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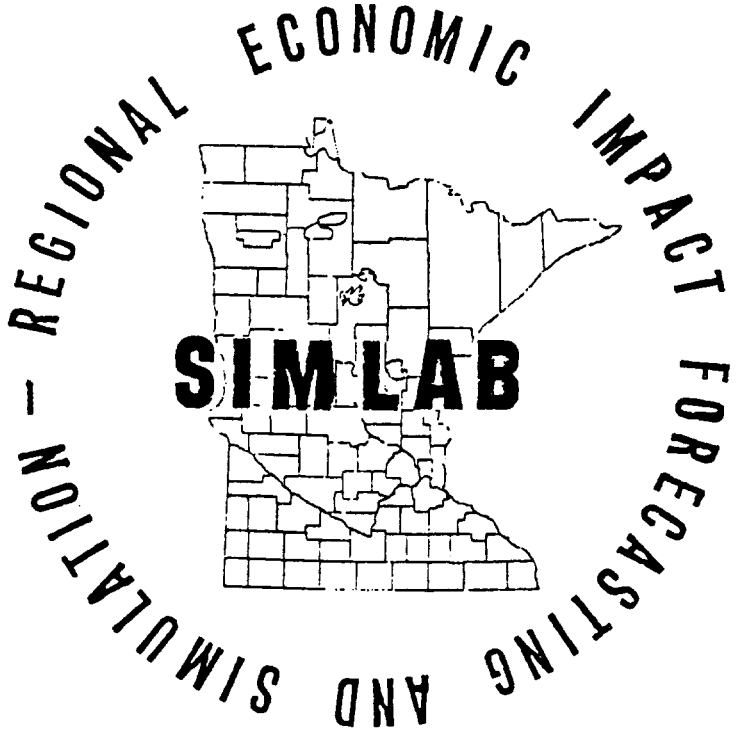

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TRACKING THE GOVERNMENT SECTOR IN A NATURAL RESOURCE-BASED ECONOMY

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Abstract

In this paper, we describe the modeling of a resource-dependent economy, namely, Southeast Alaska, in monitoring the impact of federal, state and local government taxing and spending activities on the region. An important part of the modeling effort is construction of a readily accessible regional database for estimating critical economic relationships and variables that provide a baseline forecast series for the region. The Alaska Interactive Policy Analysis Simulation System (IPASS) makes use of the database in assessing the economic impacts of alternative resource management policies on state and local governments. IPASS is a computer-based, user-interactive economic forecasting and simulation system. The basic system is divided into eight modules: investment; final demand; production; regional export; population; labor force; employment; and primary inputs with government being the ninth module. It provides the quantitative framework for measuring and monitoring changes in regional economic activity and, also, for differentiating among the causal factors accounting for these changes. The individual modules form the IPASS shell that makes possible assessment of the effects of specific government activity on each industry and sector in the region's economy and, in turn, the effects of specific industry activity on each level and function of government.

Introduction

Most interindustry analyses treat public financing as an exogenous activity. Tax and other revenue payments to governmental agencies are included among primary inputs, while receipts from the sale of goods and services to government agencies are part of final demand.

Traditional treatment of the government sector is based on the view that its activities are not critically influenced by shortrun market activity but rather by non-market, negotiational processes. In much of western USA, however, the federal government engages in "market" activities. Substantial revenues are received by the U.S. Forest Service, for instance, from the sale of timber and user fees are collected from tourists, sportsmen and ranchers. A portion of these receipts is returned to local governments as payments in lieu of taxes (PILT). Direct federal investment in rural infrastructure is still another contributor to local economies, particularly in the construction of a network of forest access roads and interstate highways. Nor is the Forest Service alone in contributing to the productive capacity of local areas. The U.S. Bureau of Land Management also engages in forest and rangeland improvements, including road construction and land rehabilitation projects. Last, but not least, state and local governments are the principal, if not the sole, providers of essential public services, including education, that create a favorable public environment for private enterprise.

In this paper, we describe the modeling of a natural resource-based economy for the purpose of tracking the regional impact of federal, state and local government activities. An important part of the modeling effort is construction of a readily accessible regional database for estimating critical

economic relationships and variables that provide a baseline series for evaluating the performance of a region's industries and sectors of its economy. For this purpose, we have selected Southeast Alaska, which is dominated by the government sector and especially Juneau--its capital city.

Regional Economic Environment

The overall Alaska economy has several unique features. Alaska's most important industry in the private sector is oil and gas. Although less than 9,000 people were directly employed in this industry in 1984, it was the major driving force in Alaska government expenditures. State and local government as well as the construction industry benefited directly from the vastly increased public and private revenues generated by oil and gas production. In 1984, oil and gas revenues accounted for more than 10 percent of total state and local government income.

