700.87	4447.04	387.031	1895.29
1986	37.335	18.449	18.041	31.557	9630.29	4580.34	405.048	2058.81
1987	39.345	19.446	18.988	32.446	10715.1	4717.64	424.658	2295.58
1988	41.441	20.531	20.009	33.522	11951.4	4863.15	445.259	2569.22
1989	43.663	21.534	21.051	34.626	13299.	5000.07	466.875	2873.11
1990	45.612	22.166	21.987	35.746	14640.3	5107.05	488.88	3200.39
1991	47.555	22.939	22.759	36.561	16058.9	5216.42	511.355	3521.29
1992	49.441	23.703	23.588	37.149	17595.7	5325.35	534.865	3848.85
1993	51.755	24.864	24.682	37.585	19429.2	5459.37	559.993	4196.03
1994	53.982	25.944	25.761	38.236	21400.1	5587.78	586.169	4590.89
1995	56.467	27.069	26.958	38.719	23584.3	5715.48	613.777	5003.57
1996	58.868	28.211	28.14	39.248	25963.3	5845.32	642.503	5447.72
1997	61.68	29.631	29.577	39.623	28714.3	5988.3	673.172	5918.7
1998	64.484	31.151	31.096	40.173	31754.9	6135.61	705.177	6453.32
1999	67.759	32.937	32.881	40.649	35287.3	6295.68	739.372	7035.4
2000	70.99	34.732	34.674	41.324	39159.2	6455.	775.085	7699.78

	EXCAP	E99S	E99SRPC	REVGF	RP9S	RT98	RENS	GFBAL
1977	270.326	1160.82	1118.56	796.269	197.2	214.301	278.522	668.165
1978	280.	1311.13	1152.37	1053.84	471.4	206.933	240.288	617.245
1979	290.	1414.71	1155.86	1439.75	860.7	273.822	222.013	813.789
1980	329.271	1558.6	1174.16	1620.	996.3	310.38	227.772	1055.05
1981	367.356	1723.39	1172.26	1980.8	1278.41	351.021	258.257	1510.35
1982	440.68	1996.59	1195.03	2322.64	1475.74	433.224	331.518	2075.1
1983	520.958	2360.69	1307.2	2646.76	1642.7	548.731	415.195	2654.54
1984	560.892	2569.74	1386.88	3219.66	2121.71	646.744	442.724	3587.18
1985	652.34	2735.08	1397.9	3622.02	2421.88	677.362	443.802	4780.98
1986	779.083	3047.35	1449.35	3802.21	2429.91	731.279	489.9	5907.36
1987	835.635	3364.33	1481.23	4046.93	2478.65	785.605	560.598	7022.91
1988	903.47	3732.54	1518.78	4298.67	2518.62	862.938	645.552	8085.08
1989	955.371	4116.95	1547.83	4557.79	2553.89	943.101	743.502	9083.46
1990	1002.56	4521.56	1577.26	4665.89	2430.95	1018.93	851.445	9861.07
1991	999.828	4872.06	1582.58	4820.76	2364.37	1092.28	964.503	10499.
1992	1020.2	5252.82	1589.75	5080.9	2400.58	1193.45	1088.06	11068.4
1993	1063.81	5671.64	1593.64	5348.71	2428.14	1309.74	1228.36	11552.7
1994	1113.01	6145.78	1604.71	5578.18	2393.23	1429.12	1395.63	11874.1
1995	1148.43	6628.82	1606.43	5801.64	2341.42	1561.4	1581.56	12016.7
1996	1192.31	7154.23	1610.67	6080.46	2327.77	1724.14	1794.29	11997.3
1997	1254.83	7723.45	1610.69	6390.26	2323.5	1906.94	2034.66	11812.9
1998	1361.38	8405.02	1623.97	6739.32	2321.79	2126.31	2318.83	11417.1
1999	1476.67	9135.71	1629.89	7131.09	2329.04	2383.66	2644.75	10813.1
2000	1608.02	9966.71	1642.89	7569.8	2331.72	2685.13	3031.36	9965.82

