Planning for a Resource-Rich Region: The Case of Alaska

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Development of the nation's natural resources, particularly its energy resources, has become a matter of increasing concern in recent years. One cause for concern is that such developments are frequently of large scale and can have major impacts on the region in which the resource is located. We report on a model which has been developed to estimate the regional economic impacts of resource development and, more specifically, evaluate regional policies designed to deal with these impacts. The model is used to analyze the situation confronting Alaska as its petroleum resources are developed to meet the nation's energy needs. The results obtained from the Alaska model are of direct interest because Alaska is such a prominent part of the overall *U.S.* energy picture. In addition, Alaska offers an excellent laboratory for a general analysis of the resource development process. Although the magnitudes of the development projects in Alaska are unusually large, this does not change the nature of the process; it merely makes the impacts easier to identify.

We give below a brief description of the structure of the Alaska model, along with a few summary statistics from historical situations. The model is then used to examine the implications of several major fiscal policy strategies available to the state. Finally, some tentative guidelines are offered for the design of effective policy strategies in regions experiencing major resource developments.

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I. An Alaska Model[1]

We have divided the regional economy into "export" and "residentiary" sectors. Production levels in the export sectors are specified exogenously, since output is constrained either by the availability of natural resources or by federal policy decisions.[2] Outputs in the residentiary industries are determined by Alaska incomes, prices, and other local demand conditions. Employment in each industry is calculated from a labor requirements function, or inverse production function. The Alaskan price level is determined jointly by *U.S.* consumer prices (almost all Alaska consumer goods are imported) and by local demand conditions. Alaska personal income consists chiefly of wages and salaries (sector wage rates are functions of *U.S.* wages and local conditions). Subtracting federal and state income taxes, as determined by the fiscal model, and deflating by the Alaska price level produces an estimate of real disposable personal income, which is the key variable determining the outputs of the nonexport industries.

In terms of its general structure, our model is similar to the regional model archetype presented by Norman Glickman. The population and fiscal submodels, however, go well beyond most regional model specifications. In the population

[1]A complete description of the model structure is given in Kresge et al. The data sources are described in Kresge (1974a, b).

[2]The principal export sectors are: petroleum; agriculture, forestry, and fisheries; fish processing; wood and paper products; and the federal government.

model, for example, the amount of civilian net migration to the state is determined endogenously as a function of Alaska employment growth and income in Alaska relative to the United States as a whole.[3] Thus rapid employment growth attracts substantial migrants, particularly if the new jobs pay high wages (for example, oil pipeline construction). This relationship is quite strong over the historical period, and has been reconfirmed by the experience during the pipeline construction period 1974–76. Migration flows keep Alaskan incomes from diverging excessively from *U.S.* levels.[4] The demographic model incorporates an age-sex-race distribution of the state's population, which when combined with a set of (exogenous) age-sex-race-specific fertility and mortality rates, and a standard aging process determines the natural increase of the population.

The Alaska model has a detailed fiscal sector in which each major source of revenue is estimated as a function of the tax structure and the relevant measure of economic activity.[5] Government expenditures are modeled by functional category, each of which has an associated employment intensity. The level of total state government expenditures is a key policy variable which is specified by the policy alternative being analyzed. Local government revenues are also modeled by major source. State revenue sharing, a key component of local revenues, is explicitly incorporated. Total local government expenditures are assumed to be equal to revenues.

The seventy-five stochastic equations in the model have been estimated using ordinary least squares (*OLS*) with annual data for the period 1961–74.[6] Using the true values of exogenous and policy variables, the model was simulated over the 1964–74 period, which was characterized by relatively steady economic growth culminating in a full-scale boom resulting from oil pipeline construction. The mean absolute percent errors (*MAPE*) of the key endogenous aggregates for this period are presented in Table 1. Although there are no official standards to judge the model's historical accuracy, these *MAPE* statistics are not greatly different from those reported for other regional models.[7] This model has been used to generate the policy simulations which are discussed below.

TABLE 1—MEAN ABSOLUTE PERCENT ERROR (*MAPE*) STATISTICS—ALASKA MODEL

Variable	*MAPE*
State revenues	1.05
Gross output	2.35
Total employment	2.49
Personal income	2.82
Population	3.63

II. Fiscal Policy Strategies

There is little question that the future growth of the Alaska economy will be dictated largely by the rate of development of Alaska's petroleum resources.[8] Within this general setting, however, the state has a wide range of policy options that it can use to influence the pattern and, to some extent, the pace of economic expansion. Perhaps the single most important decision confronting the state of Alaska concerns the extent to which revenues derived from nonrenewable resource development are

[3]The precise income variable is the lagged ratio of real per capita disposable personal income in Alaska to the equivalent *U.S.* measure. Net migration is allocated to age-sex groups based on 1970 Census patterns. For additional detail, see Seiver.