Government is the state's largest employer. Since 1977, large increases in revenues from oil royalty payments began a new chapter in Alaska's history. State government was able to increase its operating budget and undewrite large capital project grants, mortgage subsidies, growth dividend payments and tax relief. However, the recent collapse of worldwide oil prices and resulting reduction of public revenues and expenditures created an unfavorable economic outlook for Alaska's economy and subsequently employment fell sharply in virtually all industries.

In modeling the Southeast Alaska economy, the State of Alaska is viewed as a principal decision making entity, albeit a fragmented one, with many decision centers among its numerous agencies. The preparation of the Southeast Alaska database for tracking the regional impact government activities thus entailed three important tasks, starting with the preparation of the statistical series for monitoring regional economic growth and change.

The second task includes the identification of factors accounting for changing markets and policies affecting the regional economy. The third task--assessing the implications of these changes on individual industries and sectors in the region--is a continuing responsibility of the economic analysis and forecasting functions of state government.

Analytical Framework

The Alaska Interactive Policy Analysis Simulation System (Alaska IPASS) provides the basic technical formulation for assessing the regional economic effects of the government sector (Olson, et al, (4)). The IPASS is formulated around the conventional Leontief input-output tables. The IPASS computer program complements the use of the IMPLAN (Impact Analysis for Planning) system by providing a "shell" for managing a recursively interactive set of modules that track the growth and development of a regional economy through changes in capital investment, output per worker, population, employment and other economic and demographic variables. Because the internal structure of IPASS is not as comprehensive nor as complex as a full-fledged regional forecasting and simulation system, the IPASS shell is readily expanded. New modules can be introduced and operated interactively with the input-output and other core modules.

Data Base

The IMPLAN System, now maintained by the Forest Service Land Management Planning Systems Section at the USDA Computer Center in Ft. Collins, Colorado, provides the essential data base for constructing county, multi-county and state input-output tables for the base year 1982 (Palmer et al, (5)). The 528-industry use and make tables and, also, domestic trade matrices and foreign trade vectors are typically aggregated into a small number of sectors for regional analysis purposes. This data base also provides domestic export

and domestic export and import matrices for each region. With the use of the University of Maryland INFORUM international data base, the foreign export matrices are derived for selected countries and commodities.

The IMPLAN database is being updated to 1985 using 1985 U.S. commodity deflators to adjust the 1982 tables to 1985 prices. The adjusted 1982 production functions and 1985 final purchases and value added series in the U.S. National Income and Product Accounts are used subsequently to derive the 1985 U.S. IMPLAN tables. Individual county and state input-output tables are derived, once the county final purchases and industry/commodity output series are available. The new IMPLAN data base thus yields elements of the production, final demand, export market, value added, and employment modules in the IPASS data base.

Choice of Model

The IMPLAN-IPASS system is not the only one available for modeling the government sector. At least three other systems are available or can be adapted to this purpose. These include (1) the quarterly state economic models developed by DRI (Data Resources, Incorporated) and others for use in revenue forecasting, (2) the yearly economic models based on the U.S. Department of Commerce REIS (Regional Economic Information System) data series, and (3) the large-scale state economic model developed by George Treyz and Associates at REMI (Regional Economic Models Incorporated) for use in state-level industry location and impact analyses (Trez, (6)). Each of the modeling systems requires much additional work to incorporate a government sector with the degree of disaggregation that is possible by using the IPASS "shell" to

make this additional extension an integral part of the overall modeling system.

Choice of model in assessing the impact of regional and external market

events on government income and of government spending on other sectors of the regional economy depends in part on the modeling objectives. It depends also on data access and availability. To assess the comparative advantages of automobile manufacturing in several specified locations by using the IPASS sytem rather than the REMI system is second best just as the use of a more comprehensive, but cumbersome model than the IPASS "shell" is second best. Also, lack of database severely restricts model choice. In some situations, the model user may settle for REIS-based system to drive an extended government sector module for a special study.

Model Components

The Government Module, with its Tax Model and Budget Model that relate three levels of governmental activity to the intersectoral transactions of businesses, households, and government, augments the core IPASS modules that form the IPASS "shell", (Fig 1). This extension makes possible a systematic evaluation of the effects of regional economic change on the government sector and, in turn, of change in the government sector on other sectors of the regional economy without any change in the remaining system modules (Maki, et al, (2)).

