Appendix B:  
Modeling Economic Significance 
and Economic Impact
Appendix B. Modeling Economic Significance and Economic Impact

Calculating the economic effects of sport fish expenditures involves three components. The first is the determination of the expenditures associated with sport angler trips. This results in a vector of expenditures, categorized by a common set of goods and services including food, lodging, gasoline, guiding services, and other expenses. The vector of expenditures is then converted into a “final demand vector,” so it can serve as input for an input-output model. This is accomplished by running the vector of expenditures through a commodity by industry matrix, which converts expenditures by commodity to expenditures by the industries represented in the input-output model. The final step is running the input-output model, using the final demand vector as input. The input-output model produces estimates of the total effect (direct, indirect, and induced) of sport anglers’ expenditures in the form of jobs, payroll, and sales.

This appendix describes each of these elements of the analysis. The commodity-industry matrix and the input-output model were constructed on spreadsheets, making them easy to use and self-documented.

B.1 SPORT FISHING EXPENDITURES

Data on sport fishing expenditures comes from the resident and nonresident surveys conducted by ISER for the fishing year 1993. Surveys covered both the summer and winter seasons. A nonresident household survey covered the summer season. A survey of guide and charter operations provided some additional information on angler expenditures for these services, as well as information on the characteristics of these businesses. Limitations on the length of the surveys dictated the level of expenditure detail we could collect. Thus, in some instances where data was not available from the surveys to estimate a particular type of expenditure, we also used other sources as noted.

The sport fishing expenditure data from the surveys can be aggregated and displayed in a large number of ways, only a few of which are reported in this study. We calculated a number of aggregate expenditure measures for resident and nonresident sport fishing in Alaska. These include total expenditures on goods and services used for sport fishing (including capital goods); total expenditures on goods and services attributable to sport fishing (site specific and total); and instate spending attributable to sport fishing (site specific and total). We further allocated expenditures to the region within the state where they occurred. We also present information on particular types of expenditures by site.

Since the expenditure information is for the angler household it is possible to construct many other aggregations of expenditures related to sport fishing. Some obvious examples would be expenditures associated with marine versus fresh water sites, expenditures associated with shore versus boat fishing, or expenditures for guided versus unguided trips. Expenditures associated with different types of angling households could also be generated. Those could include households resident in Southcentral Alaska, households with retirees, households
with planes, households with incomes above a certain level, households with avid anglers, and many others. Variations in characteristics of nonresident households also allow the calculation of expenditures for particular types of visitors.

For some aggregations, arbitrary allocations would be required. For example, some fishing trips target more than one species. Any method that divides the trip-specific costs among the different species targeted during a single trip would be arbitrary. Whenever it is necessary to make such an arbitrary allocation, the assumption used must be explicitly stated. The same holds true for capital expenditures that can only arbitrarily be allocated among various sites visited by a given angler household.

**B.1.a. Resident Summer Sport Fishing Expenditures**

We divided resident summer sport fishing expenditures into 4 major categories.

1. **Trip-Specific Expenditures.** This category includes expenditures that can be specifically identified with an individual sport fishing trip—our basic unit of analysis. A trip consists of one or more members of a household traveling to and from at least one fishing site and fishing for at least one target species. The data on these expenditures in any particular analysis could come either directly from the surveys—pre-season, trip logs, and post-season—or from estimates made with the travel cost model.

   The general expenditure categories are food, lodging, guide and charter services, transportation costs specifically related to getting to and from the fishing site from the anglers’ place of residence, and all other expenses. They are divided into more detailed categories for use in the economic model.

   Trip-specific expenditures generally occur in the same region of the state as the fishing site and the angler’s region of residence. Some anglers do travel outside their home regions for fishing trips—for example, anglers from Fairbanks traveling to Valdez—and some purchases occur outside the region of the site—for example, aviation fuel purchased in Southcentral Alaska for a flight to a fishing site in Southwest Alaska. These expenditures outside the region of the fishing site for food, lodging, supplies, guiding services, and transportation account for a relatively small portion of total expenditures related to sport fishing.

   Some trips are multipurpose. For example, a sport fishing trip could include shopping, visiting friends, or camping. We assume in this analysis that sport fishing is the primary purpose of the trips reported by sport fishermen, but attribute a portion of expenditures to non-fishing activities based on responses to questions about the purpose of each trip.

   The category of guiding services actually consists of a number of different types of expenditures. We identify four major categories as follows: guiding, air tax services, food and lodging, and boat charter services.

   Anglers reported guiding service expenditures by the location of the guide and charter service—which does not always correspond with the region where the guiding services were actually performed. We adjusted the location of guide and charter service expenditures from the region where the service was purchased to the region where the service was provided,
using information from the guide and charter survey. This adjustment better reflects where the economic effects of charter activity associated with any site will actually be felt.

2. Fishing-Related Capital Expenditures. This category includes expenditures on sport fishing equipment and supplies—such as rods and reels or tackle—used over the course of several trips or seasons. Also included as “sport fishing supplies” are less obvious items such as magazines (although licenses are excluded). It includes expenditures associated with winter as well as summer trips. There are several ways to get this information from surveys. Household survey questions asked about total expenditures on various types of equipment during the year. We assumed that the survey year was typical for estimating such purchases, and this method also took into account the fact that some anglers might have bought equipment and yet not fished in 1993. This is because we defined an “angler household” as any household that had fished within the last 3 years. An alternative method of estimating average annual expenditures would have been to ascertain the total stock of fishing-related equipment owned by angler households and estimate an annual equipment replacement rate. But we felt this approach potentially introduced an unjustified degree of error, since it would have required survey respondents to supply a detailed inventory of equipment and us to make an independent estimate of the replacement rate. A third method would have been to survey retail suppliers of equipment; however, this method would not have allowed us to match expenditures with angler households.

Within fishing-related capital expenditures we also include equipment that can be used for other activities. Examples include expenditures for general camping gear or other equipment that can be used for sport fishing as well as for other activities such as hunting or working. We estimated the total annual expenditures on these items from the household survey in the same manner we used to estimate expenditures on equipment solely for sport fishing. We then calculated the portion attributable to sport fishing based on survey responses to a question about the portion of time this equipment was used for sport fishing.

Unlike trip-specific expenditures, which are made entirely within Alaska, some fishing-related capital expenditures are made outside the Alaska economy—either when anglers take trips outside or order items from catalogues. We estimated the portion of fishing-related capital expenditures made outside Alaska from survey responses to questions about where purchases were made.

