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The Growth of the Alaskan Economy: Future Conditions Without the Proposal

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by

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INTRODUCTION

This paper describes a projection of the future growth of the Alaskan economy. The projection will serve as the base case to which the economic, population, and state fiscal impacts of the upcoming Joint Federal-State Outer Continental Shelf (OCS) lease sale in the Beaufort Sea will be compared. This sale is one of a series of sales proposed by the Bureau of Land Management for Alaska's Outer Continental Shelf.

The U.S. Outer Continental Shelf, because of its high potential as a source of oil and gas, figures significantly in future United States energy policy. Although Alaska has historically played only a small role in supplying the U.S. energy needs, it is expected to play an important part in petroleum production in the OCS. Over 60 percent of the estimated undiscovered OCS reserves in the United States are off the Alaskan coast (U.S. Geological Survey, 1975). This potential OCS petroleum production combined with production at Prudhoe Bay will make Alaska an important future source of oil and gas for the U.S. economy.

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 Alaskan economy and population associated with the development in Upper Cook Inlet and Prudhoe Bay have 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 lead to future changes in Alaska.

The nature of these changes will not necessarily resemble those caused by past petroleum development. The objective of the current study 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 Beaufort Sea. 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 Beaufort Sea. 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.

THE BASE CASE

Petroleum development on the Beaufort Sea will affect both the structure and the size of the Alaskan economy. Changes in the economy which result from the development of OCS resources can be defined as its impact. 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 scenario described below is a consistent, plausible pattern of development; however, it should not be mistaken for a best-guess pattern 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, which is used in this study, 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 base cases. However, to estimate the impacts of OCS development, a single base case is needed. This must be selected on the basis of consistency and plausibility of assumptions, consistency with historical growth, and consistency with assumed future patterns of economic relations.

METHODOLOGY

This section describes the methodology and assumptions used to make the base case projections of Alaskan economic growth. Two econometric models, statewide and regional econometric models, are used to make the projection.

The first part of this section will describe the models used and their strengths and weaknesses. This will be followed by a discussion of the assumptions selected for the base case forecast.

The Econometric Models

THE STATE 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.

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 export component of construction. The nonbasic industries are transportation-communication-utilities, wholesale and retail trade, finance-insurance-real estate, services, and the remainder of construction.