The IPASS is divided into eight main modules: investment; final demands; production; regional exports; population; labor force; employment; and primary inputs (Olson et al, (4)). The government sectors are represented as the ninth module. It thus provides a quantitative framework and a related database for measuring and monitoring changes in economic activity in Southeast Alaska and then differentiating among the causal factors accounting for these changes.

The individual modules, including a new water resource module, make possible the assessment of the effects of government activity in natural resources

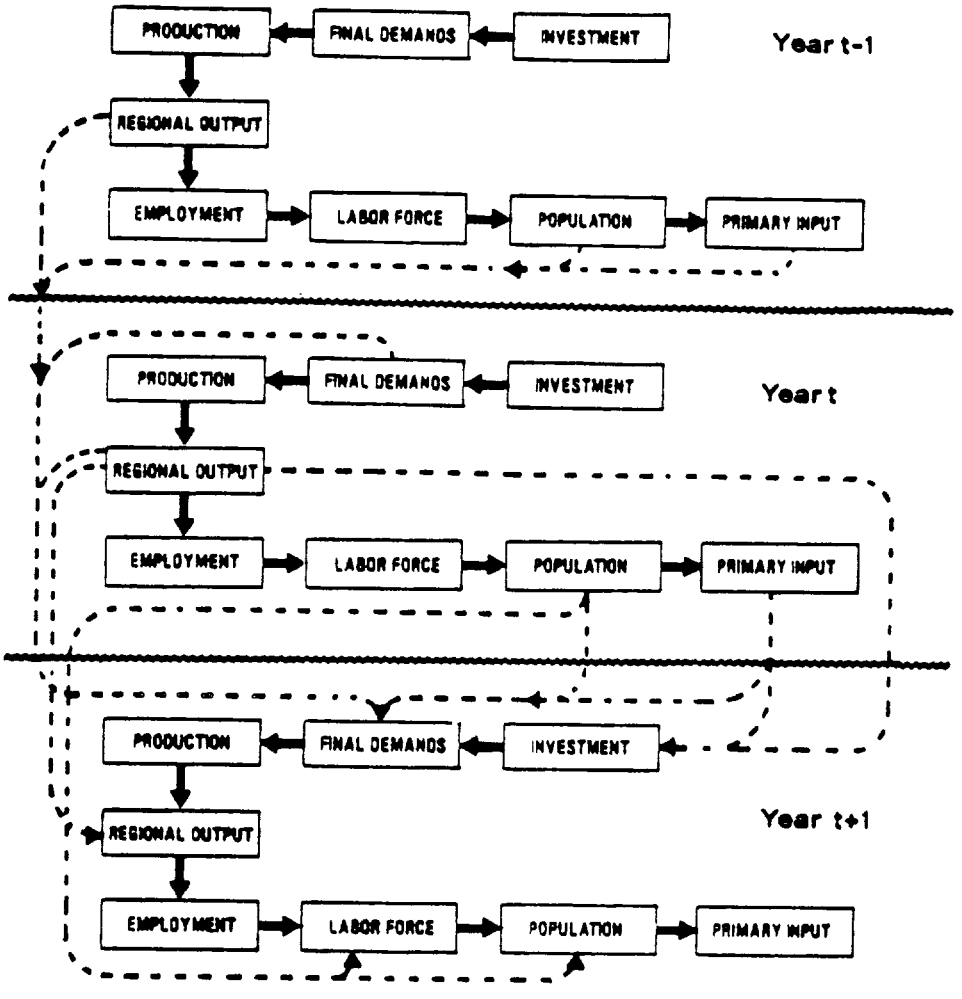

FIGURE 1. IPASS is a dynamic, recursive system. Estimates for the current year t are influenced by transactions from previous years and the preceding steps in the current year. For example, the level of investment for year t is a function of regional output and primary input for year t-1.

development on individual industries and sectors in a region's economy.

The production module, which is derived from the ordinary input-output model, is represented in Alaska IPASS as the Leontief inverse. The remaining modules interact recursively with the production module to provide a dynamic regional computer simulation of the changing course of regional economic growth and development as a result of changing market conditions and government policies.

Final demand requirements for regional industry output, which are subject to capital and labor capacity constraints, determine the potential economic activity of the region as does the investment module. The latter determines whether to replace and/or increase the capital stock of each specified industry and the level of investment for each industrial sector. The capital stock is adjusted to investment made in current year.

The population module calculates population of a region by age and gender. Net migration (affected by the excess employment in each occupation), birth and death rates affect the level and composition of population of the region in the next year.