APPENDIX E

Census Division Projections

The purpose of this appendix is to describe the methodology chosen to allocate the MAP projections for the Southcentral Region to census divisions within the region. Projections of employment, population, and income for the Southcentral Region were made through the year 2000. Within the Southcentral Region, it is necessary to disaggregate the results to census divisions. The following seven census divisions are included: Matanuska-Susitna, Kenai-Cook Inlet, Seward, Valdez-Chitina-Whittier, Kodiak, Cordova-McCarthy, and Yakutat (a portion of the Skagway-Yakutat Census Division). Population, income, and employment by the five regional industrial sectors was allocated to each census division. Census division projections were made consistent with projections made by Alaska Consultants (1979).

The approach described below produces only allocations of regional projections and cannot be assumed to substitute for a detailed analysis and forecast of local economic growth. Two types of information are used to make the census division allocations: historical information on the census divisions and the regional projections made by the MAP model. Judgmental review of the historical period is used to set starting parameters for each census division. These parameters are adjusted throughout the projection period to account for changes in relationships at the regional level. This process allows the census division allocations to reflect changes in relationships such as scale effects projected by the MAP model.

The allocation of population and income to the census divisions depends upon the allocation of employment. Census division allocations of employment follow traditional economic base theory. This theory assumes the main cause of regional economic growth is the growth in the region's basic sector; growth in the basic sector is determined by factors external to the region. Employment in the nonbasic sector responds to growth in the basic sector since it serves the basic sector. Once the relation between these sectors is known and basic employment is known, nonbasic employment is determined. For this allocation process, industrial sector I (mining and exogenous construction), sector II (manufacturing and agriculture-forestry-fisheries), and sector III (government) are basic. Sector IV (construction and transportation-communications-utilities) and sector V (trade, services, and finance) are nonbasic. Employment was allocated in the following six steps:

- Adjustment for Census Division of Direct Impact. For the base case and each OCS scenario, the regional totals were adjusted by subtracting the projections made by Alaska Consultants for the census divisions of impact. Alaska Consultants' projections were used for Yakutat, Cordova, Seward, and Kodiak.[1]
- Allocation of Employment in Industries I and II and Federal Government. Employment in these industries was allocated to each census division exogenously. This allocation will reflect assumptions regarding particular

[1] Yakutat and Cordova are assumed to be unaffected by Western Gulf OCS development and remain at their base case level throughout.

projects and developments such as a bottomfishery in Kodiak or construction and operation of an LNG in Kenai. Alaska resident OCS employment in excess of Alaska Consultants' resident employment estimates were allocated to the other census divisions based on the proportion of population in the census division.

- Allocation of State and Local Government Employment. Regional projections of government employment in the base case were allocated to the census divisions using the shift-share technique. Shift-share analysis assumes that the growth rate of subregions is related to that of regions. The subregional growth rate is made up of a share component equal to the regional rate plus a shift component which describes the subregion's comparative advantage.

The comparative advantage term for each census division was found by examining the growth rate of government employment in each census division over four periods: 1965-1970, 1965-1976, 1970-1976, and 1972-1976. The average annual growth rates for government employment for each census division and the region are shown in Table E.1.

After examining the differential in growth rates from Table E.1, the differences shown in Table E.2 were selected for the projection period. For each census division, except Valdez, the average differential over all periods was used. The period

TABLE E.1. GROWTH RATES OF STATE AND LOCAL GOVERNMENT EMPLOYMENT FOR SELECTED PERIODS

Census Divisions	1965-1970	1965-1976	1970-1976	1972-1976
Kodiak	1.089	1.078	1.098	1.029
Kenai	1.122	1.108	1.096	1.062
Matanuska-Susitna	1.061	1.107	1.147	1.103
Seward	1.038	1.053	1.066	1.100
Cordova	1.071	1.078	1.084	1.060
Valdez	1.070	1.075	1.079	1.104
Southcentral Region	1.097	1.085	1.075	1.052

SOURCE: Alaska Department of Labor, Labor Force Estimates, various years.