STRUCTURE OF THE BASIC MAP MODEL

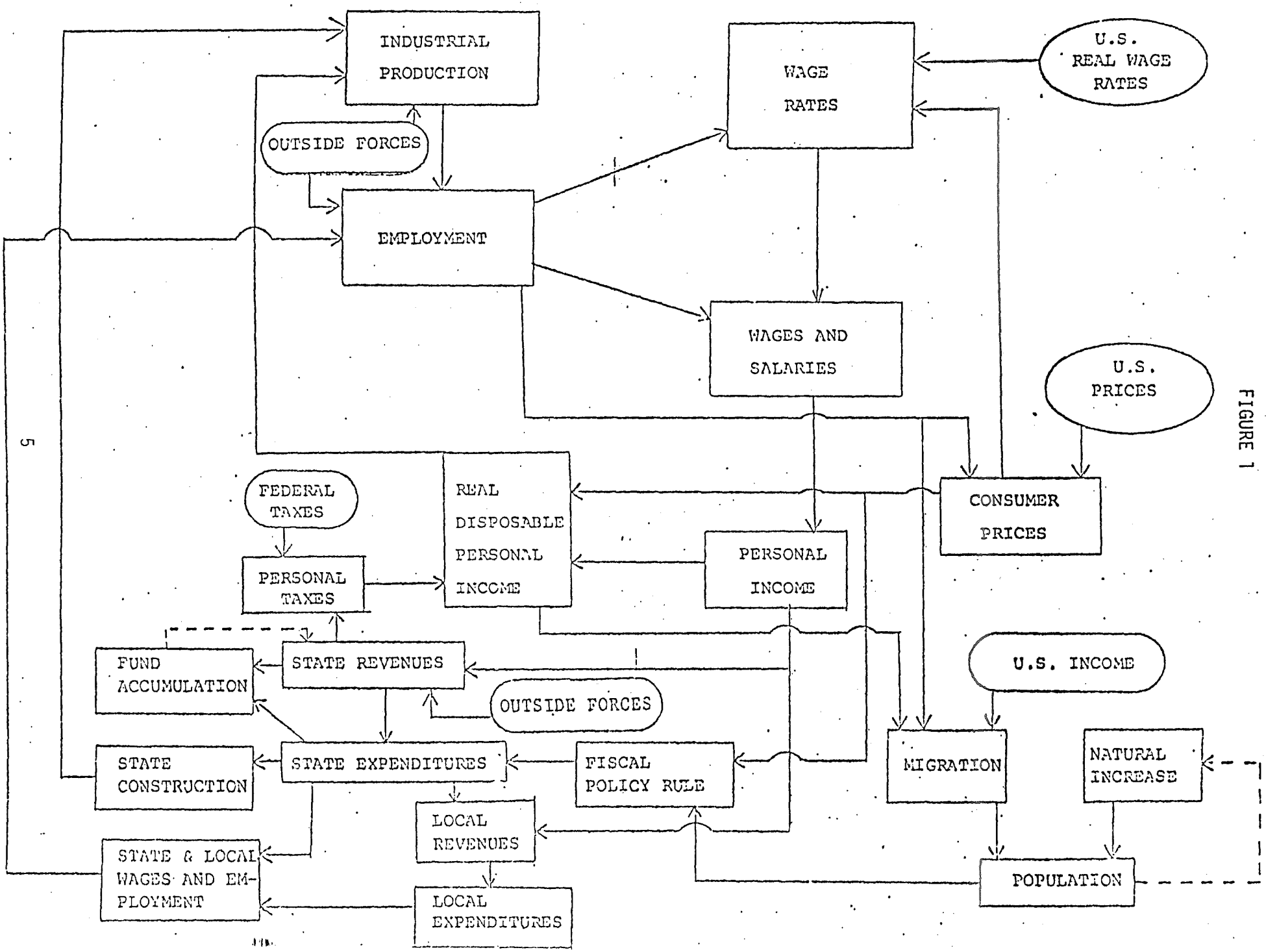

FIGURE 1

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 is 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 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 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 are based on the proportion of state population in the region. Enclave employment is added to nonenclave to

