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Alaska IPASS Database Preparation Manual

Paul McHugh, Douglas Olson, Con Schallau, Scott Lindall,
Hossein Akhavi-Pour, and Wilbur Maki

Authors

PAUL MCHUGH and DOUGLAS OLSON are research fellows; SCOTT LINDALL is a graduate research assistant, Department of Agricultural and Applied Economics, University of Minnesota. McHugh and Lindall are in S1. Paul, Minnesota 55108, and Olson is at the Forestry Sciences Laboratory, Corvallis, Oregon 97331. CON SCHALLAU is a research economist at the Forestry Sciences Laboratory, Pacific Northwest Research Station, 3200 Jefferson Way, Corvallis, Oregon 97331. HOSSEIN AKHAVI-POUR is an assistant professor at Hamline University in St. Paul, Minnesota 55104. WILBUR MAKI is a professor, Department of Agricultural and Applied Economics, University of Minnesota, S1. Paul, Minnesota 55108.

Abstract

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Describes the data, their sources, and the calibration procedures used in compiling a database for the Alaska IPASS (interactive policy analysis simulation system) model. Although this manual is for Alaska, it provides generic instructions for analysts preparing databases for other geographical areas.

Keywords: IPASS, policy analysis, impact analysis, input/output analysis, dynamic simulation, computer simulation.

Contents

Chapter 1. Introduction

The purpose of this manual is to help users of IPASS (interactive policy analysis simulation system) gather and format the socioeconomic data needed to run IPASS, and to understand the sources and limitations of the data used in the model. Although this manual describes the preparation of a database for Alaska with the IPASS model, it should be a valuable guide for developing databases for other areas.

The IPASS model is a dynamic, recursive socioeconomic simulation model with a regional input-output table as its core module. Demand for a region's goods and services drives the model. At the same time, however, output is constrained by the availability of capital and labor. Employment and labor supply, in turn, affect the simulated demographic structure of the region.

Users need to be familiar with the publication "IPASS: An Interactive Policy Analysis Simulation System" (Olson and others 1984), which is referred to in the rest of this paper as "the IPASS user manual."

Readers who plan to use this data preparation manual in depth—that is, to compile or modify an IPASS database—will probably wish to refer to the "IPASS Technical Manual," which describes the workings of IPASS in detail. It may be obtained by writing to one of the following:

Douglas C. Olson
Pacific Northwest
Research Station
Forestry Sciences
Laboratory
3200 Jefferson Way
Corvallis, OR 97331

Professor Wilbur Maki
Department of Agricultural
and Applied Economics
231 Classroom Office Building.
University of Minnesota
St. Paul, MN 55108

Organization of This Manual

Chapter 2 provides an overview of the IPASS database. It explains the "bookkeeping" parameters used in the database and some special IPASS conventions such as subscripts, rate-of-change parameters, special sectors, and so on. It is important to read chapter 2 before reading the rest of the manual.

Chapters 3 through 9 correspond to the various "modules" (each module requires related groups of variables) into which IPASS may be conceptually divided. Each chapter lists and defines items from the database that are used in that module, then discusses their data sources and possible derivation methods.

Chapter 10 discusses procedures for validation of the data collected and calibration of the resulting simulation model.

Appendix 1 is a glossary of the variables and parameters contained in the IPASS database. The process of data "resectoring" is discussed in appendix 2. Appendix 3 gives the computer-readable format of the database.

The Alaska IPASS Database

The IPASS requires users to compile a database of about 100 socioeconomic parameters and variables pertaining to the region under study.

Data items used in the IPASS model and database can be divided into two categories: parameters, which ordinarily do not change during the course of a simulation, and variables, which do change in value with each year of the simulation.

Data Sources

Nearly all the data sources cited in this manual are agencies of the Federal or State governments. Sometimes Federal and State data overlap considerably. For example, regional employment and earnings data are available from both State and Federal agencies. Users may find it advantageous to draw on both sources in preparing their estimates.

Sometimes, the only available data are national averages. (One important example is the production-capital-to-output ratio, CAPPRRi.) Users should remember that these national data mayor may not reflect actual conditions in the study region. National-average data, therefore, are best seen as a starting point. Such data may be modified before or during calibration, based on the analyst's judgment and any region-specific data available.

A final caution in regard to government data: Although this manual emphasizes published data sources, readers should not be misled into neglecting the much greater quantity of unpublished material. Within the limitations of disclosure regulations and staff time, State and Federal agencies are often able and willing to provide access to highly useful unpublished data. "If you don't see it, ask!" should be the motto of the IPASS database builder.

A significant portion of the Alaska IPASS database is derived from the Alaska IMPLAN (interindustry model for planning) input/output (I/O) table (see Siverts and others (1983) for a description of the IMPLAN software). In this manual, we assume that users have an I/O table obtained either from the USDA Forest Service IMPLAN system or from some other source. We do not describe how I/O tables are derived. Unless noted otherwise, the term "I/O table" refers specifically to the regional input/ouput transactions table.

We assume the user's I/O table contains final demand vectors for regional exports; personal consumption expenditure; gross private capital formation; change in business inventories; and Federal, State, and local administrative government (excluding government enterprise agencies) purchases. We also assume that the table includes rows for what are referred to in this manual as "primary inputs"; that is, regional imports and the components of value added. The latter consist of employee earnings, indirect business taxes, and "other value added" (direct business taxes, depreciation allowance, dividends, and retained earnings).

In creating a new transactions table, the user needs to decide on the number and definition of the industrial sectors and occupational groups to be used in the model. These choices should be guided by the nature of the region's economy, availability of data, and the purposes for which IPASS will be used. The IPASS software can accept as many as 75 input/output sectors and nine occupational groups.

No data, published or unpublished, are available for some parameters in the database—most notably, some of the annual-rate-of-change parameters. Instead, such parameters are initially either set to zero or estimated subjectively, based on informed opinions or the analyst's best guess. These values can then be adjusted during the calibration of the model. ("Calibration," discussed in chapter 10, is the process of adjusting values of various data items so that the resulting simulation is more or less consistent with historical data for the time between the base year and the present.)

Physical Format of the Database

The IPASS model reads data from a computer file. Appendix 3 shows the precise order and column-by-column layout of each item. The items are divided into 25 "format groups."

Chapter 2. IPASS Conventions

The IPASS database includes several parameters that are not used in calculations but do serve as a framework for the rest of the model:

This chapter discusses the special "bookkeeping" parameters used by IPASS. It also explains certain conventions of IPASS notation and terminology and some of its special features. Familiarity with this chapter is essential to .understanding the rest of the manual.

Bookkeeping Parameters

2.1 NAMER — The first 10 characters of the name of the region.

2.2 NAMER1 — The rest of the name of the region (as many as 10 characters).

2.3 IYEAR — The base year of the simulation —that is, the year of record for the variables in the database.

2.4 NIS — The number of industrial sectors (NIS) to be modeled; may not exceed 75.

2.5 NOC — The number of occupational groups (occupations) to be modeled; must be a minimum of 6 and a maximum of 9.

2.6 INDUSNi — The name given to each industrial sector i; INDUSN may not exceed 1 0 characters.

2.7 NOCUP1j — The first 6 characters of the name given to occupational group j.

2.8 NOCUP2j — The rest of the name given to occupational group j (as many as 6 more characters).

Subscripts Used in This Manual

A variety of subscripts are used with the variables and parameters discussed in this manual.

The years for which the simulation is run are denoted with a subscript t. By IPASS convention, the most recently completed year of simulation is denoted by "t," the previous year by "t-1," and the current year by "t+ 1." Also by convention, t = 0 for the base year of the simulation, t = 1 for the 1 st year, and so on.

Industrial sector is denoted by i and sometimes also by k. The subscripts j and sometimes m are used for occupational groups. The subscript representing age, a, ranges from 1 to 66, where a = 1 corresponds to age 0-1, 2 to age 1-2, ..., 64 to ages 64-65, and 65 to ages 65 and above. (Note that a is greater by 1 than the chronological age of-each age class.) Some variables are divided into age groups, with a subscript of g. Sex is subscripted as s. Finally, certain parameters are allowed to range across four or five time intervals, denoted by v.

"M1" Variables

A number of IPASS variables represent last year's value of some variable. All of these contain the identifier "M1," for current year minus one, in their name.

- All variables and parameters refer specifically to the study region unless otherwise defined.

Other Conventions

- All monetary variables not otherwise specified are expressed in thousand dollars ($1,000).
- "Census" is used in this manual as shorthand for the decennial census of population.

Rates-at-Change

Certain parameters in the database represent the expected annual rate of change for particular variables. These rates of change are represented as fractional increases (if negative, fractional decreases) in the related variable. The rate of change parameters are used by IPASS in the following manner (where VAR is the associated variable and v stands for the appropriate time interval):

$VAR_t+1 = VAR_t * (1 + RATE\text{-}OF\text{-}CHANGE_v)$.

This means that variable VAR will change at a compound annual rate equal to the specified rate of change. Most rates of change in IPASS must be estimated from published projections for the variable involved. Given projected values of VAR for years t_0 to t_n, the following formula for estimating rate of change may be used:

$RATE\text{-}OF\text{-}CHANGE(t_0 \text{ to } t_n) = ([t_n\text{-}t_0]\text{th root of } [VAR(t_n)/VAR(t_0)]\} - 1$

For example, if data for VAR were available for 1977 and 1980, the rate of change would be equal to the cube root of (VAR_{1980} / VAR_{1977}), minus 1. For most States, published estimates or projections for an annual rate-of-change for use in the database are not available and must be derived from other sources. For example, in the Alaska model, growth projections to the year 2030 (U.S. Department of Commerce 1986) were initially used and then were modified during the calibration phase (see chapter 10).

Sector "NIS"

The highest numbered industrial sector in the model, NIS, represents the administrative activities of Federal, State, and local governments. It is unlike the other sectors in that administrative government is a nonproduction sector, and hence is exogenous to the I/O table. Because it is mainly unaffected by market forces, it is handled separately.

Throughout this manual, for all data items subscripted by an industrial sector code, the value for the NISth sector should be set equal to zero, except where explicitly noted.

Format of the Description

The format for description of the IPASS variables and parameters derived from published sources is:

Variable or parameter name

Data

Procedure: compilation and derivation procedure or both

Identity: the equation used to formulate the variable or parameter

Chapter 3. Investment Module

This module simulates the annual investment decisions by regional industries on replacement and expansion of their capital stocks. The IPASS model constrains these decisions based on the current and accumulated retained earnings of each sector. .

Data Requirements

The following components of the investment module are described in this chapter:

Variables:

3.1 X_i
3.2 $XM1_i$
3.3 XD_i
3.4 XS_i
3.5 XL_i
3.6 $XTOT_i$
3.7 $PRCAP_i$
3.8 $PACAP_i$
3.9 $CAPPRR_i$
3.10 $CAPPAR_i$
3.11 $DEPRPR_i$
3.12 $DEPRPA_i$
3.13 $EINVPR_i$
3.14 $EINVPA_i$
3.15 $RINVPR_i$
3.16 $RINVPA_i$

Parameters:

3.17 $PCHCOR_i$
3.18 $INVLMA_i$
3.19 $INVLMC_i$

Data Sources and Derivation Methods

Variables:

3.1 X_i — Regional gross output for the base year, for each industrial sector i:

Data: Obtained from the gross output column of the Alaska IMPLAN I/O transactions table (Siverts and others 1983). See 6.1 for agriculture and fisheries.

Procedure: X_{NIS}, by IPASS convention, is set equal to the earnings of employees in sector NIS (EARNNIS).

3.2 $XM1_i$ — Regional gross output for the year before the base or the current year, for each sector i:

See X_i (3.1).

Data: Procedure: In the absence of data for XM1, data may be approximated by setting them to either X_i or kX_i, where kis close to (and probably less than) 1.0 (for example, 0.97 of 1982 Xi). Data may be adjusted as needed when the model is calibrated.

3.3 XD_i — Gross output required to meet final demand, for each sector i:

Procedure: We assume that demand is being met by X_i. So demand is initially set equal to X_i.

3.4 XS_i — Maximum gross output given current capital stocks, for each sector i:

Procedure: Output capacity is a function of the output demanded the previous year, which we assume is initially 97 per-cent of the current year's output. Also we assume that capacity is triggered when output demanded is 80 per-cent of capacity. Therefore, set XS_i equal to (XDi * 0.97)/0.80.

3.5 XL_i — Maximum gross output, given current labor force constraints for each sector i:

Procedure: Set equal to X_i for the base year.

3.6 XTOT — Total regional gross output for all sectors:

Procedure: This variable is the sum of X_i (3.1) for all sectors.

3.7 $PHCAP_i$ Production capital stock, for each sector i:

Data: Production capital/output ratio derived for parameter CAPPRR (3.9).
Alaska gross output capacity (XS_i) for the State (3.4).

Procedure: The national production capital/output ratio was multiplied by Alaska output data for each industry. The resulting number is production capital stock for each Alaska industry. Units are in thousand dollars.

Identity: $PRCAP_i = CAPPRR_i * XS_i$.

3.8 $PACAP_i$ Pollution-abatement capital stock, for each sector i:

Data: Pollution abatement capital/output ratio derived for parameter CAP PAR (3.10).
Alaska gross output capacity (XS_i) for the State (3.4).

Procedure: The national pollution abatement capital/output ratio was multiplied by Alaska output capacity for each industry. The resulting number is pollution abatement capital stock for each Alaska industry. Units are in thousand dollars.

Identity: $PACAP_i = CAPPARj * XS_i$.