TABLE E.2. YEARLY GOVERNMENT EMPLOYMENT GROWTH RATES FOR THE PROJECTION PERIOD

Census Division	Growth Rate
Kodiak	R - .04
Kenai	R + .02
Mat-Su	R + .03
Seward	R - .01
Cordova	R
Valdez	R
Yakutat	R

Where: R is the Southcentral regional rate of growth from the MAP regional model.

1972-1976 was dropped for Valdez to abstract from pipeline-induced increases. Yakutat was assumed to resemble the Cordova Census Division since separate information was not available for this area. A check against the Lynn-Canal Icy Straits labor market area which contains Yakutat shows that this is a reasonable assumption. Excess government employment was allocated to the census divisions based on the proportion of government employment in the initial allocation.

- Allocation of Nonbasic Employment. Economic base theory is operationalized through the development of nonbasic/basic multipliers which describe the relationship between the sectors. Two multipliers are developed to allocate nonbasic employment to the region, one describing Sector IV and one describing Sector V. The long-run multipliers for a change in basic employment are assumed to equal the average nonbasic-to-basic ratios found for the period 1972-1976 (except Valdez, where 1975 and 1976 were ignored because of the pipeline). Table E.3 shows the nonbasic/basic ratios used in the projection. (Yakutat is assumed to be the same as Cordova. A check against a 1976 employment survey in Yakutat conducted by Alaska Consultants showed these ratios to be similar.)

The major cause of growth in the Matanuska-Susitna Census Division (without the capital move) is assumed to be the growth of this area as a suburban community of Anchorage. Because of this assumption, nonbasic employment is assumed

TABLE E.3. NONBASIC/BASIC MULTIPLIERS FOR THE PROJECTION PERIOD

Census Division	Multiplier for Sector IV (Construction and Transportation-Communications-Utilities)	Multiplier for Sector V (Trade, Services, and Finance-Insurance-Real Estate)
Kodiak	.18	.35
Kenai	.39	.57
Seward	.11	.33
Cordova	.18	.32
Valdez	.25	.38
Yakutat	.18	.32

to grow as a function of population. Estimates of Matanuska-Susitna (Mat-Su) Census Division nonbasic employment are based on the following approach:

1. Mat-Su population is estimated as a function of Anchorage population using the following regression equation:

   Mat-Su Population = -9851 + .1269 x (Anchorage Population)

   $R^2 = .986$

   This was estimated in "The Effects of Regional Population Growth on Hunting for Selected Big Game Species in Southcentral Alaska, 1976-2000" (ISER, 1978).

2. Nonbasic employment is estimated using multipliers relating the change in population and the change in employment. These multipliers are assumed to equal the average from the period 1970-1976; they were .03 for industry IV and .06 for industry V.

The extra regional nonbasic employment was allocated to the census division based on the proportion of employment in the census division. This captures any scale effects projected at the regional level since multipliers in larger regions will change.

- Allocation of Regional Population. Except for the Matanuska-Susitna Census Division, population was allocated as a function of total civilian employment. Population-to-employment ratios were found from two sources. For Kodiak, Kenai, Seward, and Valdez, population/employment ratios were found by comparing Alaska Labor Department estimates of population and employment. In all but Valdez, the ratios used are the average of the 1972-1976 ratios. For Valdez, the 1975 and 1976 ratios were not included in the average because of the pipeline. The population-to-employment ratios for Cordova and Yakutat were based on estimates made by Alaska Consultants. Table E.4 shows these estimates.

  The extra population in the region was allocated based on the proportion of total population occurring in each census division. For this allocation, the population in Matanuska-Susitna was assumed to equal that found by multiplying the population/employment ratio by total employment.