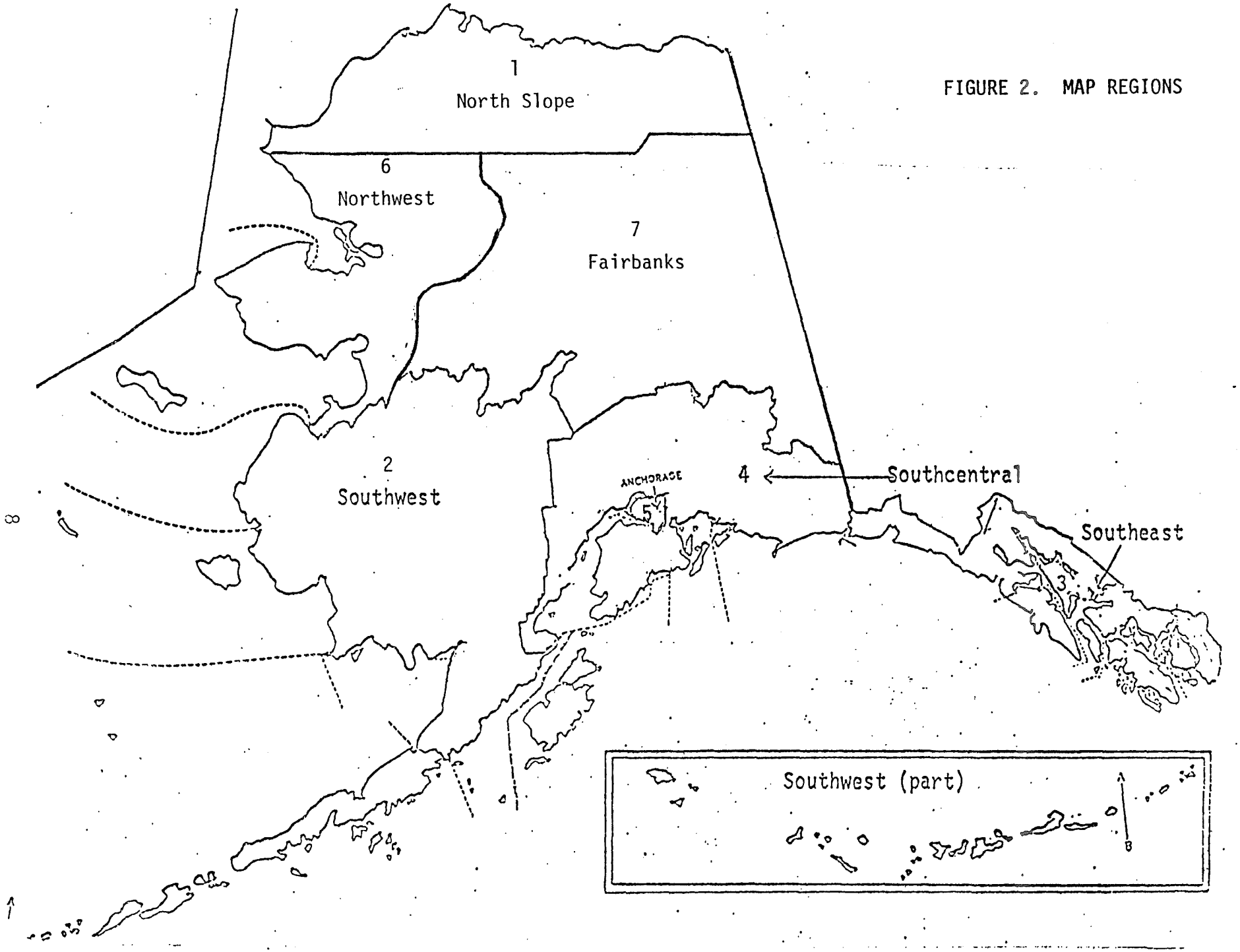

FIGURE 2. MAP REGIONS

determine total regional population. Enclave employment includes the military and major construction projects such as the trans-Alaska pipeline. Estimates of the regional model are constrained to total to equivalent 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 these models is that they capture the essence of the Alaskan 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 econometric specification of this 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 growth of the support sector on 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, it represents the economy only at a particular point in time. The econometric approach captures some of the changing relationships over time, as these can be described by historic changes or incorporated by the modeler.

The limits on this method define the limits of acceptance of the results described below. 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 in the future and the more precise in terms of location the model is expected to be. In other words, more confidence should be placed in the 1985 results than those for 1995, and statewide projections are more likely to be "correct" than regional results.

The most important limitation of these results is that the projections included in this report 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. This section will provide an overview of the set of assumptions used in the base case; these assumptions are detailed in Appendix B.

Industry Assumptions

There are two special groups of industry assumptions which are required. First are assumptions about employment connected with special projects, mainly resource development projects. 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 continues 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 other major area of petroleum activity is the Upper Cook Inlet fields. 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 are 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. 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.

Alyeska is assumed to require 850 workers per year for its long-term operations. ALCAN operations employment is assumed to be 96 beginning in 1985. The difference is accounted for because TAPS has more pipeline in Alaska, Valdez port employment is part of TAPS employment, and TAPS has substantial Alaskan 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 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. 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 South-central 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.

NATIONAL VARIABLES

Since Alaska is an open economy, 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 TRENDCONG0678 forecast (DRI, 1978). 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 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.[1] 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 a framework far different from the past, the treatment of expenditures by state and local governments is a central feature of any development scenario.

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[1] 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.

Over the projection period, the state government is assumed to receive revenues from oil development which far exceed current levels of expenditures. The rate at which state government chooses to spend these revenues and the composition of these expenditures will serve to determine not only direct employment in the government sector but, through the multiplier effects of such expenditures, will have impacts on all endogenous sectors, affecting the growth of employment, income, and prices and influencing migration into the state.

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 elasticity on 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 while the level of capital expenditures could fall.

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 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 the supply-affected portion of growth were determined by examining the changes in the period 1970 to 1971 which was the last period of rising general fund balance. Based on examining changes in this period, elasticities on the weighted 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 can then be tested.