3.9 $CAPPRR_i$ Production capital/output ratio at full capacity, for each sector i:

Data: U .S. gross private capital stocks for plant and equipment (U.S. Department of Commerce 1985c). U.S. gross output data (U.S. Department of Labor 1986).

Procedure: The data were for 75 Alaska sectors. Nonmanufacturing data were not available for 1981 and 1982, so the 1980 value for each industry was inflated to 1981 and 1982 values by a U.S. output deflator.

For 1979 to 1982, total U.S. gross stocks were divided by U.S. output for each year. The lowest value from the period was selected for each industry to represent its full capacity capital/output ratio.

Identity: $CAPPRR_i$ = U.S. private gross $stocks_i$ / $USGO_i$.

3.10 $CAPPAR_j$ Pollution-abatement capital/output ratio at full capacity, for each sector i:

Data: U.S. pollution abatement gross capital stocks for plant and equipment (U.S. Department of Commerce 1985d). U.S. output data (U.S. Department of Labor 1986).

Procedure: The data were resectored to 75 Alaska sectors. Nonmanufacturing pollution abatement data are not available. Pollution abatement capital for manufacturing was estimated by use of data from two articles: "Plant and Equipment Expenditures by Business for Pollution Abatement, 1981 and Planned 1982" (Woodward 1982); "Plant and Equipment Expenditures by Business for Pollution Abatement, 1973-80 and Planned 1981" (Rutledge and O'Conner 1981).

The ratio of pollution abatement capital stock to private capital stock was derived for nonmanufacturing industries. This ratio was then applied to the U.S. pollution abatement gross stock data for nonmanufacturing for 1979 to 1982. The result was an estimate of pollution capital for the missing nonmanufacturing sectors.

For 1979 to 1982, total pollution abatement capital stocks were divided by U.S. output for each year. The lowest value was selected for each industry, representing full capacity pollution abatement capital/output. The U.S. ratio was applied to the Alaska sectors.

Identity: $CAPPAR_i$ = U.S. pollution abatement gross stocksi/$USGO_i$.

3.11 $DEPRPH_i$ Depreciation rate for production capital, expressed as a fraction of gross output, for each sector i:

Data: U.S. Department of Commerce (1985e).

Procedure: Data from 1979 to 1982 were used. Replacement investment capital was divided by U.S. gross output for the previous year. The average for the period for each industry was calculated. The average depreciation rate formed the capital depreciation parameter.

Identity: $DEPRPR_i$ = replacement investmenti(t) / $USGO_{i(t-1)}$.

3.12 $DEPRPA_j$ Depreciation rate for pollution-abatement capital is expressed as a fraction of the product of gross output for each sector i:

Data: U.S. Department of Commerce (1985e), U.S. Department of Labor (1986).

Procedure: The data were resectored to 75 Alaska sectors by use of a LOTUS conversion program. Nonmanufacturing pollution abatement data are not available. Data from the period 1979 to 1982 were used. Replacement investment for pollution-abatement capital was divided by U.S. gross output for the previous year. The average for the period for each manufacturing industry was calculated. The average depreciation rate formed the capital depreciation parameter.

Identity (for manufacturing sectors):

$DEPRPR_i$ = replacement $investment_{i(t)}$ / $USGO_{i(t-1)}$.
Because there ate no data on depreciation of pollution abatement equipment for nonmanufacturing sectors, we assume that it depreciates at the same rate as ptoduction equipment for these sectors. Therefore, $DEPRPA_i = DEPRPA_i * PACAP_i/PRCAP_i$.

3.13 EINVPRi Expansion investment in production capital, for each sector i:

Procedure: This variable is set equal to zero.

3.14 EINVPAi Expansion investment in pollution-abatement capital, for each sector i:

Procedure: This variable is set equal to zero.

3.15 RINVPRi Replacement investment in production capital, for each $sector_i$:

Procedure: This variable is set equal to zero.

3.16 RINVPAi Replacement investment in pollution abatement capital, for each sector i:

Procedure: This variable is set equal to zero.

Parameters:

3.17 PCHCORi Annual rate of change in CAPPRRi:

Procedure: This parameter currently is not used and is set to zero.

3.18 $INVLMA_i$ Liquidity preference—that is, investment limit for accumulated net business income (retained earnings), expressed as the fraction reinvested, for each sector i:

Procedure: The value for this parameter, before calibration, is 0.5 for all sectors except NIS.

3.19 $INVLMC_i$ Investment leverage ratio; represents the investment limit for current net business income, expressed as a multiple of net business income, for each sector i:

Procedure: The precalibration value for this coefficient is 12 for all sectors except NIS.

NOTE: $INVLMA_i$ and $INVLMC_i$ are used by IPASS to determine the maximum capital available for investment, as follows:

$(\text{Maximum capital investment})_{i,t} = (NBUSINC_{i,t} * INVLMA_i) + (ACNETBI_{i,t} * INVLMC_i)$.

$NBUSINC_{i,t}$ (which does not appear in the database) is simulated net (after tax) business income plus depreciation from year t. $ACNETBI_{i,t}$ is accumulated net business income over time (retained earnings). $ACNETBI_{i,t}$ can become negative to account for debt incurred for capital expenditures.

Chapter 4. Final Demand Module

All the components of final demand are derived by this subsystem. An components are summed to obtain total final demand by sector. The total final demand is the key input to the production module (chapter 5).

Data Requirements

The following components of the final demand module are described in this chapter:

Variables:

4.1 $USGO_i$
4.2 $REGMKS_i$
4.3 $EXPORT_i$
4.4 EXPORTT
4.5 $BINCH_i$
4.6 BINCHT
4.7 PCE_i
4.8 PCESUBT
4.9 PCET
4.10 PCETM1
4.11 $FGOVE_i$
4.12 FGOVET
4.13 $SGOVE_i$
4.14 SGOVET
4.15 $GPCF_i$
4.16 GPCFT
4.17 FD_i
4.18 FDT

Parameters:

4.19 $GROWTHR_{i,v}$
4.20 $REGMKSR_i$
4.21 $BINCHR_i$
4.22 PIDITR
4.23 PCER
4.24 $ELASIN_i$
4.25 $INVMAT_{k,i}$

Variables:

Data Sources and Derivation Methods

4.1 $USGO_i$ U.S. gross output for each industrial sector i:

Data: U.S. Department of Labor (1986), U.S. Department of Commerce (1984).

Procedure: 155-sector tabulation should be converted to Alaska 75 sectors. USGO for the last or NIS sector (administrative government) must be obtained separately. By IPASS convention, gross output of the NIS sector is equated to the NIS sector earnings. Government earnings were obtained from unpublished Regional Economic Information System (REIS) data.

4.2 $REGMKS_i$ Regional market share for each sector i:

Data: Alaska exports from Alaska I/O; $USGO_i$ (4.1).

Procedure: The national gross output data should be converted to 75 Alaska sectors. Alaska exports are then divided by national gross output.

Identity: $REGMKS_i = EXPORT_i / USGOj$.

4.3 $EXPORT_i$ Exports from the study region, including final purchases by all firms, tourists, and other entities not residing within the study region, for each sector i:

Data: Obtained from the export column of the Alaska IMPLAN I/O model.

4.4 EXPORTT Total exports for all sectors:

Procedure: This is the total of $EXPORT_i$ for all i.

4.5 $BINCH_i$ Business inventory change for each sector i:

Data: Obtained from the change in business inventory (sales and purchases) columns of the Alaska IMPLAN I/O model.

4.6 BINCHT Total business inventory change for all sectors:

Procedure: Add the vector of business inventory change, $BINCH_i$.

4.7 PGE_i Personal ,consumption expenditure for the output of each sector i:

Data: Obtained from the personal consumption expenditure (PCE or household) columns of the Alaska IMPLAN I/O model.

4.8 PCESUBT Total personal consumption expenditure for outputs of industries in the region:

Procedure: This variable is the total of PCE_i for sectors 1 to NIS. (See also PCET.)

4.9 PCET Total personal consumption expenditure, base year:

Procedure: This variable is obtained from the PCE column of the transactions table. It includes imports, and other primary inputs that are not included in PCESUBT.

4.10 PCETM1 Total personal consumption expenditure for the year before the base or current year:

Procedure: This variable may be approximated by the value of PCET * 0.97.

4.11 $FGOVE_i$ Federal Government purchases from regional industry i:

Data: This variable is obtained from the Federal Government expenditures column of the Alaska IMPLAN I/O model.

4.12 FGOVET Total Federal Government purchases from regional industries:

Data: $FGOVE_i$ (4.11)
Procedure: Add $FGOVE_i$ for all sectors.

4.13 $SGOVE_i$ State and local government purchases from regional industry i:

Data: Obtained from Alaska IMPLAN I/O model.

4.14 SGOVET Total State and local government purchases from regional industries:

Procedure: This variable is the total of $SGOVE_i$ for all sectors.

4.15 $GPCF_i$ Gross private capital formation; that is, the amount of each sector's output that is purchased as investment capital by other industries in the region:

Data: This is the gross private capital formation column of the Alaska IMPLAN I/O model.

4.16 GPCFT Total gross private capital formation, all sectors:

Procedure: This variable is the total of $GPCF_i$ for all sectors.

4.17 FD_i Final demand for each sector i:

Procedure: This variable is the sum of all final demand vectors ($BINCH_i$, $EXPORT_j$, PCE_i, $FGOVE_i$, $SGOVE_i$, and $GPCF_i$) for each sector.

4.18 FDT Total final demand, all sectors:

Procedure: This variable is the total of FD_i for all sectors.

Parameters:

4.19 $GROWTHR_i$,v Annual growth rate for USGO, for each sector i, for time intervals (v) 1970-79, 1980-84, 1985-89, and 1990+:

Data: u.s. Department of Labor (1986).

Procedure: The rate of growth for four time periods was estimated based on the formula:

Identity: $A_{t+n} = At\ (1 + rog)^n$, where rog = rate of growth.

4.20 $REGMKSR_i$ Annual rate of change in REGMKS, for each sector i:

Data: U.S. Department of Commerce (1986).

Procedure: U.S. and Alaska employment data were obtained from BEA (Bureau of Economic Analysis). The rate of change in employment was calculated for both the United States and Alaska for: 1973-78, 1978-83, 1983-90, 1990-95, 1995-2035. Data for some sectors that were not disclosed were estimated from REIS data.

The rate of change of regional market share for Alaska was derived by subtracting the rate of change in employment in the United States from the rate of change in employment in Alaska.

Identity: REGMKSRj = annual rate of change in employment in Alaska minus annual rate of change of employment in the United States for each industry i.

4.21 $BINCHR_i$ Ratio of business inventory to gross output for each industrial sector:

Data: U.S. Department of Commerce (1985a).

Procedure: The business .inventory data and BLS (Bureau of Labor Statistics) gross output data were converted to the 75 Alaska sectors. We assume that to produce a given .output an industry must have a certain inventory of parts on hand. With a change in output the change in business inventory is a proportional amount represented by the ratio (for each sector i): B1NCHRi = BEA business inventory / BLS U.S. gross $output_i$.

4.22 PIDITR Ratio of disposable income to personal income:

Data: U.S. Department of Commerce (1984, 1985a).

Procedure: Average ratio for the years 1982-85.

4:23 PCER Ratio of personal consumption expenditure to disposable income:

Data: U.S. Department of Commerce (1984, 1985a).

Procedure: Average ratio for the years 1982-85.

4.24 $ELASIN_i$ Income elasticity of demand for reach sector i:

Data: From the Alaska IMPLAN I/O model

Procedure: The personal expenditure data should be converted to 75 Alaska sectors. The data are then normalized by dividing personal consumption expenditure by the number of house holds in each income class.

The income elasticity of demand is created by dividing the percentage change in per capita expenditure for each industry by the percentage change between the average ,income of each income class—low medium, and high, which we set at $5,500, $20,306, and $40,000, respectively for 1982.

Identity: $\{(PCE_{iM} - PCE_{iL}) /.[(PCE_{iM} + PGE_{iL}) / 2]\} /$
$\{(AVE\ INC_{iM} - AVE\ INC_{iL}) /$
$[(AVE\ INC_{iM} + AVEINC_{iL}) /2]\}.$

The same identity was calculated for medium income to high income classes. The average between the low-to-medium class and the medium-to-high class was used for the finial PASS parameter.

4.25 $INVMAT_{k,i}$ Investment matrix, representing the fraction of sector k capital purchases supplied by capital-goods-producing sector i:

Data: u.s. Department of Commerce, Bureau of Economic Analysis (1980). The BEA investment matrix has 77 columns of capital-goods-purchasing industries, and either 155 or 43 rows of capital-goods-producing industries (depending on which version is used).

Procedure: A three-step procedure was used, as follows:

Step 1 is to calculate the fraction that each element of an industry's vector of purchases from capital-producing industries represents of total capital purchases by that industry.

Step 2 is to adjust the new matrix to reflect the absence or under representation of specific capital-goods-producing industries in the region (that is, how much is imported). This is done by multiplying each row by the appropriate location quotient (La), subject to the constraint that La is less than or equal to 1.

Step 3 requires the converting of the result in step 2 to adapt the table to Alaska sectoring, which in this case is a matrix of 74 by 74.

NOTE: The 1977 BEA investment matrix and the 1982 location quotient for each study region were used.

Chapter 5. Production and Regional Output Module

The production and regional output modules can be viewed as the hub or pivot point of IPASS. They translate the final demands calculated by the first three modules into a vector of gross output, from which employment and population are derived. They also constrain gross output according to the capacity of the region's capital stock.

Data Requirements

The only database item introduced in the production module is the Leontief matrix, also called the $[1\text{-}A]^{-1}$ or inverse matrix. This matrix is derived mathematically from the regional I/O table. It yields the vector of estimated gross output, [Xi], when multiplied by the vector of total final demand, $[FD_k]$; that is,

$[\text{LEMA } Ti_{,k}]\ [FD_k] = [X_i]$.