[4]Alaska real wages can remain above *U.S.* real wages indefinitely, given migration costs, imperfect and costly information, and certain Alaska climatic disamenities.

[5]For additional detail, see Goldsmith.

[6]Data availability occasionally reduced the sample period to 1964–74. Two-stage least squares with principal components (*TSLSPC*) was also tried, producing results quite similar to *OLS*.

[7]See Glickman, pp. 164–65.

[8]Our basic petroleum development scenario (including a constant real price of oil) relies heavily on the Federal Energy Administration. The effects of alternative assumptions, such as a falling real price of oil, and more rapid petroleum development are discussed in Kresge et al.

TABLE 2—SELECTED SIMULATION RESULTS: ALASKA MODEL

		Population (000's)	Employment (000's)	Real Disposable Personal Income (1967 $ billions)	State Expenditures ($ billions)	State Accumulated Surplus ($ billions)
	1975	405	199	1.24	0.78	0.38
Case 1: 25 Percent	1980	487	239	1.66	2.19	.87
Savings Rate	1985	576	277	2.06	4.23	2.18
	1990	633	300	2.41	4.57	3.75
Case 2: 50 Percent	1980	479	234	1.63	2.04	1.38
Savings Rate nondeclining	1985	564	271	2.02	4.01	4.00
real per capita expenditures	1990	659	321	2.59	5.58	4.85
Case 3: 6 Percent	1980	455	218	1.51	1.51	2.53
Growth in real per	1985	495	232	1.72	2.54	12.32
capita expenditures	1990	619	310	2.49	5.22	21.42
Case 4: 8 Percent	1980	460	221	1.54	1.61	2.35
Growth in real per	1985	520	248	1.84	3.15	10.26
capita expenditures	1990	718	373	3.00	8.08	10.19
Case 5: 50 Percent	1980	487	239	1.69	2.08	1.16
Reduction in	1985	582	280	2.11	4.17	2.73
personal income tax	1990	690	336	2.74	5.91	1.29

set aside for use when the resource is exhausted. Alaskans have already voted to divert a minimum of 25 percent of oil royalties into a permanent fund, the principal of which cannot be spent on current account.

When the Alaska model is used to simulate the effect of a 25 percent savings policy, the economy is projected to grow throughout the entire period to 1990 but the growth is very unsteady (Case 1). Employment, for example, increases at 5.2 percent per year from 1978–85, but only 1.6 percent per year for 1985–90.[9] By holding to a fixed savings rate, the state discards the possibility of using fiscal policy to stabilize Alaska's long-run growth path. The level of operations in the petroleum industry would be the primary determinant of economic activity in Alaska. In fact, this type of passive state fiscal policy, by causing state spending to move in tandem with petroleum activity, will actually accentuate the fluctuations caused by varying rates of petroleum development.

A fixed savings policy, in addition to increasing the magnitude of economic fluctuations, becomes untenable by the late 1980's. State revenues level off and then begin declining after 1985 as production from Prudhoe Bay passes its peak. With revenues declining and with a fixed savings rate, state spending falls, and real state spending per capita drops by 15 percent between 1985 and 1990. The implied drop in the level of government services being provided to Alaska residents is likely to make this policy politically infeasible, as well as economically imprudent.

To avoid some of the problems associated with a fixed savings rate, the state could set aside more in earlier years in order to have funds available to sustain spending in later years. To simulate the effects of this type of policy, it is assumed that 50 percent of royalties are saved during those years when it is possible to do so without having to cut back on real state spending per capita (Case 2). In later years, when petroleum revenues begin to decline, the savings rate is gradually reduced in

[9]Selected simulation results are presented in Table 2. Users of large scale simulation models are often buried by reams of "output" and some economists consider this a fitting punishment. Others may wish to see more, and are referred to Kresge et al.

order to keep real state spending per capita from declining.

With this policy, higher levels of state spending are supported in the later years by the earnings on the permanent fund, which reaches more than $5 billion compared to $3 billion with a 25 percent savings rate. By saving a larger proportion of petroleum earnings in the early years, the state converts a temporary surge in revenues into a continuing income stream. This has the effect of moderating the employment growth rate in the 1978–85 period and producing much stronger growth of 3.5 percent a year from the period 1985–90. This is clearly a much less erratic growth path than that achieved under a 25 percent savings rate.

While the 50 percent savings rate damps some of the more extreme fluctuations, it does not lead to the accumulation of sufficient balances to completely eliminate the problems caused by "boom-bust" resource developments. By 1985, the savings rate has begun to fall below 50 percent in order to sustain public services, and by the end of the period, the state will be confronted with the uncomfortable prospect of having to cut back on public services, raise taxes, or draw down the balances accumulated in the "permanent" fund. Thus the savings-expenditure policy considered here cannot be maintained indefinitely, though it is much more viable than the fixed 25 percent savings rate.