ECONOMIC GROWTH IN THE BASE CASE

This section will describe the base case to which Beaufort OCS activity will be compared. In this report, three sets of base cases will be discussed. These base cases will be similar in the assumptions described above. They will differ in assumptions about the level of OCS activity in Alaska in addition to the Beaufort sale. The first Lower Cook Inlet OCS sale took place in 1977; the level of activity in this sale may affect the impacts of OCS activity in the Beaufort Sea. To test this, Beaufort development will be examined in relation to three separate base cases. The base cases will include a high Lower Cook development scenario, a moderate Lower Cook development scenario, and a low Lower Cook scenario. The major discussion in this section will be on the base case associated with the moderate Lower Cook scenario.

The three scenarios are described in Table 1. An important assumption is that not all OCS workers impact the Alaskan economy equally. It is assumed that offshore workers have no impact on the Alaskan economy during exploration and that offshore construction workers have no impact on the Alaskan economy. This assumption is based on the special skills required for this work and the short duration of the work. Since offshore activity is outside the state's boundaries, enforcement of possible Alaskan hire provisions is impossible. After production starts, all workers impact the economy. The longer term of production work will be responsible for this differential impact.

TABLE 1. 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	|	1,139	0	60
1988	0	417	|	1,139	0	60
1989	|	417	|	|	|	60
1990	|	|	|	|	|	|
1991	|	|	|	|	|	|
1992	|	|	|	|	|	|
1993	|	|	|	|	|	|
1994	|	|	|	|	|	|
1995	|	|	|	|	|	|
1996	|	|	|	|	|	|
1997	|	|	|	|	|	|
1998	|	|	|	|	|	|
1999	|	|	|	|	|	|
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.

Causes of 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 define 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. The demand for state government services, as measured by expenditures, has been shown to be income elastic. 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. The effect of increases in the general fund balance on spending is assumed to depend upon the relative amount in the fund. A given increase in the fund balance will have a larger effect, the larger is the existing balance relative to existing expenditures. The final factor determining the state expenditure impact on employment is the wage rate of state employees. Once state personnel expenditures are determined, the wage rate determines the number of state employees.

Besides their direct effect, 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. This process is described by the multiplier.

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. Slow growth leads to out-migration and a reduction in the supply of labor, not a reduction in the relative wage differential. 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 import substitution. Growth by affecting the structure of the economy will 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 ecocnomic 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 economically determined, 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). Because of this, migration is a response to changing economic opportunities and will affect the proportion of the population under forty.

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. Wage rate increases throughout the state can result from rapid increases in construction employment in one 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 - Lower Cook Moderate Development Base Case Projections

THE STATE

The base case describes the general pattern of growth in the Alaskan economy without Beaufort OCS development. In the following section, the Lower Cook Moderate Development Base Case is examined in terms of the change in the magnitudes of economic variables, as well as the important structural changes which occur throughout the projection period. These structural changes indicate important changes in the process of growth.

Growth is a multidimensional process which cannot be described by any one indicator. The first three tables in this section describe three aggregate indicators of growth as well as important components of changes in each indicator.

Employment

Table 2 shows the base case growth of employment. Employment growth is responsible for much of the growth in population and personal income. Total employment (EM99) grows at an average rate of 3.0 percent per year between 1978 and 2000. Employment peaks at 237,797 in 1983, the final major year of ALCAN construction. Employment does not reach its 1983 level again until 1986. After 1983 employment grows at an average annual rate of 2.8 percent.

Table 2 also illustrates the changing structure of the Alaskan economy. This table shows the distribution of employment between three sectors of the Alaskan economy: the support sector (EMSP) which includes transportation-communications-utilities, trade, finance, and service employment; the government sector (EMG9); and the basic sector (EMNS) which includes mining, manufacturing, agriculture-forestry-fisheries, and construction. This separation of the basic and support sectors is not perfect. The support sector includes certain basic elements such as pipeline transportation, while the basic sector includes certain support sector construction employment.