Industry employment requirements are derived from the industry outputs that meet final demands. The occupationally-differentiated labor force available to satisfy that demand is then calculated, based on the resident population. Thus, the output is constrained by available skills. On the other hand, unemployment is calculated as the difference between labor available and the actual employment by occupation that is affected, in turn, by the staffing requirements of individual industries.

Finally, the government module links government revenues of one year to government expeditures of the next year. Each year the scheduled expenditures are reconciled with actual revenues. While revenues are forecast within a

prescribed range of confidence, budgeted expenditures are based on a single-valued estimate of general fund and dedicated revenues.

Estimates of the current year are affected by economic activity and population characteristic of the previous year and other current year events. Each IPASS module imposes certain constraints on production, product disbursements, and income payments while also being available to introduce additional primary inputs into the regional economy.

In the remaining section of this paper we concentrate on a discussion of the new government module by focusing on its purpose and application. Since most econometric models used in regional impact assessments ignore the simultaneous interactions between the private and the government sector, we view the detailed make-up of the government sector as a principal difference between IPASS and other regional models.

The recursive nature of the government module is illustrated by its local government component in a simplified flow chart (Figure 2). Local governments provide for the delivery of particular services that require expenditures of their revenues for the purchase of goods and services produced locally or imported from other regions.

Construction of local government facilities imposes an additional tax burden insofar as the targeted expenditures exceed available current revenues. Debt financing arrangements are included therefore that make possible the exercise of alternate decision rules within local government fiscal constraints.

The Tax Model

In the government module, both revenues and expenditures of each of the three levels of government--federal, state, and local--are calculated. This module links government revenues of one year to government expenditures of the