The Leontief inverse matrix is discussed further in the IPASS user manual (Olson and others 1984) and in Miernyk (1965).

For the best approximation of the interindustry transaction matrix and final demand vectors, IMPLAN data were modified (for example, Alaska industry-specific data series for gross output and primary inputs were introduced). A staff person from the Alaska Department of Labor, Research and Analysis Section—who had access to nondisclosable earnings and employment data—assisted in the development of the Alaska IMPLAN transaction tables.

The income payments for primary inputs—namely, indirect business taxes, proprietorial income, and property income—were adjusted to the new gross output values and IMPLAN ratios. In addition, the final demands were converted from commodity demands to industry demands by multiplying the vectors of final demands by the market share matrix (the make-coefficient matrix, where the sum of the column is equal to one (1) as opposed to the by-products matrix where the sum of the row equals one (1)). The I/O model was then rebalanced so that the sum of industry outlay equaled the sum of output.

The final adjustment involved internalizing truck, water, and air transportation activities to reflect the higher transportation costs of doing business in Alaska. One-third of IMPLAN exports for truck, water, and air transportation was redistributed to Alaska origins.

5.1 $LEMAT_{i\,k}$ The Leontief inverse matrix:

Data: Alaska IMPLAN transaction matrix.

Procedure: This matrix was derived by the Leontief inversion of the modified IMPLAN I/O transactions matrix.

NOTE: LEMAT does not include the administrative government sector (sector NIS); that is, its dimensions are (NIS-1) by (NIS-1).

Chapter 6. Employment Module

This module calculates employment demanded and earnings by sector, as well as total government employment. It is closely linked with the labor force module (chapter 7).

Data Requirements

Variables:

6.1 $EMPLOY_i$
6.2 EMPLOYT
6.3 $OUTPWK_i$
6.4 $HRWPW_i$
6.5 $WKWPY_i$
6.6 $HRWPY_i$
6.7 $OUTPHW_i$
6.8 SGEMP
6.9 FCEMP
6.10 FMEMP

Parameters:

6.11 $OUTPHWR_{i,v}$
6.12 $HRWPWR_i$
6.13 $WKWPYR_i$
6.14 RSGEMP
6.15 RFCEMP

Data Sources and Derivation Methods

Variables:

6.1 $EMPLOY_i$ Employment for each sector i:

Data: Alaska Department of Labor (1985).

U.S. Department of Labor (1986); data for the commercial fish harvesting industry cover wage and salary earners only; therefore, employment and earnings impacts will be conservative. Employment estimates for the agricultural sectors (IMPLAN I/O sectors 1-23) were derived from Alaska I/O ratios of employment to gross output.

6.2 EMPLOYT Total employment for all sectors:

Procedure: This variable is the total of the $EMPLOY_i$ vector.

6.3 $OUTPWK_i$ Annual output per worker for each sector i:

Data: X_i (3.1).
$EMPLOY_i$ (6.1).

Procedure: Convert output data from thousands of dollars to dollars by multiplying by 1,000, then divide converted output by employment.

Identity: $OUTPWK_i = X_i * 1000 / EMPLOY_i$.

6.4 $HRWPW_i$ Hours worked per week per worker for each sector i:

Data: Alaska Department of Labor (1982a).

Procedure: The hours-worked-per-week data were disaggregated to 75 Alaska sectors.

6.5 $WKWPY_i$ Weeks worked per year per worker for each sector i:

Data: Assumed 52 weeks per year, including vacation.

6.6 $HRWPY_i$ Hours worked per year per worker for each sector i:

Data: Hours worked per week (HWRPW), weeks worked per year (WKWPY).

Procedure: Multiply hours worked per week by weeks worked per year.

Identity: $HRWPY_i = HWRPW_i * WKWPY_i$.

6.7 $OUTPHW_i$ Gross output per hour worked, for each sector i:

Data: Output-per-worker data are from OUTPWK; hours-worked-per-year data are from HRWPY.

Procedure: Divide output per worker by hours worked per year.

Identity: $OUTPHW_i = OUTPWK_i / HRWPY_i$.

6.8 SGEMP State and local administrative-government employment:

Data: Alaska Department of Labor (1982b).

6.9 FCEMP Federal civilian administrative-Government employment:

Data: Alaska Department of Labor (1982b).

6.10 FMEMP Federal military (that is, noncivilian) employment:

Data: U.S. Department of Commerce (1984).

Parameters:

6.11
$OUTPHWR_{i,v}$ Annual rate of change in $OUTPHW_i$ for time period v (1970-79, 1980-84,1985-89, 1990-94, 1995+):

Data: u.S. Department of Labor (1986).

Procedure: Annual rate of growth for time intervals, v, can be estimated for the output and hours of work of the employed work force by using the annual rate of change calculation from chapter 2.

Identity: $OUTPHWR_{i},v = (OUTPHW_{i},t1 / OUTPHW_{i,t0})^{[1/(t1-t0)]} - 1$;
where
to is the beginning year and t1 is the end year of time period v.

6.12
$HRWPWR_i$ Annual rate of change in $HRWPW_i$:

Data: This parameter is set equal to zero.

6.13
$WKWPYR_i$ Annual rate of change in $WKWPY_i$:

Data: This parameter is set equal to zero until calibration, at which time it (and/or $HRWPWR_i$, immediately above) may be given nonzero values as needed to adjust overall HRWPYj.

6.14 RSGEMP Annual rate of change in SGEMP:

Procedure: RSGEMP is initially set equal to zero.

6.15 RFCEMP Annual rate of change in FCEMP:

Procedure: RFCEMP is initially set equal to zero.

Chapter 7. Labor Force Module

The chief function of the labor force module is to model the interaction between the demand for and the supply of available workers by occupational category. It serves as a bridge between the employment and population modules.

Data Requirements

Variables:

7.1 $LFPARM_g$
7.2 $LFPARF_g$
7.3 $LBFAGEG_g$
7.4 LBFT
7.5 $LBFOCUR_j$
7.6 $EMPLOYS_j$
7.7 $EMPLOYD_j$
7.8 $UNEMP_j$
7.9 UNEMPT
7.10 $COMIN_j$
7.11 $COMOUT_j$
7.12 $COMINR_j$
7.13 $COMOUTR_j$
7.14 $INMIGOC_j$
7.15 $OTMIGOC_j$

Parameters:

7.16 $LFPARMR_{g,v}$
7.17 $LFPARFR_{g,v}$
7.18 $OCUP_{i,j}$
7.19 $RCONINR_j$
7.20 $RCOMOTR_j$
7.21 $INMIGR_j$
7.22 $OTMIGR_j$

Data Sources and Derivation Methods

Variables:

7.1 $LFPARF_g$ Female labor force participation rates for 12 age groups, subscripted "g":

Data: Labor force data, U.S. Department of Commerce, Bureau of the Census (1983a), $POPF_a$ (8.2).

Procedure: Female labor force by age was grouped into 12 IPASS age classes as follows: 0-13,14-15,16-17,18-19, 20-24,25-29, 30-34, 35-44, 45-54, 55-59, 60-64, and 65+. The labor force participation rate was then estimated for each age group as a ratio of labor force to population.

Identity: $LFPARF_g$ = female labor force for age group g/sum of $POPF_a$ of 1-year age classes (a) corresponding to age group g.

7.2 $LFPARM_g$ Male labor force participation rates:

Data: Labor force data, U.S. Department of Commerce, Bureau of-the Census (1983a), $POPM_a$ (8.1).

Procedure: Male labor force by age was grouped into 12 Alaska IPASS age classes as follows: 0-13,14-15,16-17, 18-19, 20-24, 25-29, 30-34, 35-44,A5-54, 55-59, 60-64, and 65+. The labor force participation rate was then estimated for each age group as a ratio of labor force to population.

Identity: $LFPARM_g$ = male labor force for age group g/sum of $POPM_a$ of 1-year age classes (a) corresponding to age group g.

7.3 $LBFAGEG_g$ Number in labor force, male and female, by age group g, as defined for $LFPARF_g$ and $LFPARM_g$ above:

Data: $LFPARF_g$ (7.1), $LFPARM_g$ (7.2), $parM_a$ (8.1), and $POPF_a$ (8.2).

Procedure: $LBFAGEG_g$ = summation of a = first to last year of age class g [$(LFPARM_g*POPM_a) + (LFPARF_g*POPF_a)$].

7.4 LBFT Total number of persons in the labor force:

Data: $LBFAGEG_g$ (7.3).

Procedure: LBFT = summation of g = 1 through 12 $LBFAGEG_g$.

7.5 $LBFOCUR_j$ Fraction of total labor force represented by each occupation j:

Data: U.S. Department of Commerce, Bureau of the Census (1983c), LBFT (7.4).

Identity: $LBFOCUR_j$ = labor force in occupational group j / LBFT.

7.6 $EMPLOYS_j$ Employment supplied, by occupation j:

Data: LBFT (7.4), $LBFOCUR_j$ (7.5), $COMIN_j$ (7.10), and $COMOUT_i$ (7.11).

Identity: $EMPLOYS_j$ (regional labor force, by occupational group j) = LBFT * $LBFOCUR_j$ + ($GOMIN_j$ - $COMOUT_j$), where
$COMIN_j$ and $COMOUT_j$ are the number of incommuters and outcommuters, respectively, by occupation j.

7.7 $EMPLOYD_i$ Employment demanded, by occupation j:

Data: X_i (3.1), $OUTPWK_i$ (6.3), and $OGUP_{i,j}$ (7.18), the industry by occupation matrix—that is, the proportion of occupation j required by each sector i.

Procedure: Calculation based on current employment by industry and the occupational matrix $OCUP_{i,j}$, 7.18 below.

Identity: $EMPLOYD_j$ = summation i = 1 to NIS of $EMPWFD_i$* $OCUP_{i,j}$,
where
$EMPWFD_i = (X_i * 1000) / OUTPWK_i$.

7.8 $UNEMP_i$ Unemployment by occupation j:

Data: $EMPLOYS_j$ (7.6) and $EMPLOYD_j$ (7.7).

Identity: $UNEMP_j = EMPLOYS_j - EMPLOYD_j$.

7.9 UNEMPT Total regional unemployment:

Data: $UNEMP_j$ (7.8).

Procedure: This variable is the total of the $UNEMP_i$ vector.

7.10 $COMIN_i$ Number of incommuters by occupation j:

Data: Assumed to be zero for Alaska.

7.11 $COMOUT_j$ Number of outcommuters by occupation j:

Data: Assumed to be zero for Alaska.

7.12 $COMINR_j$ Fraction of otherwise-vacant jobs filled by incommuters, by occupation j:

Data: Assumed to be zero for Alaska.

7.13 $COMOUTR_j$ Fraction of those otherwise unemployed who commute to jobs outside the region, by occupation j:

Data: Assumed to be zero for Alaska.

7.141NMIGOC$_j$ Number of immigrants by occupation j:

Data: Set equal to zero for the base year.

7.15 $OTMIGOC_j$ Number of outmigrants by occupation j:

Data:. Set equal to zero for the base year.

Parameters:

7.16 LFPAHFRg,v . Annual rate of change in LFPARFg during time intervals(v) 1970-80, l981-85, 1986-90, and 1990+:

Data: U.S. Department of Labor, Bureau of Labor Statistics (1979).

7.17 LFPARMRg,v Annual rate of change in LFPARMg:

Data: Same source as for 7.16.

7.18 $OCUP_{i,j}$ Industry-occupation matrix; that is, the fraction of employment for each industry i supplied by members of occupation j:

Data: U.S. Department of Commerce, Bureau of the Census (1983c).

Procedure: The census occupation profile was aggregated to eight Alaska IPASS occupation categories: managerial, professional, technician, service, operatives, clerical, sales, and farm. The 75 Alaska industry sectors were derived from Census of Population sectors. Finally, each row entry was divided by the row total.

7.19
RCOMINR Annual rate of change in $COMINR_j$ and

7.20
RCOMOTR Annual rate of change in $COMOTR_j$:

Data: These rates of change may be set to zero in the absence of judgmental estimates and adjusted during model calibration.

7.21 $INMIGR_j$ Fraction of any unfilled jobs (net of those filled by incommuters) that will be filled by inmigrants in the coming year, by occupation j:

Data: Initially set at 1.0, then adjusted during the calibration of the model.

7.22 $OTMIGR_j$ Fraction of any unemployed workers (net of those who outcommute) migrating out of the region during the coming year, by occupation j:

Data: Initially set at 0.10 and then adjusted during the calibration of the model.

Chapter 8. Population Module

This module models the changes in each of the region's age-sex cohorts because of birth, death, and inmigration and outmigration. Migration forms the link with the labor force module and thus with the regional economy. Demographic changes, in turn, affect next year's economy.

Data Requirements

Variables:

8.1 $POPM_a$
8.2 $POPF_a$
8.3 POPMT
8.4 POPFT
8.5 POPT
8.6 POPTM1
8.7 $FERTILY_a$
8.8 $NMIGDIS_{a,s}$
8.9 $RMIGDIS_{a,s}$
8.10 NEMDEPR
8.11 REMDEPR
8.12 $INMIGM_a$
8.13 $INMIGF_a$
8.14 $OUTMIGM_a$
8.15 $OUTMIGF_a$

Parameters:

8.16 $ACFERTY_{a,v}$
8.17 MFBIRTR
8.18 $DEATHRM_a$
8.19 $DEATHRF_a$
8.20 $NMIGDIR_{a,s}$
8.21 $RMIGDIR_{a,s}$
8.22 RNEMDEP
8.23 RREMDEP
8.24 $CORTMVF_a$
8.25 $CORTMVM_a$

Data Sources and Derivation Methods

Variables:

8.1 $POPM_a$ Male population, subdivided into sixty-six 1-year age classes (age 0-1, 1-2,...,64-65, and 65+):

Data: Alaska Department of Labor (1987).