TABLE 2. EMPLOYMENT GROWTH AND STRUCTURAL CHANGE
BEAUFORT EIS, BASE CASE
LOWER COOK INLET MODERATE SCENARIO

	EM99	EMSPP	EMG9P	EMNSP
1978	190.227	0.355	0.412	0.234
1979	195.599	0.366	0.398	0.236
1980	203.629	0.382	0.379	0.239
1981	216.872	0.392	0.365	0.243
1982	233.431	0.403	0.346	0.251
1983	237.797	0.403	0.351	0.246
1984	232.601	0.4	0.367	0.233
1985	234.583	0.406	0.358	0.236
1986	238.549	0.414	0.347	0.239
1987	246.151	0.422	0.34	0.238
1988	254.365	0.429	0.333	0.238
1989	263.697	0.436	0.327	0.237
1990	272.041	0.443	0.321	0.236
1991	277.827	0.448	0.318	0.234
1992	284.124	0.454	0.312	0.235
1993	290.93	0.461	0.305	0.235
1994	298.064	0.467	0.298	0.235
1995	306.861	0.475	0.29	0.235
1996	315.971	0.482	0.283	0.236
1997	326.908	0.489	0.275	0.236
1998	337.246	0.496	0.268	0.236
1999	349.393	0.503	0.261	0.236
2000	360.981	0.51	0.254	0.236

EM99 = total employment (thousands)
EMSPP = percent of total employment in transportation-communication-utilities, trade, finance, and service
EMG9P = percent of total employment in federal, state, and local government
EMNSP = percent of total employment in manufacturing, agriculture-forestry-fisheries, construction

The overall trend in these sectors follows that of the historical period. The support sector increases its importance during the projection period. It expands its share of employment from about 36 percent in 1978 to 51 percent by 2000. This growth is comparable with the employment distribution in other states and the trend in the base period. The expansion results primarily from the increase in the scale of the economy, which allows lower costs and the expansion of this sector through import substitution. The share of the government sector falls from about 41 percent in 1978 to 25 percent in 2000. This results because federal government employment does not grow. The growth of state and local government cannot keep pace with the growth in the remainder of the economy. The share of the nongovernment basic sector stays relatively constant throughout the projection period. In 1978 the share of the basic sector is 23.4 percent; in 2000 the share has increased slightly to 23.6 percent. The nongovernment basic sector grows faster during ALCAN construction when its share increases to 25 percent in 1982.

Population

The growth of population follows the growth in employment. Population and employment are linked because employment changes are an important determinant of migration. Population grows slightly slower than employment, indicating a decreasing dependency ratio. (The dependency ratio is the ratio of population to total employment.) Between 1978 and 2000, population grows at an average annual rate of 2.7 percent. Unlike employment, population does not experience a decline after completion of the ALCAN; population remains relatively stable, increasing by only 313

between 1983 and 1984. The growth of population, like employment, is faster prior to 1983, averaging 3.9 percent per year. After 1984 it grows at an average annual rate of 2.5 percent. In a small, rapidly growing region like Alaska, migration is an important component of population change. In the base case, there is out-migration in only three years of the projection period, each following the completion of a major construction project. (See Table 3.)

Personal Income

Personal income is also related to the growth of employment. Table 4 shows the growth of personal income. Wages and salaries are the most important part of personal income, so increases in employment lead to increases in personal income. The importance of high-wage pipeline construction employment to personal income can be seen by comparing the fall in personal income after 1983, 3.7 percent, with the 2.2 percent decrease in employment. Personal income grows at an average annual rate of 14.6 percent until employment on the gasline peaks in 1983. After that, it grows at a rate of 10.2 percent. Personal income is in nominal dollars, so increases include the effect of price increases.