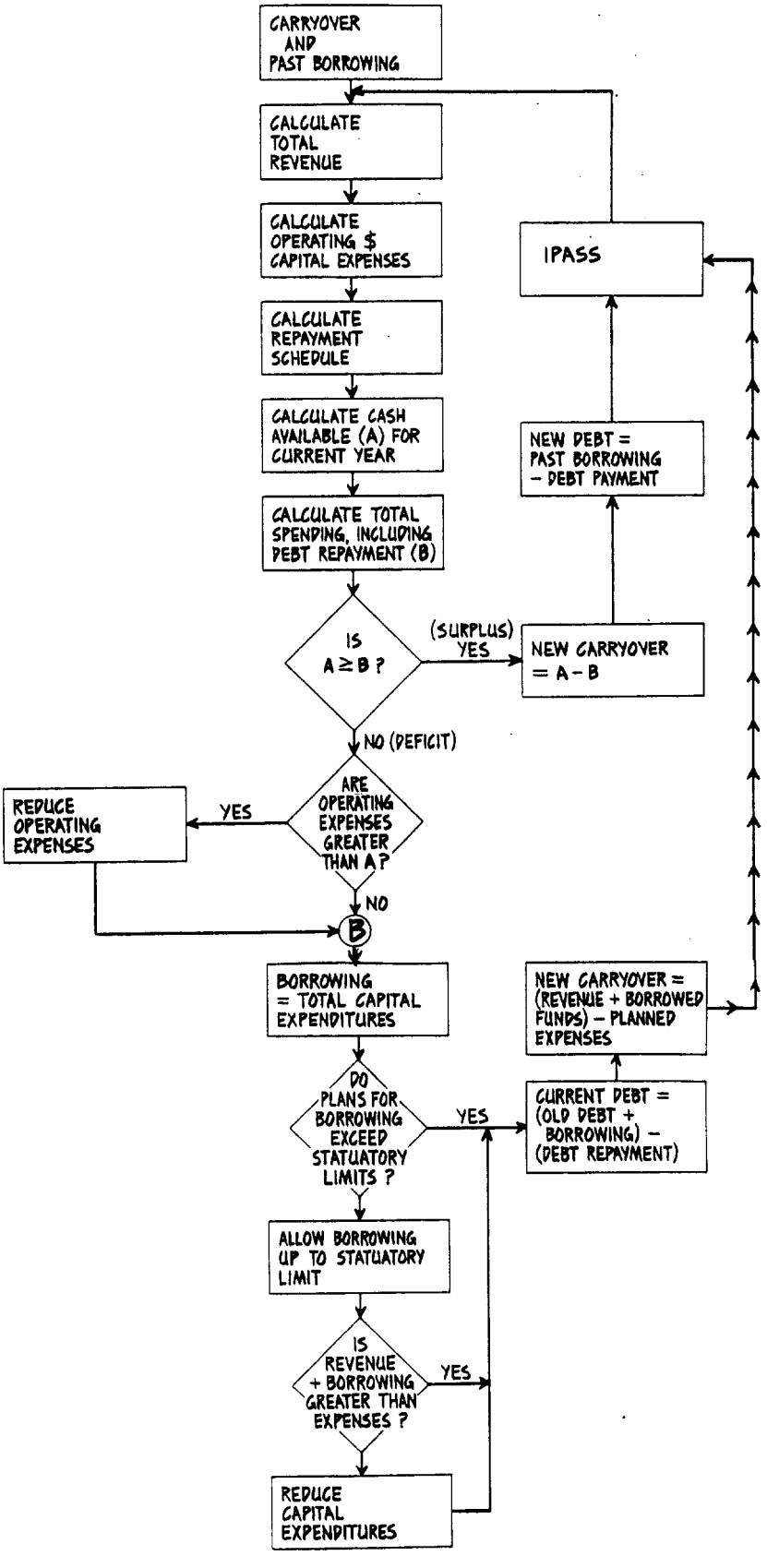

FIGURE 2. Flowchart of local government sector in Government Module of IPASS

next year. This linkage is achieved by means of the revenue forecast which is derived on an annual basis. In this paper, the essential elements of this system are represented for 1982--the current base year of the study--and the earlier base year 1977.

Regional economic and fiscal effects of federal government operations originate from both federal revenues collected and federal expenditures--purchases, payments to individuals and state and local governments. Revenues reduce the disposable income of residents of a region. Private sector income is directed, in part, to the federal government as tax payments which in turn reduces the private sector expenditure impacts. On the other hand, federal government expenditures increase total earnings and other income of the regional economy, both directly and indirectly.

Total revenues collected by the federal government in Southeast Alaska exceeded $137 million in 1977 and $258 million in 1982 (Table 1). Personal income taxes and social security taxes accounted for $89 million or 73 percent of the $122 million federal revenue, increase over the 1977-82 period. Other federal revenues accounted for 14 percent of this increase.

The federal government component of the government module, like other government components, links each type of revenue to its revenue source, namely industry output and value added. The revenue source is represented as the revenue base to which a particular revenue rate is applied. For example, the personal income tax is estimated in the federal revenue block by the form,

$$PINCTF(t) = a_{21} * (earn\ (t),\ fd(t))$$

where a_{21} is a vector of pre-specified parameters representing the tax liability incurred by household earnings from each industry affected by federal income tax laws.

Table 1. Federal, state, and local government revenues of specified class, Southeast Alaska, 1977 and 1982.

Revenue class	1977				1982			
	Federal	State	Local	Total	Federal	State	Local	Total
	($1000)	($1000)	($1000)	($1000)	($1000)	($1000)	($1000)	($1000)
Personal income taxes	57750	27742	0	85492	111000	196	0	111196
Corporate income taxes	20860	4723	0	25583	23127	92832	0	115959
Motor fuel taxes	1569	2718	0	4287	1824	4101	0	5925
Property taxes	0	0	13992	13992	0	0	9406	9406
Other taxes	0	7287	6474	13761	0	3674	14926	18600
Federal-to-state transfers	0	33535	0	33535	0	44810	0	44810
Federal-to-local transfers	0	0	7557	7557	0	0	16439	16439
Local-to-state payments	0	40	0	40	0	190	0	190
Local-to-local transfers	0	0	7278	7278	0	0	9570	9570
State-to-local transfers	0	0	35700	35700	0	0	84069	84069
Fees, charges, and misc. re	0	9669	7492	17161	0	31957	16292	48249
Real interest earnings	0	8047	1399	9446	0	123018	15800	138818
Natural resouce sales	9861	0	0	9861	20619	0	0	20619
Social security taxes	33190	0	0	33190	69149	0	0	69149
Fed. ret. fund contrib.	2082	0	0	2082	3838	0	0	3838
Other revenues	11711	0	1809	13520	29200	0	7431	36631
Total revenues	137023	93761	81701	312485	258757	300779	173933	733469
Borrowing	0	18998	1744	20742	0	181610	4629	186239

An important fact about Alaska economy in general and Southeast Alaska in particular is revealed in the data, namely, that in fiscal year 1977 the mineral production taxes accounted for only seven percent of the state government revenue in Southeast Alaska. In 1982 the same revenue source contributed more than 60 percent of the total contribution to state government revenue in the region. On the other hand, other state taxes lost their share as a major source of state government revenues--50 percent in 1977 to less than four percent in 1982. Other state taxes refers to all taxes except Mineral Production Taxes. However, the recent downard slide in oil price may require revenue sources to resume their previous importance in the Alaska economy.