Procedure: The population data by age and gender are available from the above-mentioned publication for age classes less than 1 year to 85 and older. The male population was divided into sixty-six 1-year age classes.

8.2 $POPF_a$ Female population, subdivided as is $POPM_a$:

Data: Alaska Department of Labor (1987).

Procedure: The population data by age and gender is available from the above-, mentioned publication for age class of less than 1 to 85 and older. The female population was subdivided into sixty-six 1-year age classes (age 0-1, 1-2, ...,65+).

8.3.POPMT Total male population:

Data: $POPM_a$(8.1).

Procedure: Total of $POPM_a$ for, all ages.

8.4 POPFT Total female population:

Data: $POPF_a$ (8.2).

Procedure: Total of $POPF_a$ for all ages.

8.5 POPT Total population, base or current year:

Data: POPMT (8.3) and POPFT (8.4).

Procedure: Total of POPMT and POPFT.

8.6 POPTM1 Total population for the year before the base or current year:

Data: Alaska Department of Labor (1987).

Procedure: Total of all age classes (male + female) for previous year.

8.7 $FERTILY_a$ — Fertility rate in births per thousand females, by sixty-six 1-year age classes.

Data: Alaska Department of Labor (1986).

Procedure: The data are births per thousand women and are published in 5-year age classes from ages 10 to 49. The parameter was created by applying the 5-year age class to the 1-year age classes required for IPASS.

8.8 $NMIGDIS_{a,s}$ — Age-sex distribution of any net inmigrants from outside the study area:

Data: U.S. Department of Commerce, Bureau of the Census (1972,1984).

Procedure: The 1970 data are available for in-and-out migration by males and females for 5-year age classes. Data are also available for total in-and-out migration for 1980 by age class; however, the data sources do not break down migration between males and females. Because the 1980 migration data are not classified by sex, estimates were derived from 1980 gross totals by age and 1970 distributions by age and sex; that is, the 1970 data were used to distribute 1980 total migration by sex and age classes.

Ratios representing the age-class distributions for 1970 were created by dividing each age class by the total for male and female inmigrants forming an age-sex distribution. The differential between male and female migration distribution was then calculated.

The next step was to get an estimate of 1980 migration patterns. The same distribution procedure was applied to the 1980 migration data to create total migration distribution by age. The 1970 differential between male and female inmigrants was then applied to the 1980 total migration distribution data. The result is a breakdown of inmigration to Alaska by age and sex classes for 1980.

NOTE: The total of all the fractional components—that is, age class by sex—is equal to 1.

8.9

RMIGDIS $_{a,s}$ Age-sex distribution of net outmigrants from the region:

Data: U.S. Department of Commerce (1972); U.S. Department of Commerce, Bureau of the Census (1984).

Procedure: This procedure is similar to 8.8. Again, because the 1980 migration data are not classified by sex, estimates were derived from 1980 gross totals by age and 1970 distributions by age and sex; that is, the 1970 data were used in distributing 1980 total migration by sex and age classes. Ratios representing the age-class distributions for 1970 were created by dividing each age class by the total for male and female inmigrants forming an age-sex distribution. The differential between male and female migration distribution was then calculated.

The 1980 outmigration distribution by age was formed by dividing each column entry by the column total. The 1970 differential between male and female outmigrant distribution was applied to the 1980 total migration distribution by age to form a 1980 migration distribution by age and sex. The 1980 migration distribution by 5-year age classes was then disaggregated into sixty-six 1-year age classes.

NOTE: The sum of all the fractional components—that is, age class by sex—is equal to 1.

8.10

NEMDEPR National employee dependent rate; that is, the average population per member of the U.S. labor force age 20 or older:

Data: U.S. Department of Commerce, Bureau of the Census (1983b).

Procedure: Total U.S. population was divided by total U.S. labor force age 20 and older.

Identity: Total U.S. population/total U.S. labor force age 20+.

8.11
REMDEPR — Regional employee dependent rate:

Data: U.S. Department of Commerce, Bureau of the Census (1983a); Alaska Department of Labor (1987).

Procedure: Total Alaska population was divided by total Alaska labor force age 20 and older.

Identity: REMDEPR = Alaska population/Alaska labor force age 20+.

8.12 $INMIGM_a$ — Number of male inmigrants, by 1-year age classes:

Data: Alaska Department of Labor (1985).

Procedure: The total number of inmigrating males for 1982 was multiplied by the vector of age distribution to create a vector of male inmigrants.

Identity: $INMIGM_a$ = number of male inmigrants * $NMIGDIS_a$ (male).

8.13 $INMIGF_a$ — The number of female inmigrants by 1-year age classes:

Data: Alaska Department of Labor (1985).

Procedure: The total number of inmigrating females for 1982 was multiplied by the vector of age distribution to create a vector of female inmigrants.

Identity: $INMIGF_a$ = number of female inmigrants * $NMIGDIS_a$ (female).

8.14 .
$OUTMIGM_a$ — Number of outmigrating males, by 1-year age classes:

Data: Alaska Department of Labor (1985).

Procedure: The total number of outmigrating males was multiplied by the vector of age distribution to create a vector of male outmigrants.

Identity: $OUTMIGM_a$ = number of male out migrants * $RMIGDIS_a$ (male).

8.15
OUTMIGFa The number of outmigrating females:

Data: Alaska Department of Labor (1985).

Procedure: The total number of outmigrating females was multiplied by the vector of age distribution to create a vector of female outmigrants.

Identity: OUTMIGFa = number of female outmigrants * RMIGDISa(female).

Parameters:

8.16,
ACFERTVa,v Annual rate of change in the fertility rate ($FERTILY_a$) by 1-year age classes overtime intervals, 1970-79, 1980-84, 1985-89, and 1990+:

Data: Alaska Department of Labor (1986).

Procedure: Projections are available for 1970 to 2000 by year and by 5-year age classes. The parameter was created by using the standard rate of change equation. There are sixty-six 1-year age classes. Age class 1 represents less than 1 year, and age class 66 represents age 65 years and older.

Identity: $ACFERTVa,v = [FERTILY_{a\ (t1)} / FERTILY_{a\ (t0)}]^{[1/(t1-t0)]} -1$;
where
to is the beginning year and t1 the ending year of time interval v.

8.17 MFBIRTR Ratio of male births to total births:

Data: U.S. Department of Health and Human Services, Public Health Service (1987a).

Procedure: Male births for Alaska was divided by total Alaska births.

Identity: MFBIRTR = male births / total births.

8.18

$DEATHRM_a$ Male death rates, per capita, -by 1-year age classes:

Data: U.S. Department of Health and Human Services, Public. Health Service (1987b), Alaska Department of Labor (1987).

Procedure: Overall deaths for males for 1982 obtained from data source were in 10-year age classes.

Population data came from the Alaska population projections and were available by 1-year age classes for 1982. The number of deaths was divided by the total number of people in each age class. The result was a per-capita death rate for each 10-year age class (less .than 1 year and 1 to 4 years were separate from the 10-year breakdown). The death rate was disaggregated to 1-year age classes based on the 10-year figure. The age classes in the data set are 1 to 66; 1 is less than 1 year and 66 is 65 years and older.

Identity: $DEATHRM_a$ = male deathsa / male populationa.

8.19

$DEATHRF_a$ Female death rate by 1-year age classes:

Data: U.S. Department of Health and Human Services, Public Health Service (1987b), Alaska Department of Labor (1987).

Procedure: Overall deaths for females for 1982 obtained from data source were in 10-year age classes.

Population data came from the Alaska population projections and were available by 1-year age classes for 1982. The number of deaths was divided by the total number of people in each age class. The result was a per-capita death rate for each 1 a-year age class (less than 1 year and 1 to 4 years were separate from the 10-year breakdown). The death rate was disaggregated to 1-year age classes based on the 10-year figure. The age classes in the data set are 1 to 66; 1 is less than 1 year and 66 is 65 years and older.

Identity: $DEATHRF_a$ = female deathsa / female $population_a$.

8.20
$NMIGDIR_{a,s}$ Annual rate of change in $NMIGDIS_{a,s}$ and

8.21
$RMIGDIR_{a,s}$ Annual rate of change in $RMIGDIS_{a,s}$:

Procedure: These parameters were set equal to zero and may be adjusted during calibration.

8.22
RNEMDEP Annual rate of change in NEMDEPR and

8.23
RREMDEP Annual rate of change in REMDEPR:

Procedure: These rates of change were set equal to zero and may be adjusted during the calibration.

8.24
$CORTMVM_a$. The proportion of each of the region's male cohorts, by single-year age class, which moves in (+) or out (-) of the region for reasons other than job availability (for example, college, retirement, lack of information on job availability, or the region's attractiveness) and

8.25
$CORTMVF_a$ Same as $CORTMVM_a$ for females:

Procedure: These parameters were set equal to zero and may be adjusted during calibration as needed.

Chapter 9. Value Added Module

The value added module estimates input/output "primary inputs"—imports, wage and salary payments, business taxes, and net business income.

Data Requirements

Variables:

9.1 $IMPORT_i$
9.2 $BUSTAXR_i$
9.3 $ACNETBI_i$
9.4 $EARN_i$
9.5 EARNT
9.6 $EARPWK_i$
9.7 $NBUSINC_i$

Parameters:

9.8 $VALADR_i$
9.9 $REGIMPR_i$
9.10 $IBTR_i$
9.11 $PCHITR_i$
9.12 $EARPWKR_{i,v}$
9.13 PIEARNR
9.14 UNCOMPR
9.15 TRANPR
9.16 PROPINR
9.17 PIT
9.18 PITM1

Data Sources and Derivation Methods

Variables:

9.1 $IMPORT_i$ — [Gross] import from outside the region, by industrial sector i:

Data: Data obtained from Alaska IMPLAN model. See Siverts and others (1983).

9.2 BUSTAXRi Ratio of business income taxes to pretax business income, for each sector i:

Data: U.S. Department of the Treasury, Internal Revenue Service (1981), Alaska Department of Revenue (1984).

Procedure: Data were obtained for number of returns, net taxable income, foreign credits, and income taxes paid after credit for the United States. The average net income per return was calculated as well as the average income tax paid after credit (foreign tax credit was added back into taxes paid) for each return. The income tax rate for Alaska was applied to the average income per return to get an estimate of Alaska taxes per firm. Alaska uses a progressive corporate income tax structure that was introduced in 1981. In addition, the State uses apportionment and, for multistate or multinational firms, taxes only the portion of a firm's income that is derived from operations within Alaska. In approximating the rate structure for Alaska, data from the Alaska Department of Revenue were used.

This information included total Alaska net taxable income and total taxes paid by industry. The Alaska tax rate then was calculated by dividing total taxes paid by sector by total income of firms showing net taxable income for 1982. This information approximates the average tax rates faced by different industries under the apportionment scheme. The data were then disaggregated to 75 Alaska sectors.

The ratio was calculated by dividing total corporate income taxes paid by total pretax income.

Identity: $BUSTAXR_i$ = total taxes $paid_i$ / total $income_i$.

NOTE: $BUSTAXR_i$ includes both State and Federal income tax.

9.3 $ACNETBI_i$ Accumulated net business income after taxes, including depreciation allowances, minus funds already leveraged for investment, by industrial sector i:

Procedure: This variable was set equal to zero before calibration. (This implicitly assumes that all sectors are at equilibrium with respect to the tradeoff between liquid and fixed assets. This assumption could be relaxed during calibration.)

9.4 $EARN_i$ Employee earnings, by sector i:

Data: This variable comes from the earnings data provided by the Alaska Department of Labor. Data for the commercial fish harvesting industry cover wage and salary earners only. Therefore, the impact of earnings will be conservative. Earnings for commercial fish harvesting were calculated by assuming that the average crew person 'worked 4.2 months and earned an average of $9.,000. This translates to total annual earnings of about $214 million. For agricultural sectors, earnings were derived from gross output by use of Alaska IMPLAN ratios of earnings to gross output.

9.5 EARNT Total employee wage and salary earnings:

Procedure: Sum $EARN_i$ for all sectors.

9.6 $EAHPWK_i$ Average -earnings per worker, by sector i:

Data: $EARN_i$ (9.4) and $EMPLOY_i$ (6.1).

Procedure: Divide total earnings by total employment (units in dollars).

Identity: $EARPWK_i = (EARN_i * 1000) / EMPLOY_i$.

9.7 $NBUSINC_i$ Current net business income after taxes including depreciation allowances, by industrial sector i:

Procedure: This variable is set equal to zero.

Para meters:

9.8 $VALADR_i$ Value added/output ratio, by sector i:

Data: Total value added is obtained from the Alaska IMPLAN model (see Siverts and others 1983). X_i (3.1).

Procedure: Divide value added by gross output for each sector i.

Identity: $VALADR_i = (\text{total value added})_i / X_i$.

The opportunity exists to modify IMPLAN value-added parameters by using gross state product data produced by the U.S. Department of Commerce, Bureau of Economic Analysis (1988).

9.9 $REGIMPR_i$ Ratio of regional imports to gross output, by sector i:

Data: $IMPORT_i$ (9.1) and X_i (3.1).

Procedure: Divide regional imports by output for each sector i.

Identity: $REGIMPR_i = IMPORT_i / X_i$.