3. Transportation-Related Capital Expenditures. This category consists of the expenditures associated with the purchase and maintenance of cars, trucks, boats, planes, and other vehicles used entirely or partially for sport fishing. Expenditures covering both the summer and winter fishing seasons are included here. We obtained information on each vehicle owned by each household, including age, years owned, estimated value, expenditures on repairs, maintenance, insurance, and storage, and total annual use (miles or hours) as well as use for sport fishing. We estimated annual purchases based on the average of the most recent three-year period. We adjusted vehicle purchase prices from 1991 and 1992 upward to 1993 values, based on the depreciation rate in the average value of vehicles taken from vehicle survey data. Boat and plane purchase prices from early years were not adjusted, because we assume they depreciate very little within three years.
Expenditures for repairs, maintenance, insurance, and storage were taken from the survey profiles. We included boat and plane storage costs, but not the cost of garages for automobiles and trucks. We calculated the portion of expenditures attributable to sport fishing based on the portion of miles or hours respondents estimated they used their vehicles for sport fishing. We estimated the portion of purchases of vehicles made in Alaska from survey responses.

4. Cabins. Based on the household survey, we calculated the number of cabins resident sport anglers owned or to which they had access. We also estimated the percentage of use that was related to sport fishing, based on survey information. Cabins used in both the summer and winter seasons are included here. Respondents also estimated the value of their property. Additions to the stock during the year 1993-1994 were estimated based on the U.S. census of housing data for the 10-year period from 1980 to 1990. Independent of the survey, we estimated that 75 percent of the value of property was in structures (and 25 percent in land) and that 75 percent of structures were commercially constructed (and 25 percent do-it-yourself). This provided an estimate of gross expenditures and revenues to the construction industry associated with additions to the stock of cabins related to sport fishing in a year.

The turnover of the existing stock through real estate transactions was estimated at 5 percent annually. Further assuming a 10 percent real estate commission on such sales, we were able to estimate the gross revenues of the real estate sector from the annual sale of cabins and second homes of resident sport fishermen.

Annual maintenance expenditures associated with the stock of cabins were estimated at 4 percent, net of the 25 percent of “do it yourself” owners. This was consistent with the level of maintenance expenditures reported by households in the survey. Annual expenditures on appliances were estimated at 3 percent of the stock.

These methods produce estimates of the annual flow of expenditures associated with cabins and real property used by residents for sport fishing in Alaska. It is distinct from the total value of real property used by residents for sport fishing in Alaska, which is a much larger amount. This total value represents the present value of the future stream of benefits (willingness to pay) of residents from the use of this real estate for all activities, including sport fishing. Since the real property does not—in the absence of a transaction or the construction of a structure—represent any current economic activity, it does not directly enter into the calculation of the economic significance or impact of sport fishing.

B.1.b. Winter Resident Sport Fishing Expenditures

We estimated winter resident sport fishing expenditures separately only for trip-specific expenditures. We used the same categories for summer and winter trip-specific expenditures. The estimates of fishing-related capital expenditures, transportation-related capital expenditure, and cabins represent annual amounts which are associated with both summer and winter fishing.
B.1.c. Nonresident Summer Sport Fishing Expenditures

We got our data on nonresident sport fishing expenditures from ISER’s survey of those who purchased nonresident fishing licenses in 1993. Anglers were asked to report expenditure information for their 1993 trips to the state, if they sport fished during those visits. They were also asked to provide detail on the specific sites they visited. From this information, we grouped nonresident expenditures into five categories.

1. Trip-Specific Expenditures. Nonresident trip-related expenditures were reported in the same general categories as the resident trip-related expenditures. Further allocations into more detailed categories were based on assumptions that involved allocating food expenses between groceries and restaurants, lodging expenses between hotels and camping, boat expenses among fuel, repairs, and parts, and vehicle expenses among fuel, repairs, and parts. Expenses for guiding and charter services were allocated among the categories of guide service, air taxi services, food and lodging, and boat charter services, based on regression analysis using survey responses about the types of guide services used.

We attributed all trip-specific expenditures to sport fishing for nonresident visitors.

Because some nonresident visitors had trip-specific expenditures that were included in the price of their package tours, this category does not, in the aggregate, include all nonresident expenditures specifically for sport fishing trips. It was not possible for us to determine the extent of trip-specific expenditures included in package tours and not reported elsewhere for the 23 percent of nonresident visitors who reported purchasing package tours as part of their visits to Alaska.

2. Package Tours. A large share of nonresident visitors (23 percent of survey respondents) come to Alaska through package tours, although the definition of “package tour” is not precise. Most but not all visitors traveling by cruise ship reported expenditures on package tours. Furthermore, different types of packages include different items. For example, they may differ in the travel expenditures included. A package may include all expenditures from a gateway city, which could be Seattle, Anchorage, or Kodiak.

A visitor purchasing a package tour will not normally be able to identify what shares of the total package costs are for travel to and from Alaska, food, lodging, and other expenses while they’re in the state. To deal with this, we attributed shares of package tour expenditures to the different categories of expenditures used elsewhere in the study. We allocated package tour expenditures first into two categories: (1) costs of travel to and from Alaska, and (2) all other costs.

We added travel expenditures to and from Alaska paid for through package tours to travel expenditures to and from Alaska reported by independent travelers to estimate total travel expenditures to and from Alaska.

All other package tour travel expenditures attributable to sport fishing include both non-trip-specific as well as some trip-specific expenditures of visitors who indicated that sport fishing was the purpose of their visit to the state. We assumed that package tour visitors who did not come to Alaska specifically to sport fish did so just incidentally, when they had an
opportunity. Thus we did not include their non-trip-specific expenditures as sport fishing related. But for anglers who would not have come to Alaska if they couldn’t fish, we included all non-trip-specific expenditures. Some trip-specific expenditures that were not separately reported by package tour anglers—because they were included in the price of the package—are also included in this category.

We divided all other package tour expenditures (including both non-trip-specific expenditures as well as some trip-specific expenditures) equally among five more detailed categories of expenditures: food, lodging, personal service, transportation, and durable goods.

3. Fishing-Related Capital Expenditures. We assumed that all fishing-related capital expenditures made by nonresidents occur outside the state. This assumption helped to keep the length of the nonresident survey manageable and undoubtedly improved the response rate. We recognize that while they’re in Alaska, nonresidents do buy some equipment used in sport fishing. However, the total economic impact of these expenditures is small, because almost all of this equipment is manufactured outside Alaska.

4. Non-Fishing Instate Expenditures. We divided all nonresident anglers into two categories, based on the intensity of their fishing interest—which we determined based on responses to a question about whether they would have visited the state if they had been unable to sport fish. For nonresident households that would not have visited Alaska if they had been unable to fish (41 percent), we attributed all instate expenditures to sport fishing. For households that reported they would have visited even if they had been unable to fish (59 percent), we attributed a portion of non-fishing instate expenditures to sport fishing, based on the expenditures during the days when household members fished. (For nonresident anglers visiting Alaska for reasons besides fishing, we attributed $22.7 million of $84.2 million in food and lodging expenditures to non-trip-specific sport fishing expenditures.) We divided total non-trip-specific expenditures into two categories: (1) food and lodging, and (2) all other.