Personal income is one measure of the benefits of growth; it is a measure of the command over goods and services. Its full effect is diminished by increases in prices and population. Table 5 shows the increase in Alaskan prices as measured by RPI. Prices increase at a rate of 4.9 percent per year over the period. Price increase plus population increase

TABLE 3. POPULATION GROWTH
BEAUFORT EIS, BASE CASE
LOWER COOK INLET MODERATE SCENARIO

	POP	MIGNET
1978	422.768	-2.863
1979	433.056	2.969
1980	447.479	7.07
1981	470.144	15.121
1982	498.753	20.569
1983	512.816	5.329
1984	513.129	-8.495
1985	520.431	-1.042
1986	529.915	1.296
1987	544.194	6.141
1988	559.594	7.117
1989	576.785	8.718
1990	593.007	7.494
1991	605.943	4.003
1992	619.34	4.392
1993	633.416	4.979
1994	648.041	5.409
1995	664.857	7.463
1996	682.329	7.901
1997	702.45	10.317
1998	722.155	9.575
1999	744.522	11.95
2000	766.513	11.202

POP = population (thousands)
MIGNET = net migration (thousands)

TABLE 4. INCOME GROWTH
BEAUFORT EIS, BASE CASE
LOWER COOK INLET MODERATE SCENARIO

	PI	PIRPC
1978	3509.98	3633.32
1979	3929.	3764.17
1980	4585.4	3960.57
1981	5390.94	4212.12
1982	6457.18	4520.21
1983	6932.58	4513.95
1984	6676.57	4263.4
1985	7071.61	4305.94
1986	7883.18	4425.48
1987	8806.87	4557.37
1988	9854.96	4700.75
1989	10952.2	4838.3
1990	12101.2	4963.66
1991	13105.7	5032.85
1992	14288.6	5137.21
1993	15675.8	5250.29
1994	17221.9	5370.55
1995	19010.1	5505.6
1996	21028.3	5648.64
1997	23312.3	5801.23
1998	25804.	5950.19
1999	28610.2	6107.16
2000	31695.4	6262.24

PI = personal income (millions of nominal dollars)
PIRPC = real per capita personal income

TABLE 5. RELATIVE PRICE INDEX
BEAUFORT EIS, BASE CASE
LOWER COOK INLET MODERATE SCENARIO

	RPI
1978	228.508
1979	241.028
1980	258.728
1981	272.22
1982	286.429
1983	299.483
1984	305.195
1985	315.564
1986	336.149
1987	355.103
1988	374.635
1989	392.46
1990	411.115
1991	429.751
1992	449.084
1993	471.365
1994	494.835
1995	519.342
1996	545.587
1997	572.074
1998	600.518
1999	629.23
2000	660.311

RPI = relative price index (1957 = 100)

reduce the average effect of increases in personal income; however, real per capita personal income still increases throughout the period. Real per capita personal income increases at an average rate of 2.5 percent per year. PIRPC falls after the peak ALCAN year, 1983.

The State Fiscal Position

State government contributes to economic growth by transforming exogenous petroleum revenues into expenditures which increase economic activity through increasing state employment and through increasing construction employment with state capital expenditures.

State Revenues. Table 6 shows the growth of state government revenues between 1978 and 2000. Total revenues are over $5.3 billion larger in 2000 than in 1978. Overall, these revenues increase at a rate of 8.7 percent per year. Prior to 1990, the rate of increase averages 12.9 percent per year, while this slows to 3.8 percent following 1990. This pattern of revenue increases follows the pattern of petroleum revenues received by the state.

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. Because of their importance, Prudhoe Bay production dominates these flows. Petroleum revenues increase until 1989, after which they decrease. The decrease

TABLE 6. STATE REVENUES
BEAUFORT EIS, BASE CASE
LOWER COOK INLET MODERATE SCENARIO

	REVGF	RP9S
1978	1013.44	450.1
1979	1336.4	795.3
1980	1579.45	1004.1
1981	1903.16	1253.8
1982	2275.1	1509.6
1983	2567.25	1678.3
1984	3150.18	2178.2
1985	3545.48	2472.6
1986	3695.75	2464.8
1987	3908.72	2496.6
1988	4118.08	2515.6
1989	4318.41	2518.6
1990	4346.76	2348.9
1991	4431.42	2253.1
1992	4600.38	2254.6
1993	4793.32	2268.
1994	4936.55	2216.8
1995	5075.93	2152.8
1996	5268.06	2127.5
1997	5487.71	2115.5
1998	5728.39	2108.4
1999	5994.31	2112.3
2000	6280.96	2114.1

REVGF = general fund revenues (millions of nominal dollars)
RP9S = total petroleum revenues (millions of nominal dollars)