TABLE E.4. POPULATION-TO-EMPLOYMENT RATIOS FOR THE PROJECTION PERIOD

Census Division	Population-to-Employment Ratio
Kodiak	2.3
Kenai	2.6
Seward	2.3
Cordova	2.1
Valdez	2.6
Yakutat	2.2

SOURCES: Alaska Department of Labor, Labor Force Estimates by Industry and Area and Population Estimates by Census Division.

Alaska Consultants, Inc, Cordova Comprehensive Development Plan, 1976, and Yakutat Comprehensive Development Plan, 1976.

- Allocation of Real Disposable Personal Income. Real disposable personal income by place of residence was allocated to each census division by the proportion of the total population in the census division.

Tables E.5 through E.8 include the estimates of growth in each census division in the Southcentral region in five-year increments.[2] These

[2] Low scenario projections are provided for only the period of significant impact, 1981-1984.

projections are consistent with the census division projections made for the communities of impact (Alaska Consultants, 1978) and the MAP projections for the Southcentral region. However, the variables will not add to the Southcentral totals. Since a portion of the growth in the Matanuska-Susitna Census Division is assumed to be Anchorage metropolitan area growth, a portion of the Matanuska-Susitna population is assumed to be projected in the Anchorage region.

TABLE E.5. CENSUS DIVISION PROJECTIONS
WESTERN GULF DEVELOPMENT SCENARIO
MODERATE BASE CASE

	1980	1985	1990	1995	2000
Seward					
EM1EX	3	440	5	7	9
EMRR	223	354	510	543	568
EMG9	404	463	510	545	602
EMS4	93	144	263	155	175
EMS5	433	511	510	736	957
POP	3,468	4,135	4,775	5,056	5,768
DPIR	10.8	14.7	20.4	22.7	29.3
Kodiak					
EM1EX	2	7	9	9	9
EMRR	1,867	2,382	2,734	2,932	3,082
EMG9	2,031	2,184	2,269	2,366	2,414
EMS4	495	778	863	959	1,048
EMS5	1,302	1,917	2,306	2,803	2,998
POP	10,856	13,851	15,668	17,967	19,556
DPIR	33.8	49.2	67.0	80.8	99.3
Cordova					
EM1EX	2	3	557	17	24
EMRR	697	749	812	902	969
EMG9	359	420	475	495	523
EMS4	97	119	313	324	332
EMS5	281	329	439	530	652
POP	2,872	3,240	4,098	4,536	5,000
DPIR	8.9	11.5	17.5	20.4	25.4
Yakutat					
EM1EX	2	2	12	20	20
EMRR	94	111	164	197	204
EMG9	90	107	179	188	198
EMS4	44	129	554	395	520
EMS5	71	104	231	250	263
POP	604	815	2,148	2,175	2,306
DPIR	1.9	2.9	9.2	9.8	11.7

TABLE E.5. (Continued)

	1980	1985	1990	1995	2000
Kenai					
EM1EX	851	1,055	1,602	712	787
EMRR	2,100	2,278	2,644	3,319	4,202
EMG9	856	1,031	1,270	1,357	1,497
EMS4	1,870	1,736	1,783	1,890	2,165
EMS5	4,378	4,738	5,787	5,690	6,686
POP	27,046	28,900	33,794	32,191	34,404
DPIR	84.2	102.7	144.6	144.8	174.7
Matanuska-Susitna					
EM1EX	6	230	469	187	235
EMRR	100	94	141	167	215
EMG9	622	681	761	734	730
EMS4	622	669	721	949	1,151
EMS5	1,991	2,500	3,199	3,908	4,866
POP	16,458	21,869	28,972	35,553	44,846
DPIR	51.2	76.4	118.7	145.8	189.7
Valdez					
EM1EX	417	387	451	376	388
EMRR	41	45	56	72	95
EMG9	475	527	594	580	584
EMS4	293	245	228	231	228
EMS5	716	693	769	724	732
POP	5,222	5,058	4,048	3,345	4,547
DPIR	16.3	18.0	17.3	15.0	23.1

EM1EX includes exogenous construction, mining, and all direct OCS employment.
EMRR includes other manufacturing and agriculture-forestry-fisheries.
EMG9 includes federal, state, and local government.