Some anglers reported lodging expenditures during fishing trips as “trip specific,” while others did not. By combining trip-specific and non-trip-specific food and lodging expenditures, we can estimate the total food and lodging expenditures of nonresident angler households that were attributable to sport fishing in Alaska.

Non-trip-specific expenditures do not include expenditures made as part of package tours.

5. Travel Expenditures To and From Alaska. Nonresidents spend a large portion of their travel budgets on transportation to and from Alaska by air, cruise ship, ferry, and automobile (including campers). A portion of these expenditures occurs within Alaska, depending on how they travel. Total travel expenditures to and from Alaska include both the reported expenditures of independent visitors and the portion of package tour expenditures allocated to travel to and from Alaska. We estimated this to be $134.2 million.

For the 12 percent of nonresident households that travel by automobile, we assumed all travel expenditures en route to Alaska occurred outside the state. When these visitors crossed the
border they begin to make expenditures that fell into category 4—non-fishing instate 
expenditures.

Spending on air transport services was the largest reported travel expenses for nonresidents,
but most of that spending does not effect the Alaska economy. For each round-trip interstate 
air traveler, we estimated $150 of expenditures was for Alaska-based, transportation-related 
services. (See Table B-1.) This estimate is based on data from ISER’s 1995 study of 
Anchorage International Airport, which reports the ratio of passengers to air carrier jobs. 
Also, from the input-output model we derived information on the ratio of sales to 
employment in the air carrier industry and used that ratio to calculate the $150 figure for each 
round-trip flight.

For the 3 percent of nonresident anglers traveling by state ferry, we estimated the per capita 
instate expenditure for transport services as $299. This estimate was based on an analysis of 
data from the 1992 Alaska Marine Highway System Economic Benefits Study by McDowell 
and Associates. From that study we were able to calculate the per-passenger instate 
expenditures for resident worker wages, benefits, and vendor purchases.

For cruises ship passengers, data does not exist on the average instate expenditures directly 
related to travel to and from Alaska. We assume that all employees are nonresidents and that 
no procurement of goods or services for the cruise ships occurs within the state. The 
transportation services are then limited to the docking of the cruise ships in port. We assume 
this is $10 per round trip for the 5 percent of nonresident anglers who traveled by cruise ship. 
(The total share of angler visitors who traveled on cruise ships for at least part of their trips is 
10 percent, since most passengers cruise in one direction and fly in the other.)

Some travel expenditures of nonresidents are not attributable to sport fishing. For those 
visitors who would not have come if they could not have sport fished, we attributed all 
Alaska transport services to sport fishing. For the remaining visitors who said they would 
have come even if they could not have sport fished, we attributed a share of Alaska transport 
services to sport fishing based on the portion of days they spent fishing while visiting Alaska. 
This varied from 32 percent of days for visitors who arrived by air to 17 percent for travelers 
who came on cruise ships or in land vehicles.

The regional allocation of these travel service expenditures varied by mode of travel. Land 
vehicle visitors incurred no expenditures instate on travel to Alaska. Cruise and ferry visitor 
travel service expenditures in the state occurred exclusively in the Southeast. Air travel 
service expenditures were allocated among Southeast, Southcentral, and Northern regions, 
based on the initial point of entry of the visiting household.
B.2 COMMODITY-INDUSTRY MATRIX

The commodity-industry matrix is a large spreadsheet that converts 
angler expenditures by commodity (both goods and service purchases), 
as they are reported by anglers and compiled into vectors of expenditures, 
into vectors of expenditures by industry (final demand vectors). 
This conversion is necessary, since the input-output model, which is our tool for 
calculating the economic significance and economic effects of sport fishing, describes 
the economy in terms of 40 different industries. The commodity-industry matrix is also the 
location of a number of additional adjustments that are necessary to prepare the sport fish 
expenditure vectors for conversion into vectors of final demand by industry.

For example, when an angler buys a lure in a local sporting goods shop, that is a typical 
expenditure that influences the local economy. Using the commodity-industry matrix we can 
identify the industries directly effected by this purchase—manufacturing, transportation, and 
trade. The commodity-industry matrix allocates each dollar spent on lures into the portions 
that are ultimately paid to the firm manufacturing the lure, to the transportation companies 
that bring the lure to the sport shop, and to the sport shop itself (the gross margin) from the 
sale after the payment for the goods and the transportation.

Using the commodity-industry matrix, we convert each of the categories of expenditures 
described in section B.1. into a vector of expenditures by industry. We then add these 
vectors together to get a vector of final demand that includes all categories of expenditures. 
Various subsets of categories—such as guide and charter expenditures, or winter trip specific 
expenditures—can also be combined.

Before converting expenditures by commodity to expenditures by industry, we must break 
down three categories of expenditures reported by anglers into more detailed expenditure 
categories. These special categories are guide and charter expenditures, auto insurance 
expenditures, and nonresident package tour expenditures in Alaska.

Based on regression analysis, we allocated the guide and charter expenditures reported by 
anglers among four major categories: guiding services; air taxi; food and lodging; and boat 
charter. We further disaggregated guiding services based on the distribution of operating and 
capital expenditures reported in our survey of guide and charter businesses. We allocated 
these survey expenditure categories among the National Income and Product Account 
(NIPA) personal consumption expenditure categories (see below) using a simple set of 
assumptions. For example, we allocated the expenditure category of utilities used in the 
survey into the NIPA personal consumption expenditure categories of electric (37) and water 
and sewer (39).

We further adjusted the regional distribution of guide and charter expenditures to take into 
account the fact that the region of service provision does not in all cases correspond to the 
region of the fishing site. For example, guide businesses that provide services in Southwest 
Alaska purchase some of their inputs—such as groceries and air transport services—in 
Southcentral Alaska or outside the state. These out-of-region purchases are not captured in 
the average interregional purchases by industry, which are part of the structure of the
regional input-output model. Consequently, they must be separately identified and incorporated into the allocations of guide and charter expenditures by region.

We adjusted guide and charter expenditures in the Southwest and Interior regions to account for spending that occurs in Southcentral Alaska and outside the state. We assume all Southcentral and Southeast guide and charter expenditures occur within those respective regions. These adjustments are based on responses from the guide and charter survey about the location of expenditures by firms located in various regions of the state. For example, firms located in Southwest Alaska reported that only 11 percent of their service-related vendor purchases occurred in that region, while 34 percent occurred in Southcentral and 54 percent occurred outside Alaska. The percentages varied with the type of vendor purchase, but the general pattern of large leakages out of region in Southwest, with smaller leakages from the Interior, was consistent across purchase categories.

Auto insurance premiums pay for three main activities—automobile repairs, medical services, and insurance broker expenses. Based on information from the Alaska Division of Insurance’s Annual Report on Automobile Insurance, we divided insurance premium expenditures into the following personal consumption expenditure categories: auto repair (74), drugs (45), physicians (47), and motor insurance (77), which includes the cost of administering insurance policies.