9.10 $IBTR_i$ Ratio of indirect business taxes to gross output, by sector i:

Data: Indirect business taxes are obtained from the IMPLAN model (Siverts and others 1983). X_i (3.1).

Procedure: Divide indirect business taxes by regional gross output.

Identity: $IBTR_i$ = (indirect business taxes)$_i$ / X_i.

9.11 $PCHITR_i$ Annual rate of change in $BUSTAXR_i$:

Procedure: This variable is set equal to zero.

9.12 $EARPWKR_{i,v}$ Annual rate of change in earnings per worker, including sector NIS fortime period v (1970-79, 1980-84, 1985-89, 1990-95, 1995+):

Data: U.S. Department of Commerce (1986).

Procedure: Alaska data were obtained from BEA. The rate of change in employment was calculated for Alaska for each time period v. Because of disclosure problems in the Alaska OBERS database, estimates for missing sectors were derived from REIS data (U.S. Department of Commerce 1984).

Earnings per worker were calculated for each period by dividing earnings by employment.

The rate of change in earnings per worker for Alaska was derived by the usual rate of change equation described in chapter 2.

Identity: $EARPWK_i = (EARN_i * 1000) / EMPLOY_i$;
then
EAR PWK Rt1 v =
$(EARPWKt1 ; EARPVVK_{to})^{(1/(t1 - to))}$ -1;
where
to is the beginning year and t1 the ending year of time period v.

9. 13 PIEARNR Personal income/earnings ratio:

Data: U.S. Department of Commerce(1984).

Identity: PIEARNR = PIT / EARNT.

Procedure: Personal 'income divided by earnings gives the PIEARNR variable.

9.14 UNCOMPR Ratio of unemployment :compensation payments to earnings:

Procedure: NOT USED—set 10 zero.

9.15 TRANPR Ratio of transfer payments to earnings:

Procedure: NOT USE—set to zero.

9.16 PHOPINR Ratio of proprietors' income to earnings:

Procedure: NOT USED—set to zero.

9.17 PIT Total personal income for the base year:

Data: U.S. Department of Commerce (1984).

9.18 PITM1 Total personal income for the year before the base year:

Data: U.S. Department of Commerce (1984).

Chapter 10. Model Calibration and Validation Procedures

This chapter describes general steps involved in calibrating and validating an IPASS database. "Calibration" is the process of modifying the database so that the simulation-generated values of key socioeconomic variables are acceptably close to their actual historical values (if available) and for third party forecasts over a given period of time. This period of time., which extends from the model's base year to the most recent year for which data are available, is the "baseline" period. Parameters and rates .pf change that allow simulation of the baseline period can be used in estimating future values when there are no third-party forecasts.

Because no two regions are alike, to spell out the process of calibration "cook-book" form is not possible. Rather, the principles laid out in this .chapter are to be viewed as guidelines.

Preliminaries

1**. Why calibration?** A user new to IPASS might understandably wonder why his or her painstakingly constructed database would need more than a small amount of fine tuning. There are several reasons.

Trends based on national data were used to estimate some of the variables and parameters. Examples might include key parameters such as CAPPRRj, $OCUP_{i,j}$, and $INVMAT_{k,i;}$ and some of the rate-at-change parameters such .as $EARPWKR_i$, $OUTPHWR_i$, LFPARM(F)Rg. Other variables (for example, $POPM(F)_a$ and $LFPAHM_g$) ordinarily must be estimated by interpolating or extrapolating from decennial census data. A structural change in the economy might negate the usefulness of past trends for forecasting.

Even if all the historical data for the base year itself were completely accurate, certain key parameters cannot be accurately estimated until the calibration stage. These parameters embody regional trends that are not easily derived from available data. (One important example is $REGMKSR_i$, the rate of change in regional market share.)

The IPASS model is flexible enough to allow incorporation of almost any of a region's idiosyncrasies into the simulation. As calibration proceeds, various parameters will be "massaged" to bring the simulation into better agreement with recorded history. Through this process, the user inevitably gains a better understanding of the region and its unique socioeconomic features. Furthermore, the regional trends thereby incorporated into the database serve to improve the realism of simulations that extend into the future.

It is important to stress that the user's goal is not to try to force the simulation to match the year-to-year fluctuations in value added, employment, and so forth. What is called for is simply a reasonably close match with the overall historical trends and projections.

2. **Baseline data.** An essential preliminary step is to gather as much year-by-year, detailed historical data for the baseline period as is reasonably possible; ideally, regional data for gross output, gross product; earnings, employment, unemployment, and population, and conceivably others the user might have a particular interest in. Finding published data for all these variables for a given region would be unusual, however.

Gross output data are generally difficult to obtain for years other than those in which the various economic censuses (for example, Census of Manufactures) are conducted. Production data are sometimes available at the State level for some industries, however, particularly resource sectors such as agriculture, minerals, logging, and fisheries. These data may be presented as "value of sales" or "value of shipments." These values, however, are approximations because gross output represents production that may not always be sold or shipped the year it is manufactured, and shipments may come from inventories.

For the sectors for which gross output data are not generally available, gross regional product (GRP) data—if available—are a good second choice for calibration. The GRP data are the same as value added (except when GRP is defined to include income from sites outside the region—that is, gross domestic product), so it would be used to calibrate simulated value added.

Finally, employee earnings are a major and, generally, a fairly stable component of value added and, therefore, can be used when GRP is not available.

Technical Tips

1. **Using IPASS Special Programming Options.** During calibration, the user often needs to know about the changing values of variables not found in any of the display tables. One way to obtain this information is to have IPASS save a complete, updated database for one or more years of the simulation (see question 17 in appendix E of the IPASS user manual). A simpler way of getting specific information about variables, however, is to use the "special IPASS programming" options referred to on pages 39-50 of the IPASS user manual (Olson and others 1984).

2. **Using IP ASS to modify an existing database (the zero-years simulation).** A special feature of IPASS allows, it to be used as a tool for modifying a database. The first step is to invoke the parameter-change feature of IPASS by answering "Yes" to question 5, "Do you want to modify the original database?" (Question numbers here refer to the flow chart on pages 65-69 of the user manual.) For help on how to use the parameter-change feature, see- pages 50-54 of the user manual.

Once the desired parameter changes have been made, question 7: "How many years do you want to simulate?" needs, to be, answered with "0" (zero)—hence, the phrase "zero-years simulation." This will cause IPASS to skip to. question 16. To save the modified database, answer "Yes" to question 17, "Save database for future use?" and then specify a new name for the new database when prompted by IPASS.

Initial Steps in Calibration

1. **The initial simulation.** The first step in the calibration process is to conduct an IPASS simulation with the new ,database. This should cover several years and most, if not all, of the display tables. There are two purposes for this initial simulation.

The first is to find data-entry errors. These are often, obvious from a review of the data tables.

Figure 1 illustrates this type of error and is the first of a series of examples in this chapter based on. the southeast Alaska region. In this; ,example, the database value-added ratio for "other gov" ($VALADR_{NIS}$) was inadvertently set to zero. As a result, base-year value added for sector 75 (sector NIS) shows up as zero in figure 1. Even more 'glaring is the negative value for other value added for that sector (IPASS computes other value added by deducting earnings from value added).

Missing or extra lines in the database will also show up at this stage. A missing line will cause IPASS to return an "EOF (end of file) encountered" error message. Extra lines will usually cause gross errors in the simulation.

INTERMEDIATE PURCHASES, IMPORTS, AND VALUE ADDED INDICATORS OF SPECIFIED SECTORS,
SOUTHEASTERN ALASKA , 1977.

SECTOR			VALUE ADDED			
NO.	NAME	INTERMEDIATE PURCHASES	EARNINGS	OTHER	TOTAL	IMPORTS
		(THOU)	(THOU)	(THOU)	(THOU)	(THOU)
1	DAIRY&POUL	0.	0.	0.	0.	0.
2	MEAT ANIML	0.	0.	0.	0.	0.
3	GRAINS	0.	1.	4.	5.	1.
4	OTHER CROP	0.	1.	5.	6.	1.
5	AG SERV	225.	412.	674.	1086.	477.
6	FORESTRY	635.	570.	10818.	11416.	1970.
7	FISHERY	4977.	34190.	50000.	84190.	21310.
73	ST&LOC ENT	5356.	5409.	1511.	9920.	4673.
74	SCRAP	43.	0.	0.	0.	1038.
75	OTHER GOV	182040.	181539.	-181539.	0.	0.
	TOTAL	399870.	442581.	158094	600675.	206315.

Figure 1—Spurious value-added-to-output ratio (caused by improper data entry) generates an inconsistent total for value added for the "other gov" sector.

Besides revealing typographical errors, the initial simulation will help a user check for internal consistency within the database. Variables to check for consistency between the database and the base-year display-table values (fig. 1) include $EMPLOYD_j$ (employment demanded), $EMPLOYS_j$ (employment supplied), $UNEMP_j$ (unemployment), and the "totals" variables. Sharp differences between base-year and year-one values can also signal inconsistencies. One important example of the latter problem involves $GPCF_i$, as discussed below.

2. Reconciling GPCF and INVMAT. The GPCF (gross private capital formation) vector in the database is from the Alaska IPASS IMPLAN model. For all years after the base year, however, simulated GPCF is the product of the vector of projected total investment and INVMAT (investment matrix from Bureau of Labor Statistics sources). The data from the two sources must be reconciled. For sectors with large discrepancies in GPCF between the base year and the first year of simulation, the corresponding **column(s)** of INVMAT may be increased or decreased. The analyst may also choose to modify base-year $GPCF_i$ by shifting some of the GPCF dollars to (or from) another component of final demand, such as $EXPORT_i$. The analyst must decide which method produces the more realistic portrayal of the region. If there is no clear rationale either way, discrepancies in GPCFmay be handled by allocating half the difference to GPCF and half to INVMAT.

The following ,examples illustrate two ways of handling differences in GPCF (figs. 2 and 3).

Example 1: A typical case. For sector 51, the "Truck Transportation" sector, there is no basis for preferring the base-year value for GPCF to its simulated value for the first year.

In this situation, the best approach to reconciling the two values is to divide the difference between them equally. Accordingly, both $GPCF_{51}$ and column 51 of INVMAT will be adjusted so that simulated GPCF for both 1977 and 1978 will equal its average value over the two years—that is, 195.

In addition, another component of final demand must be adjusted to offset the change in GPCF so that total final demand remains constant. Here, exports were adjusted. This, in turn, also necessitated a small adjustment to $REGMKS_{51}$.

	GPCF before adjustment		GPCF after adjustment	
Sector	1977	1978	1977	1978
51 Truck Tran	50	341	195	194
52 Water Tran	176	20	176	176

Figure 2—Gross private capita! formation for southeastern Alaska for selected sectors, before and after GPCF reconcilement.

```
DO YOU WANT TO MODIFY THE ORIGINAL DATA BASE?
[YES OR NO]
Y

WHAT PARAMETERS DO YOU WANT TO MODIFY?
TYPE UP TO TEN NUMBERS [1-120]
19,17,2,117,4

HOW DO YOU WANT TO MODIFY
19   GROSS PRIVATE CAPITAL FORMATION (FIXED)
1,51,1,-146
SECTOR 51, 1  WAS ...      348.70000   IS ...      194.70000
0

HOW DO YOU WANT TO MODIFY
17   INVESTMENT MATRIX
6,51,292.
SECTOR  1,51  WAS ...         .00128   IS ...         .00581
SECTOR  2,51  WAS ...         .00128   IS ...         .00581
SECTOR  3,51  WAS ...         .00288   IS ...         .00784
SECTOR  4,51  WAS ...         .00288   IS ...         .00784
SECTOR  5,51  WAS ...         .00095   IS ...         .00372
SECTOR  6,51  WAS ...         .00077   IS ...         .00308
SECTOR  7,51  WAS ...         .00077   IS ...         .00308


SECTOR 73,51  WAS ...         .00062   IS ...         .00242
SECTOR 74,51  WAS ...         .00000   IS ...         .00000
SECTOR 75,51  WAS ...         .00000   IS ...         .00000


0

HOW DO YOU WANT TO MODIFY
2   REGIONAL EXPORTS
1,51,1,146.
SECTOR 51, 1  WAS ...     1681.20000   IS ...     1827.20000
0

HOW DO YOU WANT TO MODIFY
117   REQUIRED OUTPUT OF FINAL DEMAND
1,51,1,8.1
SECTOR 51, 1  WAS ...    11879.32300   IS ...    11887.42300
0

HOW DO YOU WANT TO MODIFY
4  REGIONAL MARKET SHARE
1,51,1,.00005862
SECTOR 51, 1  WAS ...         .00005   IS ...         .00006
0

DO YOU WANT TO MAKE ANY OTHER PARAMETER MODIFICATIONS?
[YES OF NO]
N

HOW MANY YEARS DO YOU WANT TO SIMULATE?
   0

YEAR 1977 HAS BEEN REACHED
DO YOU WANT TO SEE THE NEW DATA TABLES?
[YES OR NO]
N

SAVE 1977 DATA BASE FOR FUTURE USE?
Y
UNDER WHAT FILE NAME DO YOU WANT TO SAVE THE DATA?
THE NEW DATA BASE HAS BEEN SAVED UNDER THE NAME
   IP77NEX8
PURGE IT WHEN YOU NO LONGER NEED IT BY TYPING
PURGE,IP77EX8
CONTINUE SIMULATION?
N
IT HAS BEEN A PLEASURE TO WORK WITH YOU.
HAVE A NICE DAY
```

Figure 3—Using the parameter change option to increase. purchase of sector 51 for GPCF by 292 percent.