Under either of the fiscal policy options considered thus far, spending patterns in the years immediately after the completion of the trans-Alaska oil pipeline set the stage for the state's eventual fiscal difficulties. Because of the tremendous surge of state petroleum revenues (from $0.5 billion in 1977 to $1.4 billion in 1980, and $2.8 billion in 1983), and even with a 50 percent savings rate, real per capita state expenditures are projected to more than double between 1977 and 1983. With production from Prudhoe Bay, and hence state revenues, expected to start declining in the mid-1980's, the increase in spending is simply not sustainable in the long-run. Perhaps even more importantly, the surge in state spending accelerates the pace of economic activity and attracts more people into the state. The model projects an increase of 75,000 in Alaska's population between 1977 and 1980, two-thirds of which is induced interstate migration.

A larger population combined with a higher level of per capita spending could drive state expenditures so far above current revenues that the entire "permanent" fund could be exhausted in just a few years. One way of dealing with this problem would be to undertake severe austerity programs in the late 1980's by curtailing public services, cutting government employment, and raising taxes. An alternative approach would be to deal with the initial source of the problem, namely, the surge in state spending in the late 1970's. If state spending were to grow steadily instead of following the fluctuations in petroleum revenues, this would help stabilize the economy and would also allow the state to accumulate a much larger fund to support the long-run demands for public services. Since some of the accumulated surplus would be used in later years to sustain long-run growth, this fund might more appropriately be termed a state growth fund rather than a permanent fund.

Two simulations (Cases 3 and 4) were carried out using a policy of steady growth in real state expenditures per capita; alternative growth rates of 6 and 8 percent a year were used. With either growth rate, the Alaska economy seems to end up in a stronger position, whether viewed in the aggregate or on a per capita basis. The overall growth rate is more stable, being lower in the earlier years and faster later on, and the employment rate is consistently higher. On a per capita basis, real disposable personal income in 1990 is $130–$250 higher (in 1967 prices) and real state spending is as much as $570 higher per person, depending on the growth rate used.

Another important effect of the steady expenditure growth policy is a much stronger state fiscal position. The balances accumulated in the state growth fund would

reach $10 billion with an 8 percent spending growth rate and more than $20 billion with 6 percent growth. In the previous case, it should be recalled these balances reached only $5 billion. By the late 1980's, it is likely that petroleum developments will no longer be driving the Alaska economy at such a rapid pace. At that time, the very large balances accumulated during the high growth years will leave the state government in a position to guide the economy onto a slower but more sustainable growth path.

It has been frequently suggested that some of the petroleum revenues be used to reduce state taxes. To examine the impact of this policy option, another policy simulation was run in which personal taxes were cut by 50 percent (Case 5). The direct cost of such a tax cut is $50 million in 1978, rising to $150 million by 1990. However, the tax cut also has indirect effects which accumulate over time and within a few years become significantly larger than the direct effects. The increase in economic activity induced by the tax cuts creates additional jobs, and this, together with the relative increase in disposable personal income, attracts additional migrants to Alaska. State spending then has to be increased to meet the needs of the larger population (it is assumed that the tax cut is not accompanied by a reduction in the average level of public services being provided).

With lower taxes and higher spending, the state is not able to accumulate trust fund balances nearly as rapidly as before. In fact, the growth fund at its maximum is less than half as large as the fund achieved in the absence of a tax cut. The interest earnings on the funds are cut by more than $200 million a year. The total cost to the state treasury (a total comprised of the direct tax cut, the loss of interest income, and the increase in spending) reaches $600 million a year by the end of the projection period. The cost is thus three to four times as large as the tax cut alone. Furthermore, because the potential gains tend to be dissipated by the increases in population, the increase in real disposable personal income per capita in 1990 is only $30, a gain of seven-tenths of 1 percent. Clearly, reducing income taxes is not an effective way of increasing the economic well-being of the average Alaskan.

III. Conclusions

There are several important policy conclusions derived from the Alaska model which seem to be generally applicable to a region involved in a resource development process. These conclusions are robust with respect to changes in the underlying assumptions concerning the magnitude of the development projects, and thus, seem to reflect the general nature of the process rather than the specifics of the Alaska situation:

Surges in state and local spending during development boom periods accentuate fluctuations in the regional economy and eventually lead to fiscal difficulties. When the pace of development subsides, the governments will have to cut back on public services, raise taxes, or draw heavily on their accumulated surpluses (if any). The problems will be particularly severe if the resource is exhaustible since, in that case, the resource activity will not merely level off but will decline.

An effective policy strategy to achieve a sustainable growth path would be to have state and local government expenditures grow at a steady rate based on long-run projections of revenues. When revenues grow at above average rates, the state government should accumulate surpluses that will be used in later years to support long-run growth.

Reducing personal income taxes is not an effective way of using revenues from resource developments to increase individual economic well-being. Induced migration quickly dissipates the gains in disposable personal income per capita. The increase in population also requires additional state spending and the total drain on the state treasury is several times as large as the tax cut alone.

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