We initially divided nonresident package tour expenditures into (1) travel expenditures to and from the state and (2) all other expenditures. We added together, and treated similarly, travel expenditures to and from the state reported by visitors who had package tour expenditures and by visitors who traveled on their own.

“All other” expenditures consisted mostly of non-trip specific expenditures. We divided these equally among five more detailed sport fish categories of expenditures: food, lodging, personal services, transportation, and durable goods purchases.

After we categorized sport fish related expenditures in sufficient detail, we converted them into the NIPA personal consumption expenditure categories. This then allowed us to link the personal consumption expenditure categories to industries in the national input-output table.

For some sport fish expenditure categories—such as groceries—there is a comparable NIPA personal consumption expenditure category. Grocery purchases as reported by anglers can be directly linked to “Food Purchased For Off-Premise Consumption,” in the NIPA personal consumption expenditure accounts. Table B.2 further shows the industries (national I-O definitions) where sales are generated by the purchase of food for off-premise consumption (Source: Survey of Current Business, April 1994). The table shows that in 1987 consumers purchased $330.8 billion worth of groceries.

Although most of the food produced came from the Food and Kindred Products Industry, there were nine different industries that provided portions of the items sold as groceries. We calculated the share produced by each industry based on purchasers’ prices—the prices that consumers pay. For each type of commodity, the purchase price is further divided among three major categories of businesses. Overall food producers received $211 billion, transportation providers were paid $7.8 billion, and wholesale/retail trade businesses received
$112 billion from the sale of groceries. We calculated the distribution of purchase price for each type of commodity between producer price, transport margin, and trade margin. This allowed us to distribute $100 of grocery purchases by anglers among all the relevant industrial sectors (defined by the NIPA input-output tables). The margins estimated in this manner are equal to those of the national economy and do not vary by region of the state.

Some sport fish expenditure categories are not directly comparable to those in the NIPA personal consumption expenditure list. We assigned those expenditures the NIPA industry categories that most closely corresponded. For example, we assigned sport angler expenditures on air charters to the NIPA industry category of Air Transport (65D). We divided other sport fish expenditure categories—such as guide and charter transportation—among four personal consumption expenditure categories: New Autos (70), Other Motor Vehicles (72), Tires, Tubes, Accessories and Other Parts (73), and Gasoline and Oil (75). These in turn were allocated among NIPA industries, using the procedure described in the previous paragraphs.

Regional input-output models in general do not contain as much industry detail as the NIPA input-output model. Whereas the version of the NIPA model used to assign personal consumption expenditures to industries has 85 industrial sectors, the Alaska input-output model divides all regional economic activity into 40 industries. So we had to assign each of the NIPA industry categories to an appropriate Alaska input-output model category. For example, Air Transport was assigned to Air Transport, but New Cars had to be assigned to Other Manufacturing, since there is no category in the Alaska input-output model for new automobile manufacturing.

For expenditures on services, the correspondence between the expenditure and an industry is complete at this point. However, each category of expenditures on goods at this point still consists of the manufacturing cost, the transportation margin, and the trade margins. For example, the spending on sporting equipment is the total amount that sport anglers paid for the equipment, which includes the cost of manufacturing the goods, the cost of transporting them to Alaskan stores, and the costs associated with wholesaling and retailing the equipment. The costs associated with the purchase of sporting goods must be allocated across industries before being put into the vector of final demand.

For each manufactured good, the share of expenditures which is manufacturing cost (goods at producer prices) is split out and allocated to the appropriate manufacturing industry in the Alaska input-output model. This amount is then adjusted downward by an estimate of the share of manufacturing which occurs within the state. Since very little manufacture of consumer goods does take place within Alaska, we assume between 0 and 50 percent to be local manufacture, depending on the item. For example, automobile manufacturing is assigned 0 share, while oil and gas manufacturing is assigned 50 percent share. These shares are based on general knowledge of the manufacturing sector of the Alaska economy. The shares by industry are shown in the table on the following page.
Alaska I-O Industry | Local manufacturing share
---|---
1 | agriculture .05
3 | fishing .2
5 | other mining .05
8 | food and kindred products .05
10 | chemicals and petroleum .05
11 | lumber and wood .2
12 | other manufacturing varies

The transportation margin is allocated among the seven transportation sectors of the Alaska input-output model, based on our judgement of the structure of the economy. These sectors are: Railroads, Local and Inter Urban Transit, Motor Freight and Warehousing, Water Transportation, Air Transportation, Pipelines, and Transportation Services.

For simplicity we assume the entire transportation margin is spent within Alaska and influences the Alaska economy. Since the transport margins are a small share of the purchasers’ price, this simplification does not significantly bias the results of the analysis.

The share of expenditures on manufactured goods which is the trade margin (wholesale and retail markup) is allocated between wholesale and retail trade activities, based on the 1987 NIPA personal consumption expenditure category transport and trade margins. We assume 50 percent of the wholesale activity and 100 percent of the retail activity occur in Alaska.

The result of these adjustments for expenditures on goods is twofold. First, a portion of the dollars spent on goods flows directly out of the state and has no indirect or induced economic effects. Secondly, the typical expenditure on a good generates economic activity in the trade and transport sectors, and if the good is manufactured locally, within one of the manufacturing industry sectors. An example of the treatment of sport fishing expenditures on goods is shown in Table B-3.

Using these conversions, all sport fish expenditures could be allocated to an industry represented in the Alaska input-output model. These expenditures attributable to sport fishing could then be allocated among the four regions represented in the input-output model. Most but not all expenditures occur within the region where the fishing site is located. In addition, some capital expenditures take place outside the state and do not influence the Alaska economy. These non-Alaska expenditures are removed from the vector of final demands at this point. The result is a 160-element vector of final demands for 40 industries for each of four regions of the state.
B.3 INPUT OUTPUT MODEL

The primary purposes of the ISER Alaska input-output model are to measure the economic impact and economic importance of selected activities on the Alaska economy and to measure the economic impact of changes in the level of these activities. A related purpose is to study the structure of the Alaska economy.

B.3.1 Output

The output measures that the model can produce include output (sales), employment, payroll, employee compensation, and value added for 40 industries in four regions of the state. As currently configured, the model generates output, employment, and payroll by industry and geographic region as well as aggregates across industries and regions. Additional measures, such as tax revenues generated by industry, may be added as data becomes available.

Output represents all the sales revenues of firms except for the trade sector, where output is a measure of the trade margin (the difference between revenues and the cost of goods sold). For this reason, employment and payroll are generally more useful indicators of economic activity than output or sales. Employment is annual average employment based on the average annual wage of workers in each industry. Payroll is the total wages received by workers. Employee Compensation is all payments to workers including payments in kind and payments made on behalf of the worker, such as for health insurance. Value Added includes not only employee compensation, but also indirect business taxes and profits. It is the best measure of the income earned within the region and is comparable to Gross Product.