The various adjustments required are summarized in general form below. Values for sector 51 are given in parentheses. Figure 3 shows how these changes to the example database were made by use of the IPASS parameter change feature. Their effect on the simulation can be seen in figure 2.

Define ADJ = ($GPCF_{i,t}$=O - $GPCF_{i,t}$=1)/2. (Example 1: ADJ = (50 - 341)/2 = -146.) Database variables are then adjusted as follows:

(a) Add ADJ to $GPCF_i$.

(b) Subtract ADJ from $EXPORT_i$.

(c) Recalculate $REGMKS_i$ = $REGMKS_i$ - ADJ_i / $USGO_i$.

(d) Change column i of INVMAT by a percentage corresponding to the fraction -ADJ / $GPCF_i$,t=1. (Example 1: 146/50 = 292 percent.)

Example 2: A special case. At times the analyst may have a rationale for regarding either base-year $GPCF_i$ or $GPCF_i$ for a subsequent year as correct. For example, the GPCF vector from the IMPLAN I/O table may be more representative of the region than is INVMAT, which is derived from national data.

Just the reverse happens with water transportation (sector 52). $GPCF_{52}$ is much larger in year 1 than in the base year. Water transportation in the southeast Alaska region is known to be proportionately much more important in the study region than in the United States. This provides a clear rationale for choosing the larger (1978) value.

The needed adjustments are thus:

(a) Set base-year $GPCF_i$ equal to $GPCF_{i,t=1}$. (Example 2: 196 in place of 20.)

(b) No change to INVMAT.

(c) Change $EXPORT_i$ as needed to offset the change in $GPCF_i$.
(Example 2: 20 - 196 = -176.)

(d) Adjust $REGMKS_i$ for consistency with adjusted $EXPORT_i$ (see example 1).

Calibrating Key Variables

Calculated values of certain variables determine the values of other variables in a set sequence of cause and effect. For example, levels of gross output determine the desired level of employment that provokes inmigration or outmigration. To calibrate the simulation-that is, to adjust certain parameters or variables to bring simulated values into rough alignment with the desired projected values is, therefore, necessary. This is accomplished one variable at a time and in the approximate order of its computation by IPASS.

The recommended order of calibration is:
1. Gross output or, if it is not available, its proxies—value added and earnings.
2. Employment.

3. Earnings (if not used as a proxy for gross output).
4. Population.
5. Labor force and unemployment.

The sequence of calibration is iterative, but the recommended order is such that changes in succeeding variables have the least possible impact on preceding variables.

The analyst's objective will influence the calibration process. An investigation of employment trends, for example, would not require as rigorous a calibration of GPCF as would an analysis of investment trends. Finally, keep in mind that it will always be possible to force the model to achieve more precision. The point at which the user Should stop calibration is mainly a matter of judgment.

1. **Gross output or value added.** These two variables are calibrated most readily by changing the simulated level of regional exports. This, in turn, is done by adjusting REGMKSRi (rate of change in regional market share). This can be illustrated by the sawmill sector in southeastern Alaska. Table 1 shows estimates for historical value added from the base year through 1983. Although these estimates fluctuate considerably over the 7-year period, there is a gradual downward trend. The "precalibration" column in table 1 gives the results of a simulation before any calibration was attempted.

Because of the fluctuations just mentioned, the analyst must first select a single target value (and year) representative of the overall trend. Ordinarily, the historical value for the latest year (1983, in this case) is used. The 1983 value, however, is sharply lower than those for preceding years. The more gradual overall trend, therefore, is represented by a proxy value for calibration purposes. In this case, a value of 17,500-roughly midway between the 1982 and 1983 values—is used to calibrate 1983 value added.

Table 1—Historical and simulated value added, sawmills sector, southeastern Alaska, 1977-83

Year	Historical value added	Simulated value added: Pre-calibration	Simulated value added: Post-calibration	Deviation of simulated value from historical value
	- - - - - - - - - - *Thousand dollars*	- - - - - - - - -		*Percent*
1977	20,737	20,737	20,737	—
1978	17,691	20,141	19,432	+10
1979	24,053	19,740	18,272	–24
1980	25,029	20,226	18,062	–28
1981	20,471	20,696	17,933	–12
1982	19,608	20,859	17,696	–10
1983	15,429	21,357	17,512	+13

The next step is to compute the level of exports for the target year that would yield the desired value added. First, we estimate desired gross output:

$$X_{i,1983} = X_{i,1977} * (\text{value added}_{i,1983} / \text{value added}_{i,1977}) = 66{,}059 * (17{,}500/20{,}737) = 55{,}747.$$

Next, because $X_i = FD_i$ + intermediate salesi, we modify equation (1), section (4.20), to obtain desired exports; as follows:

$$EXPORT_{i,1983} = X_{i,1983} - (\text{intermediate sales}_{i,1983} + \text{other } FD_{i,1983}).$$

Using values from a previous simulation for the parenthetical expression above, we obtain:

$$EXPORT_{i,1983} = 55{,}747 - 12{,}886 = 42{,}861.$$

Finally, rearranging equation (2), section (4.20), using values from the southeastern Alaska database for $GROWTHR_{i,v}$, and solving:

$$\begin{aligned}(1'+ REGMKSR_i)6 &= (EXPORT_i, 19831EXPORTj, 1977) / [(1 + GROWTHR_{i,1})^2 * (1 + GROWTHR_{i,2})^4] \\ &= (42{,}861/51{,}865) / [(1-0.0120)^2 * (1 + 0.01316)^4] \\ &= - 0.03581;\end{aligned}$$

$$REGMKSR_i = -0.04119.$$

Table 1 shows simulated value added from this new REGMKSR, along with the corresponding percentage deviation from the historical estimates.

Although the export vector is the main component of final demand that might be manipulated for calibration purposes, there may be others. Occasionally, for example, it may be appropriate to adjust $GPCF_i$. Suppose that, in response to rising levels of investment, $GPCF_i$ seems to grow disproportionately for a given sector. The corresponding column in INVMAT could then be reduced by an approximate proportion.

Another factor that can sometimes influence gross output is the supply of funds available for investment. If the after-tax cash flow of a sector is lower than its need for investment capital, investment will be unable to keep up with demand. This may be appropriate in some instances. In other instances, however, the analyst may want to remove the inhibiting effect of capital shortage on investment; a number of methods can be used.

The first step is to find out more about the simulated flow of cash for investment by the industry in question. This is done via IPASS special programming option 8, "DO YOU WANT TO PRINT OUT COMPONENTS OF BUSINESS INCOME CALCULATIONS?" The simulation should be run for at least 2 or 3 years to give the analyst a fairly clear picture of what is occurring.

Then, if simulated $NBUSINC_i$ shows up as negative or close to zero, its value will need to be increased. This can be done by reducing any of the other components of value added—earnings, indirect business taxes, and direct business taxes.

Means of adjusting earnings ($EARN_i$) are discussed below (section 3). Indirect and direct business taxes may be adjusted by their tax-rate parameters. These are, respectively, $IBTR_i$ (which represents the fraction of gross output paid as indirect taxes) and $BUSTAXR_j$ (the fraction of pretax business income paid as tax). The ratio of value added to gross output (V ALADR) can also be increased. Although this "unbalances" the I/O model, it may be justifiable if the model represents a time period when prices were depressed for a given industry.

Once $NBUSINC_i$ reaches a satisfactory level, the user may vary the resulting flow of cash for investment by adjusting $INVLMC_i$, which represents the fraction of $NBUSINC_i$ available for investment. The user might also choose to give $ACNETBI_i$ nonzero values—for example, for an industry that is investing despite relatively low profitability.

2. **Employment.** Once calibration of gross output/value added is complete, employment maybe adjusted by varying output per worker. Output per worker, in turn, is the product of output per hour worked, hours worked per week, and weeks worked per year. Specifically, IPASS derives employment as follows:

$$EMPLOY_i = X_i/OUTPWK_i = X_i \mathrel{I} (OUTPHW_{i},v * HRWPW_i * WKWPY_i).$$

Each variable in the denominator of the right-hand-side expression can be made to vary over time by adjusting the variables associated rate-of-change parameter. The relevant equation is:

$$(EMPLOY_{i},\sqrt{}X_{i,t}) \mathrel{I} (EMPLOY_{n}+_{t,i}\sqrt{}X_{n}+_{t,i}) = OUTPHW_{i,t}\,(1 + OUTPHWR_{i,v})^{n} * HRWPW_{i,t}\,(1 + HRWPWR_{i})^{n} * WKWPY_{i,t}\,(1 + WKWPYR_{i})^{n.}$$

Which rate(s) of change should be adjusted? Special knowledge about a given industry-for example, changes in commodity prices or production technology over the calibration period-may suggest the appropriate choice. Otherwise, for simplicity either $HRWPWR_i$ or $WKWPYR_i$ can be used. An exception is an industry in which the trend of output per worker itself is known to change. In that event, the time-interval subscripting of $OUTPWHR_i$ enables the rate of change in output per worker to be varied over time. In solving for $OUTPHWR_{i,v}$, note that the equation given above becomes slightly more complicated than is shown if the period from year t to t+n overlaps more than one of the time intervals denoted by the subscript v.

3. **Earnings.** IPASS computes earnings as a function of employment. Earnings, therefore, are ordinarily calibrated simply by adjusting the, rate of change in earnings per worker ($EARPWKR_{i,v}$). This parameter may be solved in the following equation:

$$EARNt+n_{,i} = EMPLOY_{t}+_{n,i} * EARPWKt_{,i} * (1 + EARPWKR_{i,v})^{n}.$$

This procedure should not be followed, however, if earnings is the first variable to be calibrated. Instead, earnings are adjusted by manipulating gross output, as discussed above.

NOTE: IPASS calculates employment and earnings for administrative government (sector NIS) in a different manner than for other sectors. The following equations summarize the algorithm involved:

$$
\begin{aligned}
SGEMP_{t+1} &= SGEMP_t * (PCESUBT_{t+1}/PCESUBT_t) * (1 + RSGEMP).\\
FCEMP_{t+1} &= FCEMP_t * (POP_t/POP_{t-1}) * (1 + RFCEMP).\\
FMEMP_{t+1} &= FMEMP_t.\\
EMPLOYNIS_{,t+1} &= SGEMP_{t+1} + FCEMP_{t+1} + FMEMP_{t+1}.\\
EARNNIS_{,t+1} &= EMPLOYNIS_{,t+1} * EARPWKNIS_{,t+1}.
\end{aligned}
$$

The fact that total population (POPT) and total personal consumption expenditures for local production (PCESUBT) are part of the above algorithm means that sector-NIS must be calibrated iteratively—that is, as a series of increasingly better approximations. The first of these adjustments is best accomplished at this point—that is, before population is calibrated. Then, when population is itself adjusted, simulated PCESUBT will change. The first two equations above show that as these latter two variables shift, so will sector-NIS employment. The analyst may switch to and from calibrating the sector-NIS variables and calibrating population for as many iterations as are needed to approximate historical trends.

One additional note: as was mentioned earlier in this manual, in IPASS, X_{NIS} and value-added$_{NIS}$ are defined as equal to $EARN_{NIS}$. This means that to avoid discrepancies, the following conditions should be met:

(a) $OUTPWK_{NIS} = (OUTPHW_{NIS} * HRWPW_{NIS} * WKWPY_{NIS}) = EARPWK_{NIS}$.
(b) $OUTPHWR_{NIS,v}$, $HRWPWR_{NIS}$, and $WKWPYR_{NIS}$ should have the same net effect on $OUTPWK_{NIS}$ as $EARPWKR_{NIS}$ has on $EARPWK_{NIS}$.
(c) $VALADR_{NIS}$ should equal 1.

4. Population. Total population may be calibrated by any or all of the three types of population change that are incorporated into an IPASS simulation: natural (births minus deaths), economic (employment-related) migration, and noneconomic (nonemployment-related) cohort migration.

The first, natural change in population, ordinarily need not be manipulated during the calibration because available.dataon fertility and death rate are generally reliable.

Another method is to vary the average population impact of each economic migrant. In other words, one may change the ratios representing the average total number of household members who enter or leave the region because of a worker's employment-related migration. Either the ratios themselves (REMDEPR and NEMDEPR) or their rates of change (RREMDEP and RNEMDEP) may be adjusted.

Finally, nonemployment-related migration (which might include students, retired people, and unsuccessful job seekers) can be adjusted. Noneconomic migration is manipulated by the $CORTMVM_a$ and $CORTMVF_a$ vectors. This can be a very important step in calibrating population.

Some analysts may wish to calibrate not only total population but also its distribution by age and sex. One means of doing this is by $NMIGDIS_{a,s}$ and $RMIGDIS_{a,s}$, which specify age and sex distribution of those migrating in and out for economic reasons. A second approach is to manipulate $CORTMVM_a$ and $CORTMVF_a$ to alter the distribution of noneconomic migration.

5. Labor force and unemployment. IPASS computes unemployment directly from projected labor force. Their relation in the IPASS algorithm may be expressed as follows:

$$\begin{aligned} UNEMPj_{,t+1} = {} & (LBFTt+1 * LBFOCUR_j) - \text{actual } EMPLOY_{j,t+1} \\ & + (COMIN_{j,t+1} - COMOUT_{j,t+1}). \end{aligned}$$

Total labor force is computed by multiplying labor force participation rates for each age group and sex into the corresponding groupings of population and totaling the result. Therefore, the principal means of calibrating total labor force is by altering labor force participation rates. This is done through their rate-of-change parameters, $LFPARFR_{g,v}$ and $LFPARMR_{g,v}$. When manipulating these rates, the analyst may use his or her knowledge of local trends. One problem caused by rate of change in female labor participation is that although it has increased historically and is expected to continue, many new participants work only part time. IPASS, however, works with annual average employment; hence, three workers, for example, may share one IPASS job and leave two for IPASS unemployment. To avoid high unemployment and outmigration, it has been necessary to reduce $LFPARFR_{g,v.}$

Once labor force is calibrated, any additional adjustments to unemployment may be accomplished by the variables affecting commuting. These are $COMINR_j$ and $COMOTR_j$ and their rate-of-change parameters $RCOMIN_j$ and $RCOMOTR_j$. (The base-year distribution of unemployment across occupational groups may also be altered by changing $LBFOCUR_j$.)