EMS4 includes local construction and transportation.
EMS5 includes trade, services, and finance-insurance-real estate.

POP is population.
DPIR is real disposable personal income (millions of constant dollars).

TABLE E.6. CENSUS DIVISION PROJECTIONS
WESTERN GULF DEVELOPMENT SCENARIO
MEAN CASE

	1985	1990	1995	2000
Seward				
EM1EX	440	5	7	9
EMRR	354	510	543	568
EMG9	466	510	545	602
EMS4	164	263	155	175
EMS5	515	510	736	975
POP	3,699	4,775	5,056	5,768
DPIR	13,238	20,422	22,752	29,273
Kodiak				
EM1EX	8	12	17	15
EMRR	3,214	3,689	3,957	4,159
EMG9	2,187	2,299	2,370	2,414
EMS4	801	882	978	1,048
EMS5	1,923	2,312	2,810	2,998
POP	12,612	14,353	16,455	17,844
DPIR	45,136	61,387	74,049	90,561
Cordova				
EM1EX	3	557	17	24
EMRR	749	812	902	969
EMG9	420	475	495	523
EMS4	119	313	324	332
EMS5	329	439	530	652
POP	3,240	4,098	4,536	5,000
DPIR	11,595	17,527	20,412	25,376
Yakutat				
EM1EX	2	12	20	20
EMRR	111	164	197	204
EMG9	107	179	188	198
EMS4	129	554	395	520
EMS5	104	231	250	263
POP	815	2,148	2,175	2,306
DPIR	2,918	9,187	9,788	11,703

TABLE E.6. (Continued)

	1985	1990	1995	2000
Kenai				
EM1EX	1,107	1,626	749	787
EMRR	2,278	2,644	3,319	4,202
EMG9	1,088	1,250	1,350	1,492
EMS4	1,858	1,958	2,017	2,294
EMS5	4,824	5,819	5,689	6,679
POP	29,971	32,822	31,543	34,633
DPIR	107,261	140,376	141,948	175,769
Matanuska-Susitna				
EM1EX	261	484	210	235
EMRR	94	141	167	215
EMG9	657	749	730	728
EMS4	702	791	1,018	1,221
EMS5	2,492	3,218	3,933	4,866
POP	21,961	29,000	35,579	44,847
DPIR	78,595	124,031	160,109	227,605
Valdez				
EM1EX	397	455	393	388
EMRR	45	56	72	95
EMG9	502	585	577	582
EMS4	251	264	248	242
EMS5	677	820	730	732
POP	5,029	5,538	4,855	4,569
DPIR	17,999	23,688	21,848	23,189

EM1EX includes exogenous construction, mining, and all direct OCS employment.
EMRR includes other manufacturing and agriculture-forestry-fisheries.
EMG9 includes federal, state, and local government.

EMS4 includes local construction and transportation.
EMS5 includes trade, services, and finance-insurance-real estate.

POP is population.
DPIR is real disposable personal income (millions of constant dollars).