Each output measure is presented in total and also allocated among the Direct, Indirect, and Induced effects. The Direct Effect measures the direct effects produced in Alaska industries by the changes in Final Demand contained in the Final Demand Vector. For example, an increase in export sales of Alaskan coal (measured at the mine mouth, net of transportation costs) would generate an increase in output, employment, and payroll in the coal mining industry to satisfy the higher level of industry demand. This is the direct effect of the change in final demand for export coal sales.

The Indirect Effect measures the changes in output, employment, and payroll for Alaska businesses that result from local businesses supplying goods and services to the coal mining industry. For example, an increase in coal production would require more fuel, and Alaska fuel producers and distributors would increase their production to meet the increased demand indirectly created for them by the increase in coal exports. Furthermore, firms selling to the fuel suppliers would experience increases in their businesses and this would be included in the indirect effect. The indirect effect is a measure of the interdependency of industrial sectors within the economy.

The Induced Effect further measures the changes in output, employment, and payroll for all Alaska businesses resulting from consumer purchases by households with workers whose incomes increase due to the rise in economic activity in the region. For example, new workers in the fuel distribution business will make personal consumption expenditures they
would not otherwise have made. These purchases increase demands in trade, services, and other sectors of the economy. Businesses in these sectors in turn hire additional workers who spend their new wages in the economy, further stimulating economic activity across a broad spectrum of industries. This process continues until spending within the economy stops. Leakages that stop this process of re-spending within the region consist primarily of the purchase of goods and services outside the region and savings.

The example of the economic effect of an increase in coal exports of $1 million is shown in Table B-4, which is a sample of the output of the model. The first page contains the final demand vector showing an increase in output of $1 million for the Other Mining industry. The direct and total effects are summarized on the second page of the output. The direct effect, all of which occurs in Other Mining, consists of an increase of output by $1 million, payroll by $326,900, and annual average employment by 5.5 workers. The total effect on the economy of this increase in export sales is an increase of output by $1,682,000, payroll by $486,300, and employment by 11.3 (annual average workers). The sum of the indirect and induced effects, which represent the effects which occur almost entirely outside the mining industry, are an output increase of $682,000, payroll increase of $159,400, and employment increase of 5.7. The distribution of total payroll across industries demonstrates that the effect of this increase in export sales influences economic activity throughout the economy. This is shown in page 3 of the output. The trade and service industries share most of the indirect and induced sales generated by this change in final demand. The final 3 pages of output provide more detail by industry and type of effect.

**B.3.2. Multipliers**

The process by which purchases by businesses and households further stimulate purchases by other businesses and households is known as the **Multiplier Effect**. Several types of **Economic Multipliers** can be derived from the input-output model, summarizing the amount of total economic activity stimulated by a change in final demand.

The U.S. Department of Commerce uses two different categories of economic multipliers: **Direct Effect Multipliers** and **Final Demand Multipliers**. A direct effect multiplier is defined as the ratio of the total to the direct change in a measure of economic activity, such as sales, employment, or payroll. A final demand multiplier is defined as the ratio of the total economic effect to the change in final demand measured in dollars, and can be interpreted as a “bang per buck” measure. An additional measure known as a **Response Coefficient** is also occasionally used. This is a measure of the change in some economic variable in response to a one-unit change in the physical output of some good or service.

The direct effect multipliers for coal export sales are shown on the second page of the sample output in Table B-4. The output multiplier of 1.68 means that total output of $1.68 million is generated by an increase of $1 million in direct output. The payroll multiplier of 1.49 means that total payroll increases by $1.49 million from an increase of $1 million in direct payroll. The employment multiplier of 2.03 means that 2.03 total jobs are generated for each direct job generated.

Final demand multipliers for coal exports are also shown on the second page of the sample output. The final demand output multiplier is $1.68 indicating $1.68 million in total output.
for a $1 million change in final demand. The final demand payroll multiplier of $.49 indicates that $.49 million in total payroll is produced by a $1 million change in final demand. The final demand employment multiplier of 11.28 indicates that 11.28 total jobs are created by an increase in final demand of $1 million.

Direct effect multipliers are also defined as Type I, Type II, Type III, and so on, based on the categories of spending that are included in the calculation. The Type I multiplier includes direct plus indirect effects; the Type II multiplier includes direct, indirect, and induced effects. The multipliers generated as output of the Alaska I-O model are Type II multipliers because the model is closed to households, meaning that the change in household purchases in response to a change in final demand is included in the calculation. A Type III multiplier is sometimes defined as differing from a Type II multiplier in the treatment of household expenditures. In the Forest Service IMPLAN model, the Type III multiplier includes a household expenditure response based on spending by new households that move into the region rather than additional spending by existing households in the region. Type II multipliers will be larger than Type I multipliers, because they include the household spending response.

Generally regional models are not closed to investment or government spending. The response of new capital investment spending and government spending tend to occur with a time lag and the link between changes in current output levels and changes in investment spending and government spending tends to be less direct than changes in current business activity and household spending. Because these responses are not included in the Alaska input-output model, it is characterized as an impact model and its multipliers as Impact Multipliers. Some input-output models, however, are closed to state and local government spending. These may also be called Type III models. A model that is also closed to investment is sometimes called a Type IV model.

Since it is an impact model, the Alaska Input-Output model has multipliers that are generally smaller than those of a dynamic simulation model such as ISER’s MAP econometric model for Alaska. The MAP model incorporates an investment spending response as well as a government spending response to changes in current economic activity. In a simulation model, the size of the multiplier will generally vary over time as the effects of these responses work through the economy. In addition, a simulation model can reflect the process of structural change over time, which is not captured in a static input-output model. Import substitution is one form of structural change that could reduce leakage over time for a given level of final demand. In particular, the introduction of a new industry selling to final demand in a region can alter the pattern of trade coefficients in many industries, if new types of firms move into the region to supply inputs to the new industry.

The size of the multiplier depends not only on the variable being measured and whether the model is closed to the household sector. For a given change in final demand the multiplier varies by industry as well as by location. This is shown in Table B-5, where final demand multipliers for employment and payroll as well as total output multipliers are presented for each industry in the model for each region. Industries that have relatively large purchases of supplies produced by Alaska businesses (most services and supplies like fuels); industries that are labor intensive; and industries with a large ratio of value added to sales will tend to
have larger multipliers. This is because the local purchase of supplies leads to a larger indirect effect, a large share of expenses devoted to payroll leads to a large induced effect, and a large share of sales consisting of value added potentially results in large increases in public and private income within the region. (The economic effect of $1 of payroll is the same for all industries, but the multiplier will be larger if there are more payroll dollars.)

The role of payroll in determining the size of the multiplier is particularly important in Alaska since inter-industry purchases (backward links) are less important here than in more mature economies. The absence of a developed manufacturing sector means that most goods must be purchased outside the state, resulting in large leaks of spending and small indirect multiplier effects. Most of the backward links occur as the result of the purchase of services and the purchase of raw materials by natural resource processors (which may be constrained by supply).