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Appendix 1. Glossary of Variables and Parameters

Variable name	Chapter	Format group	Definition
$ACNETBI_i$	9.3	20	Accumulated net business income after taxes, including depreciation allowances, by sector i
$ACFERTY_{a,v}$	8.16	2	Annual rate of change in the fertility rate (FERTILY) by 1-year age classes over time intervals (v) 1970-79, 1980-84, 1985-89, and 1990+
$BINCH_i$	4.5	10	Business inventory change over the previous year, in thousand dollar ($1,000) units, by sector i
$BINCHR_i$	4.21	20	Ratio of change in business inventory to change in gross output, by sector i
BINCHT	4.6	11	Total business inventory change ($1,000)
$BUSTAXR_i$	9.2	20	Ratio of business income taxes paid to pre-tax business income, by sector
$CAPPAR_i$	3.10	22	Pollution-abatement-capital/output ratio, by sector i

$CAPPRR_i$	3.9	21	Production-capital/output ratio, by sector i
$COMIN_j$	7.10	7	Number of incommuters (those who work in but live outside the region), by occupation j
$COMINR_j$	7.12	7	Fraction of otherwise vacant jobs filled by incommuters, by occupation j
$COMOUT_j$	7.11	7	Number of outcommuters (those who work outside but live inside the region), by occupation j
$COMOUTR_j$	7.13	7	Fraction of those otherwise unemployed who commute to jobs outside the region
$CORTMVF_a$	8.24	5	Fraction of each female cohort by 1-year age classes that move in (+) or out (–) of the region for reasons other than job availability (for example, college or retirement)
$CORTMVM_a$	8.25	5	Same as $CORTMVF_a$ for male cohorts
$DEATHRF_a$	8.19	2	Female death rate (per capita) by 1-year age classes
$DEATHRM_a$	8.18	2	Male death rate (per capita) by 1-year age classes
$DEPRPA_i$	3.12	22	Depreciation rate for pollution-abatement capital (expressed as a fraction of gross output), by sector i
$DEPRPR_i$	3.11	21	Depreciation rate for production capital (expressed as a fraction of gross output), by sector i
$EARN_i$	9.4	16	Worker earnings ($1,000), by sector i
EARNT	9.5	18	Total worker earnings for all sectors ($1,000)
$EARPWK_i$	9.6	16	Average earnings per worker by sector i
$EARPWKR_{i,v}$	9.11	16	Annual rate of change in $EARPWK_i$ over time intervals (v) 1970-79, 1980-84, 1985-89, 1990-94, and 1995+
$EINVPA_i$	3.14	22	Expansion investment in pollution abatement capital ($1,000), by sector i

$EINVPR_i$	3.13	21	Expansion investment in production capital ($1,000), by sector i
$ELASIN_i$	4.24	13	Income elasticity of demand for the output of each sector i
$EMPLOY_i$	6.1	14	Number of employees, by sector i
$EMPLOYD_j$	7.7	8	Employment demanded, by occupation j
$EMPLOYS_j$	7.6	8	Employment supplied, by occupation j
EMPLOYT	6.2	19	Total employment for all sectors
$EXPORT_i$	4.3	10	(Gross) exports from the study region ($1,000), by sector i
EXPORTT	4.4	11	Total exports from the study region ($1,000)
FCEMP	6.9	17	Federal civilian administrative Government employment
FD_i	4.17	10	Final demand ($1,000), by sector i
FDT	4.18	11	Total final demand ($1,000)
$FERTILY_a$	8.7	2	Fertility rate in live births per 1,000 females, by sixty-six 1-year age classes
$FGOVE_i$	4.11	10	Federal Government purchases ($1,000) from each industry i
FGOVET	4.12	11	Total Federal Government purchases ($1,000)
FMEMP	6.10	17	Federal military employment
$GPCF_i$	4.15	10	Gross private capital formation ($1,000), by sector i
GPCFT	4.16	11	Total gross private capital formation ($1,000)
$GROWTHR_{i,v}$	4.19	1	Annual rate of growth of $USGO_i$ for time intervals (v) 1970-79, 1980-84, 1985-89, 1990-94, and 1995+
$HRWPW_i$	6.4	15	Average hours worked per week per worker, by sector i

$HRWPWR_i$	6.12	15	Annual rate of change in $HRWPW_i$, by sector i
$HRWPY_i$	6.6	15	Average hours worked per year per worker, by sector i
$IBTR_i$	9.9	20	Ratio of indirect business taxes to gross output, by sector i
$IMPORT_i$	9.1	20	(Gross) imports from outside the region ($1,000), by sector i
$INDUSN_i$	2.6	9	The name given to each industrial sector (10 characters maximum)
$INMIGF_a$	8.13	4	Number of inmigrating females by 1-year age classes
$INMIGM_a$	8.12	4	Number of inmigrating males by 1-year age classes
$INMIGR_j$	7.21	8	Fraction of any unfilled jobs (net of those filled by incommuters) that will be filled by inmigrants during the coming year, by occupation j
$INMIGOC_j$	7.14	7	Number of inmigrants, by occupation j
$INVLMA_i$	3.18	13	Investment limit for accumulated net business income (retained earnings), expressed as the fraction re-invested, by sector i
$INVLMC_i$	3.19	13	Investment limit for current net business income, expressed as a multiple of net business income, by sector i
$INVMAT_{k,i}$	4.25	25	Investment matrix: the fraction of sector k capital purchases supplied by capital-goods-producing sector i
IYEAR	2.3	1	The "base year" for the simulation; that is, the year of record for database variables
$LBFAGEG_g$	7.3	6	Number in labor force by age groups (g) 0-13 years, 14-15, 16-17, 18-19, 20-24, 25-29, 30-34, 35-44, 45-54, 55-59, 60-64, and 65+

$LBFOCUR_j$	7.5	7	Fraction of the total labor force represented by each occupation j
LBFT	7.4	19	Total labor force
$LEMAT_{i,j}$	5.1	24	The $(I-A)^{-1}$ input-output matrix, also called the inverse or Leontief matrix
$LFPARF_g$	7.2	6	Female labor force participation rates for 12 age groups (see LBFAGEG above)
$LFPARFR_{g,v}$	7.17	6	Annual rate of change in $LFPARF_g$ for time intervals (v) 1970-79, 1980-84, 1985-89, and 1990+
$LFPARM_g$	7.1	6	Male labor force participation rates by age group (see LBFAGEG above)
$LFPARMR_{g,v}$	7.16	6	Annual rate of change in $LFPARM_g$ (see LFPARFR above)
MFBIRTR	8.17	3	Ratio of male births to total births
NAMER	2.1	1	Name of region (first 10 characters)
NAMER1	2.2	1	Name of region (second 10 characters)
NEMDEPR	8.10	3	National employee dependent rate; that is, average population per member of the labor force who is age 20 or older
NIS	2.4	1	Number of industrial sectors
$NMIGDIR_{a,s}$	8.20	5	Annual rate of change in $NMIGDIS_{a,s}$
$NMIGDIS_{a,s}$	8.8	5	National migration distribution; that is, age-sex distribution of any net outmigrants from the region, by 1-year age classes (a) and sex (s)
NOC	2.5	1	Number of occupational groups
$NOCUP1_j$	2.7	8	The first six characters of the name given to occupational group j
$NOCUP2_j$	2.8	8	The rest of the name given to occupational group j

$OCUP_{i,j}$	7.18	23	Industry-occupation matrix: the fraction of employment in industry i represented by occupation j
$OTMIGOC_j$	7.15	7	Number of outmigrants by occupation j
$OTMIGR_j$	7.22	8	Fraction of any unemployed workers (net of those who outcommute) migrating out of the region in the coming year, by occupation j
$OUTMIGM_a$	8.14	4	Number of outmigrating males, by 1-year age classes
$OUTMIGF_a$	8.15	4	Number of outmigrating females, by 1-year age classes
$OUTPHW_i$	6.7	15	Output per hour worked per worker, by sector i
$OUTPHWR_{i,v}$	6.11	14	Annual rate of change in $OUTPHW_i$ by time intervals (v) 1970-79, 1980-84, 1985-89, 1990-94, and 1995+
$OUTPWK_i$	6.3	14	Average annual output per worker, by sector i
$PACAP_i$	3.8	22	Pollution abatement capital stock for each sector i ($1,000)
PCE_i	4.7	10	Personal consumption expenditure ($1,000) 0, by sector i
PCER	4.23	18	Ratio of change in PCET to change in disposable income
PCESUBT	4.8	11	Total personal consumption expenditure for outputs of industries in the study region ($1,000)
PCET	4.9	18	Total personal consumption expenditure (includes imports to the region; in $1,000)
PCETM1	4.10	18	PCET for the previous year ($1,000)
PCHITR	9.10	20	Annual rate of change in $BUSTAXR_i$, by sector i
$PCHCOR_i$	3.17	21	(Not currently used by IPASS)
PIDITR	4.22	19	Ratio of disposable income to personal income

PIEARNR	9.12	18	Ratio of personal income to earnings
PIT	9.16	18	Total base-year personal income
PITM1	9.17	18	Total personal income for the year before the base year
$POPF_a$	8.2	2	Female population, subdivided into sixty-six 1-year age classes (age 0-1, 1-2, ..., 64-65, and 65+)
POPFT	8.4	3	Total female population
$POPM_a$	8.1	2	Male population, by age (see POPF)
POPMT	8.3	3	Total male population
POPT	8.5	3	Total population
POPTM1	8.6	3	Total population, year before base (or current) year
$PRCAP_i$	3.7	21	Production capital stock ($1,000), by sector i
PROPINR	9.15	18	Ratio of total proprietors' income to total earnings
$RCOMINR_j$	7.19	7	Annual rate of change in $COMINR_j$
$RCOMOTR_j$	7.20	7	Annual rate of change in $COMOUTR_j$
$REGIMPR_i$	9.8	20	Ratio of regional imports ($IMPORT_i$) to gross output (X_i), by sector i
$REGMKS_i$	4.2	12	Regional market share ($EXPORT_i$ as a fraction of $USGO_i$) for each sector i
$REGMKSR_i$	4.20	12	Annual rate of change in $REGMKS_i$
REMDEPR	8.11	3	Regional employee dependent rate; that is, the average population per member age 20 or older of the regional labor force
RFCEMP	6.15	17	Annual rate of change in FCEMP (Federal civilian employment)
$RINVPA_i$	3.16	22	Replacement investment in pollution-abatement capital ($1,000), by sector i

$RINVPR_i$	3.15	21	Replacement investment in production capital ($1,000), by sector i
$RMIGDIR_{a,s}$	8.21	4	Annual rate of change in $RMIGDIS_{a,s}$
$RMIGDIS_{a,s}$	8.9	4	Fractional distribution, by single year of age and by sex, of any net outmigrants from the region
RNEMDEP	8.22	3	Annual rate of change in NEMDEPR
RREMDEP	8.23	3	Annual rate of change in REMDEPR
RSGEMP	6.14	17	Annual rate of change in SGEMP
SGEMP	6.8	17	State and local administrative-government employment
$SGOVE_i$	4.13	10	State and local government purchases (in $1,000) from each sector i
SGOVET	4.14	11	Total State and local government purchases ($1,000)
TRANPYR	9.14	18	Ratio of total transfer payments to total earnings
UNCOMPR	9.13	18	Ratio of unemployment compensation to total earnings
$UNEMP_j$	7.8	8	Unemployment by occupational group j
UNEMPT	7.9	19	Total unemployment
$USGO_i$	4.1	12	U.S. gross output ($1,000), by sector i
$VALADR_i$	9.7	20	Ratio of value added to gross output (X_i), by sector i
$WKWPY_i$	6.5	15	Average number of weeks worked per year per worker, by sector i
$WKWPYR_i$	6.13	15	Annual rate of change in $WKWPYR_i$
X_i	3.1	9	Actual gross output ($1,000), by sector i
XD_i	3.3	9	Gross output required to satisfy final demand ($1,000), by sector i

XL_i	3.5	9	Maximum gross output possible, given current labor force (and capital stock) constraints ($1,000), by sector i
$XM1_i$	3.2	9	Gross output for the year before the base (or current) year ($1,000), by sector i
XS_i	3.4	9	Maximum gross output possible, given current capital stock constraints ($1,000), by sector i
XTOT	3.6	11	Total actual gross output ($1,000)

Appendix 2. Sectoring the Input-Output Industries

Much of the data in the IPASS database is subscripted by sector. The sectoring process consists of the following steps: (1) choosing the number and nature of the sectors to be used; (2) defining them on a standardized basis, commonly the Standard Industrial Classification (SIC) code; (3) constructing a sectoring table; and (4) converting data from other sectoring schemes.

Choosing a sectoring scheme can be more art than science. Choices are limited by the sectoring in the I/O model being used. For example, IMPLAN is based on the 537-sector BEA (1977) scheme. Sectors can be aggregated (combined). In devising a sectoring plan, points to consider include intended uses of the model (for example, study of impacts of or on particular industries), available time and resources, and ease of resectoring (for convenience, sector definitions can parallel those used by BEA and BLS).