The state government block links each type of revenue to its revenue source, either primary input and industry output. For example, corporate income tax is estimated in revenue block from other value added with the form,

$$cincts(t) = b_{31} * ova(t)$$

for each industry. Major categories of revenue sources include federal-to-state transfers, fees, charges and miscellaneous revenues that impact upon households, businesses, and state and local government.

Local government revenues are confined largely to five sources--state government, federal government (including payments in lieu of taxes, PILT, mainly associated with timber sales from National Forests), and local property taxes, sales taxes, and fees/charges. Property taxes "top" the list as being the most important local revenue source.

For the reader unfamiliar with the types of local government found in Alaska, a few words of explanation are in order. The Alaskan counterpart to county government is the "borough." It should also be noted that borough (including city-borough) governments often provide urban services such as

sewage, roads, and fire protection under contract with "service areas" (many of which are unincorporated settlements) within their boundaries. These services may be supported by the income derived from property taxes, special assessments, intergovernmental grants and user fees from revenue sources within the service area. Service area functions are treated in IPASS simply as part of the operations of the borough which provides the services.

A final unusual feature of local government in Alaska is the way that school districts are organized. In the more sparsely-populated areas, some groups of local schools are not operated by local school districts at all, but by the state of Alaska. Although the REAAs are organizationally and financially part of state government operations, the IPASS government sector treats them as though they were in fact local school districts.

The Budget Model

The budget model serves the budget officer of state government by assisting in the reconcilation of proposed expenditures with expected revenues. For initial modeling purposes, a simple decision rule is specified that allocates changes in revenue sources to corresponding changes in expenditure classes (Johnson, (1)). The historical bases for the expenditure allocations are represented in the tabular summaries of federal, state and local current and capital expenditures in Southeast Alaska in 1977 and 1982.

All government expenditures are broken down into two main categories--current and capital. Federal current outlays cover the cost of goods and services consumed by the federal government sector while capital outlays are largely for federal facility construction (Table 2). Federal government expenditures are related to industry gross output and total personal income and population.

A primary impact group is associated with each expenditure class, which in

Table 2. Federal, state, and local government expenditures in specified class, Southeast Alaska, 1977 and 1982.

Expenditure class	1977				1982			
	Federal	State	Local	Total	Federal	State	Local	Total
A. Current:	($1000)	($1000)	($1000)	($1000)	($1000)	($1000)	($1000)	($1000)
Military	11365	0	0	11365	5024	0	0	5024
Education	0	60573	35017	95590	0	140241	51732	191973
Health and human services	30684	35553	2318	68555	99681	114315	932	214928
Transportation	22027	20777	2253	45057	37032	67416	4922	109370
Recreation/natural resources	15862	20978	1391	38231	120879	152424	2759	276062
Other administrative government	32279	58112	11353	101744	138377	142242	27677	308296
Total direct expenditures	112217	195993	52332	360542	400993	605053	88022	1094068
Federal-to-state transfers.	30535	0	0	30535	97864	0	0	97864
Federal P.I.L.T.	909	0	0	909	1685	0	0	1685
Other federal-to-local transfers	3387	0	0	3387	5335	0	0	5335
State-to-local transfers	0	32469	0	32469	0	137096	0	137096
Local-to-local transfers	0	0	5020	5020	0	0	11266	11266
Transfers to individuals	0	1800	0	1800	0	1871	0	1871
Social security payments	8586	0	0	8586	32997	0	0	32997
Federal retirement fund disburseme	6757	0	0	6757	3346	0	0	3346
Other transfers	5924	0	1025	6949	2934	0	2647	5581
Principal payments	0	2660	3350	6010	0	4797	5683	10480
Interest expense	0	7585	2437	10022	0	37521	10665	48186
Total current expenditures	168315	240507	64164	472986	545154	786338	118283	1449775
B. Capital:								
Military	2385	0	0	2385	1242	0	0	1242
Education	0	7755	2004	9759	0	15327	13308	28635
Health and human services	855	635	0	1490	6464	565	6875	13904
Transportation	4618	48479	2509	55606	7763	56305	3392	67460
Recreation/natural resources	6062	3494	304	9860	46196	2293	2589	51078
Other administrative government	425	21574	5620	27619	17278	52807	8405	78490
Government enterprise agencies	9	2500	0	2509	11	5423	0	5434
Total direct expenditures	14354	84437	10437	109228	78954	132720	34569	246243
Federal-to-state transfers.	3000	0	0	3000	9800	0	0	9800
Other transfers	700	0	5134	5834	0	0	14438	14438
Total capital expenditures	18054	84437	15571	118062	88754	132720	49007	270481
Total expenditures	186369	324944	79735	591048	633908	919058	167290	1720256

turn, is linked to IPASS through local purchases of goods and services specified by the Final Demand Module. Federal government expenditures in a region are formulated here as a function of the previous year's level of expenditures. For example, federal current military expenditures in a region are presented as:

$$MCEF(t+1) = d_{11} * MCEF(t),$$

where d_{11} is a pre-specified coefficient that shows the expected expenditure next year as a proportion of the actual expenditure in the current year.