Smaller regions tend to have a narrower range of businesses represented in the local economy and consequently the leaks out (purchases from other regions) will tend to be higher and the multipliers lower.

The size of the multiplier depends on the structure of the economy at the time of the change in final demand. For example, the availability of supplies and labor is important. If resident workers are available, the induced effects will be larger than if nonresident and transient workers fill the jobs created by the change in final demand. In this case, much of the household income will leak out of the region and generate economic activity where these temporary workers permanently reside. In addition, the size of the economy will influence its structure and consequently the share of supplies that a business or household is likely to purchase locally.

The size of the multiplier also depends on the size of the area within which the effects are being measured. Generally the larger the area, the smaller the leakage of transactions and the larger the multipliers. In the Alaska Input-Output model, the multipliers for each industry in each region can be calculated based on the effects occurring either within the region of direct effect or throughout the state. The second page of Table B-5 shows that the total output multipliers are generally larger for the state than for the region. Changes in final demand in the Southeast, Southwest, and North regions have effects not only within region but also in the Southcentral region. The same is true for payroll and employment multipliers.

Finally, the size of the multiplier depends on the characterization of the change in final demand. An increase of coal exports of $1 million measured at the mine mouth will have effects on the economy over and above the direct, indirect, and induced effects we have discussed. The most obvious additional effect will be to increase the output of the Alaska businesses transporting the coal to tidewater. This is a forward link that should be included as an additional component of the change in final demand when conducting the economic impact or significance analysis. Often, however, it is incorrectly included with the indirect and induced effects in the numerator of the multiplier formula. The result is an inappropriate multiplier value.
B.3.3. Regional Divisions

The model produces both statewide and region output for up to four regions. The model is designed with a procedure allowing the user to customize the analysis to the census division level or to another regional disaggregation defined by aggregations of census divisions. This procedure involves the creation of regional input-output tables using the state table and region-specific information on location quotients, value added components, and worker residence. The current version of the model consists of four regions: Southeast, Southcentral, Southwest, and Northern, shown in Map 4-1 in Chapter 4. The regional version of the model includes an inter-regional linkage module to account for out-of-region purchases by businesses and households, which occur in all regions except Southcentral.

B.3.4. Types of Analysis

The input-output model can be used to conduct both economic impact analysis and economic significance analysis. These are different methods of assessing the economic importance of an activity within a region.

Economic impact is the traditional analysis done using input-output. A final demand vector, representing a change in export sales, or income flowing into a region, is used to calculate the resulting total change in economic activity. The assumption of this type of analysis is that all the economic activity thus measured is attributable to the change in final demand, and would not occur without that change in final demand.

An economic significance analysis is a description of the level of activity associated with an industry or sector, but it does not presume the activity would not occur if the industry or sector were absent. In this case, the vector used to generate the result is not really a final demand vector. Rather, it represents the activity whose importance is being measured.

For example, the model could be used to estimate the economic importance of a new ski resort in Southcentral Alaska. The change in final demand represented by the new resort would determine its economic impact on the region. The change in final demand would come primarily from nonresident visitors who would be attracted to Alaska to use the new resort. The components of the change in final demand would be not only spending at the resort, but also travel and spending on other activities by visitors while they’re in Alaska. In contrast, the economic significance of the resort would be based on its total sales to both residents and nonresidents. The economic significance would include but be greater than the impact, because resident spending at the resort would be largely offset by reduced spending elsewhere in the region. The net economic effect of the shift in the pattern of resident expenditures would be small, even though it might be difficult to determine what spending was eliminated by the presence of the resort.

B.3.5 Implementation

The model resides in a Lotus V file (OUTPUTn) which consists of several sheets for formulating the Final Demand Vector, storing the Total Requirements Table and other data vectors necessary to run the model, and displaying the model output (n designates the version of the file). A separate set of files contains the data necessary for the creation of the Total
Use of the model requires the creation of a final demand vector describing the change in final demand resulting from the activity under study, broken down by the 40 industries and four regions represented in the model. Examples of final demand vectors include the expenditures associated with an increase in the number of tourists visiting the state or the opening of a new mine which exports its output to other states or countries.

Correctly structuring the final demand vector is the most important and often the most difficult task involved in using the model. There are three different forms of final demand vector that the model can accept. Each is constructed and interpreted differently. The types of vector are as follows:

1. Sales to final demand of one or more firms represented among the columns of the Direct Requirements Table. [FINAL DEMAND CHANGE] An example of this would be an increase of $1 million in export sales of the mining industry. In this case the final demand vector would have a single entry of $1 million in the Other Mining Industry row in the appropriate region. (Depending on the analysis, it might also have an entry in the Railroad Transportation row representing the cost of transportation from the mine mouth to tidewater.)

   This is the easiest type of final demand vector to create and use and the type most commonly presented as an example in descriptions of the input-output model methodology—but it is rarely used with the Alaska input-output model. That’s because most analysis involves activities that are not well represented by the 40 industries included in the model. For example, we might want to calculate the impact of an increase in sales by bush air carriers to tourist visitors. Although the model has an Air Transport Industry, it includes large domestic and international passenger and freight carriers as well as bush carriers. Bush carriers are only a small part of the industry, and they may well have structural characteristics very different from the larger carriers. Estimation of the impact of bush carrier expansion based on industry averages would be possible, but a better estimate could be made using more specific information about the bush carriers. This can be done using the second method of constructing a final demand vector. Table B-7 shows the form of the final demand vector, the summary of the economic effect, and the summary of total employment, payroll, and sales by industry statewide for an increase of output in Other Mining of $1 million.

2. Total local purchases by a firm, including payroll. [PROCUREMENT] This alternative allows us to “fine tune” the final demand vector using locally available information to better represent the activity under analysis rather than relying on the aggregate industry average structural information embedded in the direct requirements table. For example, the bush air carrier sector of the Air Transport industry in Alaska may be more labor intensive than the industry average, pay a lower average wage, and have a higher percentage of resident employees than the industry average. This information is important for determining the total economic effect of a change in final demand for bush carrier services—but this information is not imbedded in the input-output model, where Air Transport represents the average structure for the industry.
There are two ways to incorporate this firm-specific information into the analysis. The first would be to add a new row and column to the direct requirements table for the activity under consideration—in this case the bush carrier industry. This would require a revision of the existing Air Transportation row and column of the direct requirements table in order to divide it into two new industries representing a new Bush Carrier industry and the redefined Air Transportation Industry, Net of Bush Carriers. An alternative, and simpler, procedure is to treat the final demand vector as if it were the direct requirements vector for the bush carrier industry. This avoids the necessity of splitting out bush carriers from other air carriers but retains the bush carrier specific information in the analysis. This procedure yields virtually identical results to adding rows and columns when the inter-industry purchases are limited. (Presentation of the results requires adding the direct impacts back into the output from the model to get the total impact. This procedure occurs automatically when this alternative is specified in OUTPUTn.) Table B-8 shows the form of the final demand vector, the summary of the economic effects, and the summary by industry for an analysis of an increase in output of Other Mining by $1 million, using specific information about firm procurement and payroll. In this case, we derived the distribution of firm purchases from the Other Mining column of the direct requirements table. The resulting total economic effects are identical to those which are shown in Table B.7 and which we calculated simply by using a final demand vector with $1 million in output for the Other Mining industry.