Next, a sectoring table is prepared. This should list and number each sector and define it by listing the appropriate SIC code(s). The table should also list, for each sector, the number(s) of the corresponding sector(s) for important sources of sectored data, such as BLS and BEA. Here is a sample excerpt from a sectoring table:

Sector no. and industry title	SIC code (1972 version)	BLS 155-industry	BEA 466-industry
56, communication	48	118-119	463-464
57, electrical utility	pt 491, pt 493	120	465
58, gas utility	492, pt 493	121	466
59, water and sewer	494-497, pt 493	122	467-468
60, wholesale	50-51	123	469
61, retail	52-57, 59, 7396, 8042	125	470

The notation "pt" ("part of") indicates that only a portion of the numbered industry is included in the sector. In the example, SIC class 493 consists of "combination" utilities (those providing more than one kind of service). Any data falling under SIC 493 must therefore be distributed among IPASS sectors 57-59. One method of distribution is based on the relative amounts of economic activity in each utility.

"Fractional" sectors like these can be awkward to handle. The sectors in the above example, however, were purposefully given definitions that coincide with the BLS and BEA sectors listed so that data from these sources, at least, are easily converted.

Once the sectoring table is prepared, converting data based on other sectorings to the IPASS sectors begins. For fractional sectors, the analyst must estimate what proportion of the source-data sector should be allocated to each IPASS sector. These proportions can be derived from data sources with sufficient sector detail (for example, "County Business Patterns"—U.S. Department of Commerce, 1982-85).

Appendix 3. Physical (Computer-Readable) Format of the IPASS Database

The original IPASS program was in the Fortran language, and the data file is in "Fixed Format" meaning that each data element must be in a particular position in the data file. Formats given below are in Fortran notation with an example for each. An "X" marks a column not read by the program.

```
Format Group     NAMER          IYEAR NIS NOC
 1)  X<----   A20     ----><I4><I4><I4>      (one line)
       Southeastern Alaska1977  75   8

 2)    N   POPM(I)     POPF(I)    DEATHRM(I)  DEATHRF(I)  FERTILY(I) ACFERTY(I,1)ACFERTY(I,2)ACFERTY(I,3)ACFERTY(I,4)
     XI2X<-- F12.0--><-- F12.0--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6-->  (I=1 to 66 lines)
      20          4213        3395    0.002971    0.001193    65.0          0.006056    0.003980    0.003850   -0.000510

 3)       POPMT        POPFT         POPT        POPTM1       MFBIRTR      NEMDEPR      REMDEPR     RNEMDEPR     RREMDEPR
     X<-- F12.0--><-- F12.0--><-- F12.0--><-- F12.0--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6-->     (one line)
            210193      186067      396210      396210    0.510265    2.590000    2.930000    0.000000    0.000000

 4)    N   INMIGM(I)   INMIGF(I)  OUTMIGM(I)  OUTMIGF(I) RMIGDIS(I,1)RMIGDIS(I,2)RMIGDIR(I,1)RMIGDIR(I,2)
     XI2X<-- F12.0--><-- F12.0--><-- F12.0--><-- F12.0--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6-->                (I=1 to 66)
       1          0.0         0.0         0.0         0.0    0.023780    0.023780    0.000000    0.000000

 5)    N NMIGDIS(I,1)NMIGDIS(I,2)NMIGDIR(I,1)NMIGDIR(I,2) CORTMVM(I)  CORTMVF(I)
     XI2X<-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6-->                                        (I=1 to 66)
       1     0.020593    0.025666    0.000000    0.000000    0.000000    0.000000

                                     LFPARMR(I,2)       LFPARMR(I,4)       LFPARFR(I,2)       LFPAR4R(I,3)
 6)    N  LFPARM(I)LFPARF(I) LFPARMR(I,1)       LFPARMR(I,3)       LFPARFR(I,1)       LFPARFR(I,3)         LBFAGEG(I)
     XI2X<- F10.6-><- F10.6-><- F10.6-><- F10.6-><- F10.6-><- F10.6-><- F10.6-><- F10.6-><- F10.6-><- F10.6-><-- F12.6--> (I=1 to 12)
       3   0.368095  0.308241  0.005650  0.005650  0.005650  0.005650  0.017301  0.017301  0.017301  0.017301      4817.0

 7)    N  LBFOCUR(J)  INMIGOC(J)  OTMIGOC(J)    COMIN(J)    COMOUT(J)   COMINR(J)  COMOUTR(J)  RCOMINR(J)  RCOMOTR(J)
     XI2X<-- F12.6--><-- F12.0--><-- F12.0--><-- F12.0--><-- F12.0--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6-->     (J=1 to NOC)
       1     0.093280           0           0           0           0    0.000000    0.000000    0.000000    0.000000

 8)    N NOCUP1NOCUP2 EMPLOYS(J)  EMPLOYD(J)   UNEMP(J)    INMIGR(J)   OTMIGR(J)
     XI2X<-A6-><-A6-><-- F12.0--><-- F12.0--><-- F12.0--><-- F12.6--><-- F12.6-->                                        (J=1 to NOC)
       1  MANA- GERS      19218.0     18922.0       796.0    1.000000    0.010000

 9)   N  INDUSN(I)      X(I)          XD(I)          XM1(I)         XS(I)          XL(I)         XHOLD(I)
     XI2X<-- A10--><--- F15.3 ---><--- F15.3 ---><--- F15.3 ---><--- F15.3 ---><--- F15.3 ---><--- F15.3 --->       (I=1 to NIS)
        1 DAIRY,POUL      3958.000       3705.990       3490.060       3633.980       3598.000       3598.000

10)    N      PCE(I)         GPCF(I)        BINCH(I)       EXPORT(I)      SGOVE(I)       FGOVE(I)         FD(I)
     XI2X<--- F15.3 ---><--- F15.3 ---><--- F15.3 ---><--- F15.3 ---><--- F15.3 ---><--- F15.3 ---><--- F15.3 ---> (I=1 to NIS)
       1        2698.000          0.000          1.000         14.000         69.000          8.000       2781.000

11)        XTOT           PCESUBT         GPCFT          BINCHT         EXPORTT        SGOVET         FGOVET           FDT
     X<--- F15.3 ---><--- F15.3 ---><--- F15.3 ---><--- F15.3 ---><--- F15.3 ---><--- F15.3 ---><--- F15.3 ---><--- F15.3 --->(one line)
         11817703.299    1755579.000     585594.000      44224.000    4829339.000     404842.000      55129.000    8273691.000

12)    N    USGO(I)   GROWTHR(I,1)GROWTHR(I,2)GROWTHR(I,3)GROWTHR(I,4)GROWTHR(I,5)  REGMKS(I)  REGMKSR(I)
     XI2X<-- F12.0--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.9--><-- F12.6-->             (I=1 to NIS)
       1   15002000.0   -0.040864    0.011892    0.026731    0.026731    0.026731 0.000000933   -0.067564

13)    N   ELASIN(I)   INVLMA(I)   INVLMC(I)
     XI2X<-- F12.6--><-- F12.6--><-- F12.6-->                                                                        (I=1 to NIS)
       1     0.200000    0.500000   14.000000

14)    N   EMPLOY(I)   OUTPWK(I) OUTPHWR(I,1)OUTPHWR(I,2)OUTPHWR(I,3)OUTPHWR(I,4)OUTPHWR(I,5)
     XI2X<-- F12.0--><-- F12.0--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6-->                            (I=1 to NIS)
       1         70.0       51400   -0.006130    0.032380    0.045903    0.045093    0.045093

15)    N   OUTPHW(I)    HRWPW(I)   HRWPWR(I)    WKWPY(I)   WKWPYR(I)    HRWPY(I)
     XI2X<-- F12.6--><-- F12.2--><-- F12.6--><-- F12.2--><-- F12.6--><-- F12.2-->                                        (I=1 to NIS)
       1    22.063879       44.80   -0.006806       52.00    0.000000     2329.00

16)    N    EARN(I)    EARPWK(I) EARPWKR(I,1)EARPWKR(I,2)EARPWKR(I,3)EARPWKR(I,4)EARPWKR(I,5)
     XI2X<-- F12.0--><-- F12.0--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6-->                            (I=1 to NIS)
       1         70.0       51400    0.000000    0.000000    0.000000    0.000000    0.000000

17)       SGEMP       FCEMP       FMEMP      RSGEMP      RFCEMP
     X<-- F12.0--><-- F12.0--><-- F12.0--><-- F12.6--><-- F12.6-->                                                   (one line)
            29591       16367       24984    0.000000    0.000000
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18)     PIT          PITM1       UNCCMPR      TRANPYR      PROPINR      PIEARNR      PCER         EARNT        PCET         PCETM1
   X<-- F12.0--><-- F12.0--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.0--><-- F12.0--><-- F12.0-->(one line)
        4771974      4973239     0.000000     0.000000     0.000000     1.289729     0.941673     3386712      3402978      3402978

19)     LBFT         EMPLOYT      EMPM1T       UNEMPT       PIDITR
   X<-- F12.0--><-- F12.0--><-- F12.0--><-- F12.0--><-- F12.6-->                                                              (one line)
         196791       193711       193711        19395     0.846775

20)  N  VALADR(I)    IBTR(I)     REGIMPR(I)  BUSTAXR(I)   PCHITR(I)   IMPORT(I)  ACNETBI(I)   BINCHR(I)
   X12X<-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.0--><-- F12.0--><-- F12.6-->                       (I=1 to NIS)
     1   0.630906    0.032796    0.093107    0.279900    0.000000          335           0   0.433000

21)     PRCAP(I)     CAPPRR(I)    EINVPR(I)    RINVPR(I)    PCHCOR(I)    DEPRPR(I)
   X12X<-- F12.0--><-- F12.6--><-- F12.0--><-- F12.0--><-- F12.6--><-- F12.6-->                                              (I=1 to NIS)
     1         4936  1.358390             0            0  0.000000     0.071668

22)     PACAP(I)     CAPPAR(I)    EINVPA(I)    RINVPA(I)    DEPRPA(I)
   X12X<-- F12.0--><-- F12.6--><-- F12.0--><-- F12.0--><-- F12.6-->                                                          (I=1 to NIS)
     1          103  0.028249             0            0  0.071668

23) (The following is shown as having 9 columns, this assumes NOC=9, which is the maximum number of columns which can be used.)
     N  OCUP(I,1)   OCUP(I,2)   OCUP(I,3)   OCUP(I,4)   OCUP(I,5)   OCUP(I,6)   OCUP(I,7)   OCUP(I,8)   OCUP(I,9)
   X12X<-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6--><-- F12.6-->           (I=1 to NIS)
     1   0.074300    0.000000    0.000000    0.000000    0.114000    0.000000    0.000000    0.811700

    (The following is shown assuming 75 industries (i.e., NIS-1 = 74)):
     N LEMAT(I,1) LEMAT(I,2) LEMAT(I,3) LEMAT(I,4) LEMAT(I,5) LEMAT(I,6) LEMAT(I,7) LEMAT(I,8) LEMAT(I,9)
       LEMAT(I,10) LEMAT(I,11) LEMAT(I,12) LEMAT(I,13) LEMAT(I,14) LEMAT(I,15) LEMAT(I,16) LEMAT(I,17) LEMAT(I,18)
24)   .
       LEMAT(I,64) LEMAT(I,65) LEMAT(I,66) LEMAT(I,67) LEMAT(I,68) LEMAT(I,69) LEMAT(I,70) LEMAT(I,71) LEMAT(I,72)
       LEMAT(I,73) LEMAT(I,74)

    X13X<--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10-->
    XXXX<--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10-->
    .
    XXXX<--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10-->
    XXXX<--F12.10--><--F12.10-->  (This section repeats for each I=1 to NIS-1)

    (The following is shown assuming 75 industries (i.e., NIS = 75)):
     N INVMAT(I,1) INVMAT(I,2) INVMAT(I,3) INVMAT(I,4) INVMAT(I,5) INVMAT(I,6) INVMAT(I,7) INVMAT(I,8) INVMAT(I,9)
       INVMAT(I,10)INVMAT(I,11)INVMAT(I,12)INVMAT(I,13)INVMAT(I,14)INVMAT(I,15)INVMAT(I,16)INVMAT(I,17)INVMAT(I,18)
      .
25)    INVMAT(I,64)INVMAT(I,65)INVMAT(I,66)INVMAT(I,67)INVMAT(I,68)INVMAT(I,69)INVMAT(I,70)INVMAT(I,71)INVMAT(I,72)
       INVMAT(I,73)INVMAT(I,74)INVMAT(I,75)

    X13X<--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10-->
    XXXX<--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10-->
    .
    XXXX<--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10--><--F12.10-->
    XXXX<--F12.10--><--F12.10--><--F12.10-->  (This section repeats for each I=1 to NIS)
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McHugh, Paul; Olson, Douglas; Schallau, Con; Lindall, Scott; Akhavi-Pour, Hosseln; Makl, Wilbur. 1989. Alaska IPASS database preparation manual. Gen. Tech. Rep. PNW-GTR-233. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 79 p.

Describes the data, their sources, and the calibration procedures used in compiling a database for the Alaska IPASS (interactive policy analysis simulation system) model. Although this manual is for Alaska, it provides generic instructions for analysts preparing databases for other geographical areas.

Keywords: IPASS, policy analysis, impact analysis, input/output analysis, dynamic simulation, computer simulation.

Pacific Northwest Research Station
319 S.W. Pine St.
P.O. Box 3890
Portland, Oregon 97208

U.S. Department of Agriculture
Pacific Northwest Research Station
319 S.W. Pine Street
P.O. Box 3890
Portland, Oregon 97208