The linkage between federal revenues and federal expenditures in a region is not necessarily one-to-one. In 1977, for example, the total federal revenues in Southeast Alaska were $49 million less than total federal expenditures. Of the $186 million expenditures by federal government, about eight percent was for direct capital expenditures while 50 percent was for direct current expenditures and 32 percent was an direct expenditure, i.e., federal-to-state and federal-to-local transfers. By 1982, federal expenditure had increased by 24 percent and shifted towards more capital expenditures in recreation an natural resource functions. Federal expenditures exceeded federal revenues in Southeast Alaska by $149 million in 1977 and $375 million in 1982. Location of the U.S. Coast Guard, and numerous other federal agency offices accounts for the large "reverse flow" of federal tax dollars between Alaska and Washington, D.C.

Regional assessments of the private sector impact of state and local government revenues and expenditures are prepared from the alternate IPASS simulations. Again, the linkage between state revenues and expenditures in a given region is not necessarily one-to-one because of the localization of much of state government administration in the regional center--Juneau. State government expeditures exceeded state government revenues by $231 million in

1977 and $618 million in 1982. Local government expenditures, on the other hand, conform fairly closely in classification to state government expenditures. However, growth in local expenditures lagged behind growth in state and federal expenditures. In 1977, local government expenditures were close to $80 million. They increased to $169 million by 1982. Largest increases were in education and health and human services.

The Economic Accounts

Government revenues and expenditures retain their individual identities in Alaska IPASS. They are summarized in a table of regional economic accounts for purposes of achieving internal consistency in the government accounts and providing early summary statements of federal, state, and local government performance in the region (Maki, 1984).

The Alaska IPASS government module is represented by the institutional accounts in Rows 6 to 11, and Columns 6 to 11 in Figure 3. The individual institutional accounts are linked to (1) activities and commodities accounts in production, (2) factor and other institution accounts in consumption, (3) investment account, and (4) rest of world and rest of U.S. trade accounts. They are labeled by their functional importance. For example, the production activities account provides for the collection of indirect taxes from the producing industries, while the commodity account provides for government purchases of commodities produced by industries in the region.

The individual government-related accounts show the contribution of the three levels of government to each of the economic sectors--production, consumption, accumulation and trade. Changes in the level and disbursement regional industry product, for example, can be related to changes in government revenues and government expenditures in period-to-period comparisons of these accounts.