TABLE E.7. CENSUS DIVISION PROJECTIONS
WESTERN GULF DEVELOPMENT SCENARIO
HIGH CASE

	1985	1990	1995	2000
Seward				
EM1EX	469	5	7	9
EMRR	353	511	543	568
EMG9	478	520	550	607
EMS4	247	336	191	211
EMS5	535	604	743	964
POP	3,960	3,940	4,003	4,525
DPIR	15,070	17,151	19,406	23,076
Kodiak				
EM1EX	7	9	9	9
EMRR	3,214	3,689	3,957	4,159
EMG9	2,184	2,296	2,366	2,414
EMS4	778	863	959	1,048
EMS5	1,917	2,306	2,803	2,998
POP	13,851	15,668	17,967	19,556
DPIR	52,712	68,202	87,100	99,729
Cordova				
EM1EX	3	557	17	24
EMRR	749	812	902	969
EMG9	420	475	495	523
EMS4	119	313	324	332
EMS5	329	439	530	652
POP	3,204	4,098	4,536	5,000
DPIR	12,330	17,838	21,989	25,498
Yakutat				
EM1EX	2	12	20	20
EMRR	111	164	197	204
EMG9	107	179	188	198
EMS4	129	554	395	520
EMS5	104	231	250	263
POP	815	2,148	2,175	2,306
DPIR	3,102	9,350	10,544	11,760

TABLE E.7. (Continued)

	1985	1990	1995	2000
Kenai				
EM1EX	1,741	1,992	971	1,100
EMRR	2,278	2,644	3,319	4,202
EMG9	1,044	1,265	1,347	1,487
EMS4	2,442	2,181	2,228	2,534
EMS5	5,431	5,954	5,937	7,029
POP	31,801	33,964	32,755	36,272
DPIR	121,024	147,848	158,788	184,977
Matanuska-Susitna				
EM1EX	638	713	348	426
EMRR	94	141	167	215
EMG9	690	758	729	725
EMS4	836	934	1,096	1,303
EMS5	2,542	3,489	3,995	4,942
POP	22,398	29,595	36,034	45,350
DPIR	85,239	128,825	174,684	231,269
Valdez				
EM1EX	518	516	495	449
EMRR	45	56	72	95
EMG9	534	592	576	580
EMS4	341	306	289	269
EMS5	789	869	802	776
POP	5,488	5,907	5,301	4,811
DPIR	20,886	25,712	25,700	24,535

EM1EX includes exogenous construction, mining, and all direct OCS employment.
EMRR includes other manufacturing and agriculture-forestry-fisheries.
EMG9 includes federal, state, and local government.

EMS4 includes local construction and transportation.
EMS5 includes trade, services, and finance-insurance-real estate.

POP is population.
DPIR is real disposable personal income (millions of constant dollars).

TABLE E.8. CENSUS DIVISION PROJECTIONS
WESTERN GULF DEVLOPMENT SCENARIO
MODERATE BASE CASE

	1981	1982	1983	1984
Seward				
EM1EX	3	4	4	4
EMRR	224	204	245	291
EMG9	413	421	431	440
EMS4	104	130	122	128
EMS5	440	445	460	474
POP	2,720	2,764	2,846	2,964
DPIR	9,378	10,312	11,039	10,094
Kodiak				
EM1EX	2	4	5	6
EMRR	2,644	2,766	2,916	3,062
EMG9	2,099	2,120	2,141	2,163
EMS4	533	588	643	733
EMS5	1,416	1,540	1,672	1,801
POP	11,447	12,017	12,614	13,278
DPIR	39,467	44,833	44,494	45,218
Cordova				
EM1EX	2	2	2	3
EMRR	707	717	727	749
EMG9	404	408	412	416
EMS4	102	106	111	115
EMS5	290	296	311	320
POP	3,010	3,068	3,126	3,182
DPIR	10,378	11,446	11,027	10,836
Yakutat				
EM1EX	2	3	3	2
EMRR	96	98	109	111
EMG9	93	94	102	102
EMS4	75	85	124	129
EMS5	79	83	93	96
POP	690	726	810	810
DPIR	2,379	2,709	2,857	2,758

TABLE E.8. (Continued)