Because information on industry purchases may not be available for the categories into which the input-output model divides economic activity, it may be necessary to use a matrix that converts firm purchases by commodity into purchases by industry prior to creation of the final demand vector.

3. Personal Consumption Expenditures [HOUSEHOLD EXPENDITURES] This alternative allows us to estimate the economic effects of a change in personal income or personal consumption expenditures. Examples of activities subject to this type of analysis would be the Permanent Fund Dividend or an increase in nonresident visitor expenditures. A change in personal income would be easily represented in the model by a change in the Household row of the final demand vector. For example, in Table B.9 we show this method for analyzing a $50 million increase in personal income. If this income comes in the form of a transfer payment, there will be no direct output, payroll, or employment associated with it, so there are no multipliers in the usual sense.

If it is possible to specify the personal consumption expenditures households would make in response to a change in income, or if a change in personal consumption expenditures itself is the activity of interest, then the final demand vector would represent those specific expenditures. Since the personal consumption expenditures are generally reported by commodity, whereas the input-output model is designed around industries, it is necessary to convert expenditures by commodity into expenditures by industry in order to create the final demand vector for household expenditures. Conversion tables for personal consumption expenditures are available from the National Income and Product Accounts to accomplish this. For example, a tourist purchase of a souvenir cannot be directly represented in a final demand vector because there is no industry classification entitled “Souvenirs.” The commodity-industry matrix would allocate this tourist purchase among the appropriate
manufacturing industry and the transportation and trade margins represented by the purchase price.

Table B.10 demonstrates the use of the model to calculate the economic effects of an increase in personal consumption expenditures associated with an increase of resident personal income of $50 million. Here we assume that the composition of new personal consumption expenditures is the same as the average represented in the model by the Household column. (We use the coefficients of the household column of the direct requirements table to allocate shares of the $50 million in personal income to the industries where it is spent.) The result is that about half of the $50 million, $25.8 million, is spent within the region on personal consumption expenditures. The total effect of these personal consumption expenditures, specifically identified by industry, is the same as the effect shown in Table B.9. In that table, household income was increased by $50 million and the model allocated that additional income among the various industries based on the pattern of personal consumption expenditures in the model.

**B.3.6. Model Construction**

The starting point for the creation of the Alaska input-output model is the RIMSII model for Alaska, published by the U.S. Department of Commerce, Bureau of Economic Analysis. This is a 39-industry input-output model constructed from the national input-output model. (See *Regional Input-Output Modeling System (RIMS II): Estimation, Evaluation, and Application of a Disaggregated Regional Impact Model* and *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II)*, both from the Bureau of Economic Analysis. The current version of the model uses the tables published in 1993.)

The regionalization of the RIMSII model uses a disaggregated “mixed location quotient” technique to generate regional trade coefficients directly from the national technical coefficients without the necessity of creating a regional transactions table. Earnings-based location quotients are used for industries that sell predominately to intermediate demand, while personal-income-based location quotients are used for industries that sell predominately to final demand. The use of personal-income-based location quotients in service industries is intended to account for all sources of output demand in these industries. Furthermore, RIMSII estimates regional Household row and column coefficients based on national I-O household payment and expenditures coefficients. The resulting coefficients are then aggregated from the 496-industry level into a more manageable table of technical coefficients.

Although the RIMSII model is not based on a survey, it has been shown to closely approximate the results of very expensive survey-based models for some states. However, a number of further adjustments have been done to the RIMSII model so that it more closely represents the structure of the Alaska economy and the regions within Alaska.

1. **Disaggregate Important Alaska Industries.** We disaggregated three RIMSII industries—Forestry and Fishing, Transportation, and Miscellaneous Services—using data from the detailed national input-output tables of the U.S. Department of Commerce, Bureau of Economic Analysis. For each of these three RIMSII industries, the appropriate set of industries from the national table was substituted into the RIMSII direct requirements table.
For example, seven separate industries—Railroads, Local Transportation, Motor Transportation, Water Transportation, Air Transportation, Pipelines, and Transportation Services—were inserted into the direct requirements table in place of the single Transportation industry. The national coefficients were adjusted to reflect Alaska conditions, using location quotients constructed from Alaska and U.S. earnings data. The result of this procedure was a hybrid direct requirements table containing 48 industries.

2. Combine Small Alaska Industries. To form a smaller and more manageable table of industries, we combined several small industries (industries that have little presence in Alaska) from this hybrid direct requirements table. For example, we combined a number of manufacturing industries that have very little Alaska presence—apparel, printing and publishing, rubber and leather products—into a single category of “Other Manufacturing.” This aggregation was done using employment and wage shares for each of the combined industries in calculating each aggregated industry trade coefficients.

Table B-11 shows the relationship between the 39 RIMSII industries and the 35 industries in the Alaska I-O model after the disaggregation and aggregation procedures. (The computer program is capable of accommodating 40 industries. This allows for further disaggregation of industries or for closing the model to other sectors, such as local government.)

3. Regionalize the Model. We next used earnings-based location quotients to regionalize the Alaska I-O model into four regions which are aggregates of Alaska census areas. (Users can redefine these regions, but four is the maximum number into which the state can be divided.) The four-region direct requirements table includes inter-regional purchases to reflect the fact that economic activity in the regional centers such as Anchorage is influenced by changes in final demand in outlying regions such as the Southwest. The inter-regional purchase coefficients were calculated so that the statewide total economic effect of a change in final demand occurring in any region would be the same. The location by region of the economic effects differs depending on the region of final demand change. The current version of the model assumes that purchases flow from outlying regions to Southcentral Alaska but that no purchases flow out from Southcentral to the other regions.

4. Localize Alaska Wage Rates and Value Added. After regionalization, the direct requirements table—a 160 by 160 matrix—was inverted to create a total requirements table. Pre-multiplication of this total requirements table by a 160-by-1 final demand vector generates a vector of total change in output for 40 industries in four regions of the state. From this output vector employment, payroll, value added, and other variables by industry and region can be generated using output ratios. The ratio of payroll to output by industry is used to calculate the total payroll effect of a change in final demand. At this point, the residence adjustment for nonresident payroll paid by industry is adjusted, based on judgement by the authors. The average annual wage by industry by region is used to calculate the total employment effect of a change in final demand (currently based on 1994 wage rates). The ratio of value added to output is used to calculate the total value added effect of a change in final demand.