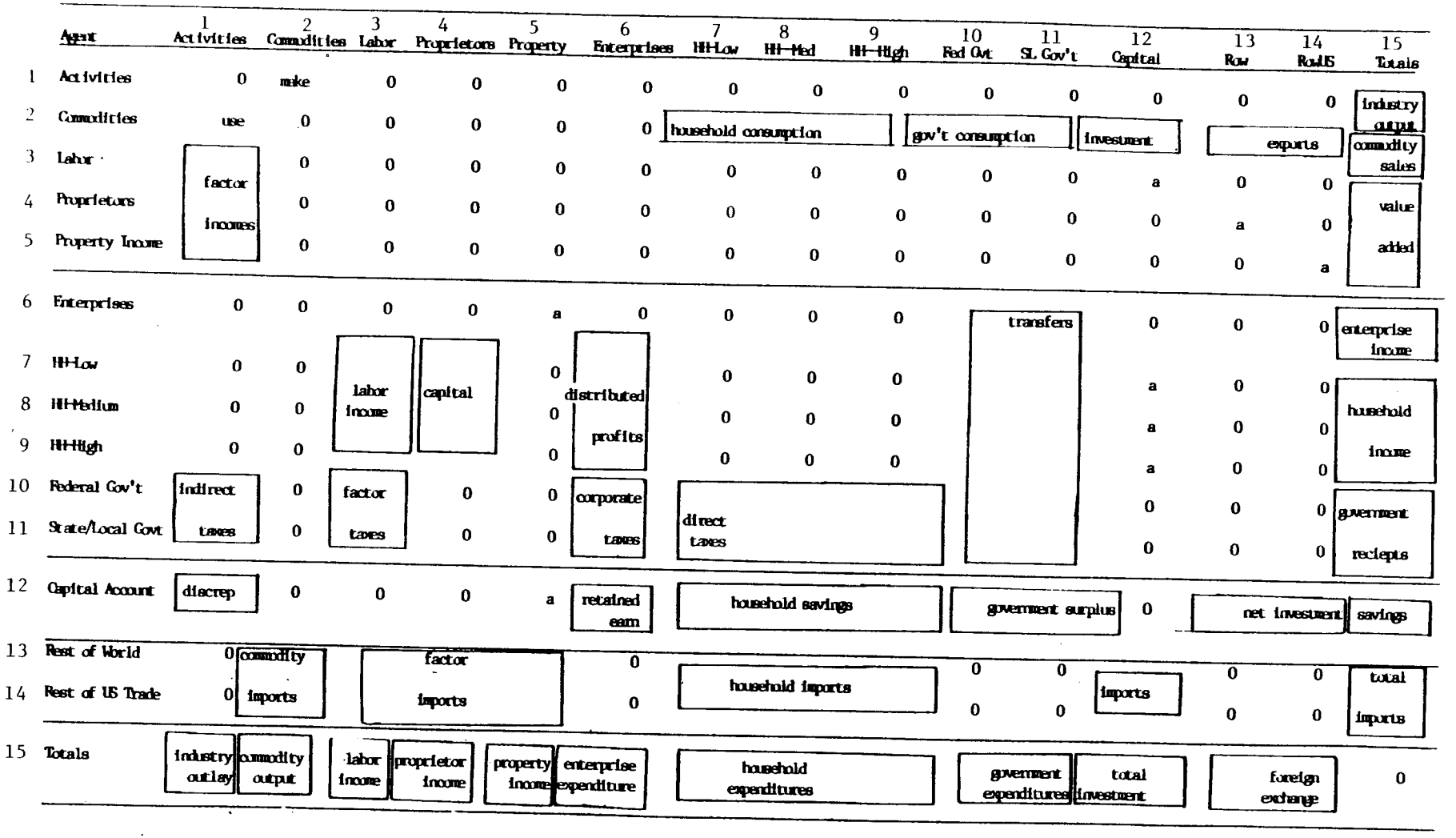

FIGURE 3. Individual economic accounts in Alaska IPASS.

Simulating Alternative Futures

The financing of state and local government in Southeast Alaska is highly dependent on mineral production taxes and royalities. Almost half of the State of Alaska's revenues in 1982 were based on oil production. Local governments are likewise dependent on oil via state-to-local transfers, as shown earlier in Table 1. Barring new discoveries of oil, state and local services will have to be drastically curtailed unless new revenue sources can be found.

The augmented IPASS model can be used to trace the direct and indirect effect of alterntive "what if" scenarios for adjusting to reduced revenues. The worst case scenario is not too difficult to visualize: most local and state government expenditures in Southeast Alaska would have to be drastically curtailed if not eliminated. But short of the total loss of oil-based revenues, the IPASS model could be used by planners to develop strategies that would minimize the economic impacts of the loss of revenue.

The prospects of changes in the way the National Forests are being managed are not as threatening as if the oil revenues were to decrease. Nevertheless, some adjustments would have to be accommodated, particularly since PILT must be used for roads and schools. IPASS would be useful in evaluating proposed ajustments. For example, one question addressed is the role of the tourism/recreation industry in replacing the loss of revenues and employment in petroleum production. What are the industry effects of increasing investment in the tourism/recreation industry in Southeast Alaska and what are their implications in government? What, in turn, are the likely effects of increasing state government expenditures on tourism/recreation advertising and infrastructure development?

Conclusions

Assessment of the importance of government revenues and expenditures in Alaska is facilitated by use of a comprehensive and internally consistent computer model of the Alaska regional economy, that serves as a "shell" in managing the core input-output model and its related modules that make the core model recursively interactive with other modules, including the new regional government sector module (Maki, et al, (2) and Maki, (3)). Alternative scenarios involving the management and use of forest resources in Southeast Alaska can are being related by this model to the financing and operation of governmental activities in that region.

Given the large state government outlays since 1981, the boom and bust cycles of Alaskan economic development have entered an extremely critical stage. The government module provides a systematic approach for assessing how the management of National Forests, for example, can complement the inevitable adjustment to lower royalty payments of the oil and gas industry.

The model portrays the complex interrelationships which exist between firms, household and government and captures the effects of changes in the government sector on individual industries and sectors of regional economy. It represents this economy in a highly disaggrated regional forecasting system. This model also has the capability of tracing the budgetary impacts of alternative future economic scenarios in government and the private sector of the state or regional economies to individual production and marketing activities in the region.

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