	1981	1982	1983	1984
Kenai				
EM1EX	1,621	2,139	1,303	892
EMRR	1,234	1,294	1,357	1,484
EMG9	850	907	1,050	1,108
EMS4	1,720	1,751	1,542	1,452
EMS5	4,599	4,985	4,486	4,293
POP	29,083	30,588	26,987	26,533
DPIR	99,122	112,092	96,209	90,292
Matanuska-Susitna				
EM1EX	52	77	120	126
EMRR	56	58	60	62
EMG9	605	634	719	746
EMS4	626	676	630	666
EMS5	2,291	2,251	2,506	2,695
POP	17,540	18,622	19,705	20,787
DPIR	60,475	69,475	69,507	70,782
Valdez				
EM1EX	339	346	358	359
EMRR	25	26	28	29
EMG9	464	486	554	575
EMS4	246	261	250	257
EMS5	686	657	757	791
POP	5,085	4,840	5,566	5,756
DPIR	17,405	17,971	19,235	19,677

EM1EX includes exogenous construction, mining, and all direct OCS employment.
EMRR includes other manufacturing and agriculture-forestry-fisheries.
EMG9 includes federal, state, and local government.

EMS4 includes local construction and transportation.
EMS5 includes trade, services, and finance-insurance-real estate.

POP is population.
DPIR is real disposable personal income (millions of constant dollars).

TABLE E.9. CENSUS DIVISION PROJECTIONS
WESTERN GULF DEVLOPMENT SCENARIO
LOW CASE

	1981	1982	1983	1984
Seward				
EM1EX	3	4	4	4
EMRR	224	204	245	291
EMG9	417	425	432	440
EMS4	131	157	131	128
EMS5	447	452	462	474
POP	2,796	2,840	2,872	2,964
DPIR	19,664	10,623	10,145	10,096
Kodiak				
EM1EX	2	4	5	6
EMRR	2,644	2,766	2,916	3,062
EMG9	2,099	2,120	2,141	2,163
EMS4	533	588	643	733
EMS5	1,416	1,540	1,672	1,801
POP	11,447	12,017	12,614	13,278
DPIR	39,565	44,949	44,560	45,230
Cordova				
EM1EX	2	2	2	3
EMRR	707	717	727	749
EMG9	404	408	412	416
EMS4	102	106	111	115
EMS5	290	296	311	320
POP	3,010	3,068	3,126	3,182
DPIR	10,404	11,476	11,042	10,840
Yakutat				
EM1EX	2	3	3	2
EMRR	96	98	109	111
EMG9	93	94	102	102
EMS4	75	85	124	129
EMS5	79	83	93	96
POP	690	726	810	810
DPIR	2,384	2,716	2,861	2,759

TABLE E.9. (Continued)

	1981	1982	1983	1984
Kenai				
EM1EX	1,699	2,217	1,330	892
EMRR	1,234	1,294	1,357	1,484
EMG9	848	908	909	1,111
EMS4	1,843	1,954	1,785	1,659
EMS5	4,665	5,647	4,438	4,293
POP	29,083	30,588	26,987	26,533
DPIR	100,523	114,416	95,333	90,380
Matanuska-Susitna				
EM1EX	101	126	137	126
EMRR	56	58	60	62
EMG9	603	634	721	748
EMS4	658	635	754	762
EMS5	2,282	2,242	2,563	2,699
POP	17,544	18,630	19,716	20,802
DPIR	60,638	69,684	69,648	70,859
Valdez				
EM1EX	354	371	363	359
EMRR	25	26	28	29
EMG9	463	486	555	576
EMS4	264	251	302	294
EMS5	693	673	777	790
POP	5,085	4,840	5,566	5,756
DPIR	17,575	18,103	19,661	19,607

EM1EX includes exogenous construction, mining, and all direct OCS employment.
EMRR includes other manufacturing and agriculture-forestry-fisheries.
EMG9 includes federal, state, and local government.

EMS4 includes local construction and transportation.
EMS5 includes trade, services, and finance-insurance-real estate.

POP is population.
DPIR is real disposable personal income (millions of constant dollars).

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