5. Commodity by Industry Matrix. Since many applications of the input-output model are based on changes in final demand described by commodity rather than industry, a commodity
by industry matrix is required to convert expenditures by commodity into expenditures by industry. The commodity by industry matrix not only allocates manufactured good expenditures to the appropriate manufacturing industry, it also splits out the transportation and trade margins.

B.3.7. Model Accuracy

The model is constructed using both national and Alaska sources. The national data include the National Income and Product Accounts, the National Input-Output Model (including supplementary tables), and the RIMSII models for Alaska. The data from these sources are in the form of coefficients and ratios describing the structure of the economy and particular industries. This structure tends to be relatively stable over time. The technical coefficients reflect the average production process for each industry and relative input prices. These coefficients will change over time if the average technology in the industry changes, the mix of firms in the industry changes, or if relative prices change. In using national data from former years we assume that these changes, to the extent they do occur, happen gradually and have little effect on the results generated by the model.

The process of converting the national input-output direct requirements table into a set of regional trade coefficients introduces some potential errors. These include aggregation bias, bias due to the existence of cross-hauling, and differences in production functions between Alaska and the U.S. average. Aggregation bias occurs when firms with different production functions are assigned to the same industry. The result is an industry that does not exactly reflect the characteristics of either firm. This problem is minimized in RIMSII by conducting the regionalization procedure on the most disaggregated level the data will allow. The disaggregation process assumes that intermediate output in the region is sold within the region to meet local firm demands before any is exported to other regions. In reality, sometimes inputs are imported even when local industry output is sufficient to meet local demand. Because the regionalization procedure cannot estimate the extent of this cross-hauling, the regional trade coefficients may have some upward bias. The amount of cross-hauling between the Alaska economy and the rest of the world has not been documented, but it is probably relatively small—so we disregard this as a factor influencing the quality of the regional model. Differences in the industry production functions between Alaska and the rest of the U.S. are potentially more significant, and it is here that adjustments to the Alaska I-O model are made based on our judgement and knowledge of the local economy. These differences are likely to be in industries like Petroleum and Construction, where the production function is influenced by local geography and climate.

In addition, the RIMSII trade coefficients will change if there are changes in the locally supplied shares of industry inputs. Again, in using RIMSII we assume that changes in the locally provided shares of inputs to Alaskan industries occur very slowly and that these changes do not have an appreciable effect on the results of the model. Of course, change can be rapid for individual industries due to the small size of the economy. The introduction of a new firm or the loss of an existing firm within an industry, or a change in the source of supply for an important input to an industry, can change the trade coefficients for that industry in the direct requirements table. Because of this, the model results for individual
industries are less robust than the aggregate results across all industries or broad categories of industries.

In general, a change in the trade coefficients for one industry will have a very small effect on the aggregate results of any analysis using the input-output model. More important than the size of any particular trade coefficient is their sum, which represents the share of industry inputs that is supplied from within the economy. As long as the leakage out of the economy does not change appreciably due to a change in one trade coefficient, the aggregate economic impact will not vary much with variation in the individual trade coefficients.

In Alaska, the sum of the trade coefficients for most industries is relatively small since many industrial inputs, particularly intermediate manufactured goods, are not produced locally. The indirect economic effect of any change in final demand will be relatively small. The induced economic effect due to household spending of income may be larger because household purchases tend to have a higher local component. As a result, the most important variables for determining the total economic effect of a change in final demand within Alaska are generally the proportions of the direct effect that are paid to Alaskan suppliers and Alaskan households. (It is also important to properly identify what share of any change in final demand should be allocated to Alaska. For example, a wilderness resort serving nonresidents may buy groceries in Seattle. So although the visitors pay for groceries they eat at the resort, that particular visitor purchase does not have an indirect or induced effect on the Alaska economy.)

The Alaska data include payroll and employment information from the Alaska Department of Labor, earnings and income data from the U.S. Department of Commerce, value added developed by ISER, and incidental data from a variety of Alaska sources, used to adjust model coefficients to better reflect current Alaska conditions. Furthermore, it is necessary that the wage rate data consistently use the same base year as the data in the final demand vector that is used to drive the model.

The accuracy of estimates of economic effects also depends on proper model application. This in turn requires knowledge of the structure of the economy and judgement about how it is likely to change in response to a change in final demand. Two important considerations are whether supply constraints will influence the response and whether the change should be treated as an average or a marginal change.

The output of most industries can increase in response to an increase in demand, although sometimes only with a lag. The natural resource industries are generally constrained by supply, so that an increase in final demand for the output of the seafood, wood products, mining, petroleum, and perhaps the tourism industries might be unsatisfied from local sources of supply. In those instances, an increase in final demand could only be satisfied through an increase in imports of the commodity that is constrained by supply. The locally supplied commodity for which a potential supply constraint is most important is petroleum, since fuel is used as an important input in a broad range of industries. The supply of labor might be another instance where a short-term shortage results in the importation of workers. The potential for supply constraints is handled on a case by case basis in the application of the model.
An important assumption of the input-output model is that in response to a change in final demand, the composition of purchases by each industry in the economy will be similar to the average for the industry. There are two reasons why this assumption might not be valid.

First, the firms within the industry affected by the change in final demand might not be representative of the average for the industry. For example, the Air Transportation industry aggregates together national and international passenger and freight carriers with bush airlines. Although both are engaged in Air Transportation, the structure of purchases for a typical international freight carrier could be quite different from that of the typical Alaska bush carrier. A change in final demand that specifically affects Alaska bush air carriers may then not be properly modeled by the Air Transportation industry, which includes the international freight carriers. Second, a change in final demand could stimulate the establishment of new businesses rather than expansion of existing businesses in the region. If the structure of the new businesses were significantly different from that of existing businesses, the average coefficients in the direct requirements table for that industry might not be appropriate. For example, the Food Manufacturing industry consists primarily of shore-based fish processing. It would be inappropriate to use this industry to estimate the effect of a new large-scale meat processing plant on the economy. In both these instances, it would be preferable to construct a direct requirements vector that specifically described the structure of the business activity under analysis.

B.3.8. ISER Studies Employing the Alaska Input-Output model


Marginal Oil Field Development—The Economic Impact, for Alaska Oil and Gas Policy Council, June 1995.

The Economic Contribution of the Anchorage International Airport, for Anchorage International Airport, October 1995.


Heavy Oil Development: The Economic Impact, for BP Alaska, December 1995.

Economic Effects of Management Changes for Kenai River Late-Run Sockeye, for Alaska Department of Fish and Game, January 1996.

The North Star Project: Economic Impact, for BP Alaska, April 1996.

Economic Impacts of the 1996 Arctic Winter Games, for Arctic Winter Games International Committee, June 1996.

Sport Fishing in Alaska: Economic Importance (Review Draft), for Alaska Department of Fish and Game, October 1996.
Economic Impact of the 1995 Carr’s Great Alaska Shootout, for University of Alaska, November 1996.