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Multiregional Input-Output Accounts, 1977 - Volumes 4 - State Estimates of Final Demands

Jack Faucett Associates, Inc.

MULTIREGIONAL INPUT-OUTPUT ACCOUNTS, 1977. VOLUME 4. STATE ESTIMATES OF FINAL DEMANDS

FAUCETT (JACK) ASSOCIATES, INC.
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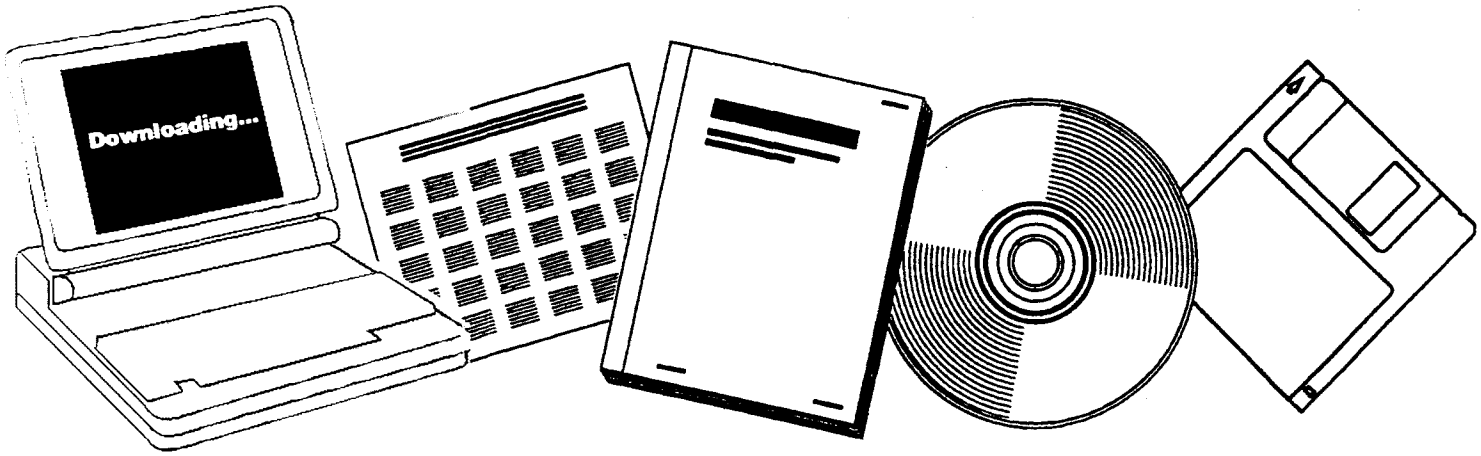

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The multiregional Input-Output (MRIO) accounts provide estimates for 1977 of (1) output (by industry and commodity), (2) value added, (3) intermediate uses, and (4) final uses of goods and services, by sector and state. Interregional flows balance the production and consumption of goods and services between states. The project was also supported by the Department of Commerce (Economic Development Administration), the Federal Emergency Management Administration, and the Army Corps of Engineers.

This volume presents the final demand estimates for the MRIO accounts, describes the methodology used to deveop the estimates, and evaluates the estimates.

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Linda K. Lent coordinated the development of the report. Secretarial effort was coordinated by Leila Snyder. Robert Skarr compiled the bibliographic material.

CHAPTER 1

INTRODUCTION AND SUMMARY

This report is one in a series of reports documenting the development of the Multi-Regional Input-Output (MRIO) model by Jack Faucett Associates (JFA) for the Department of Health and Human Services. The report presents the final demand estimates, a description of the methodology used to develop the estimates and an evaluation of the estimates. Final demand estimates are described for each of the following categories:

- personal consumption expenditures;
- gross private domestic fixed capital investment (structures and equipment);
- net inventory change;
- imports (comparable and noncomparable) and exports;
- Federal government purchases (defense and non-defense);
- state and local governments (current and capital).

The final demand estimates are consistent with the output, employment, payroll and value-added data developed by JFA for the MRIO. Data were developed for 119 MRIO sectors as listed in Appendix A. Additionally, the final demand estimates are aligned with the National Income and Product Accounts (NIPA) to permit overall control and ease in updating. The estimates in this report are preliminary and will be revised as appropriate throughout the model development. JFA welcomes comments on this report and requests that any suggestions or criticisms be submitted to the authors.

Purchases that are included in final demand are the current and capital purchases of the noncommercial private and public sectors and the capital purchases of commercial sectors and government enterprises. In addition to purchases, imputed values for services without explicit transactions data, e.g., rental value of owner-occupied housing and service charges for checking services provided at no charge, are included within final demand estimates.

A computer tape containing the data developed according to the methods and procedures described herein was submitted to the Department of Health and Human Services along with this report. Users of these data should note carefully the data limitations indicated throughout this report and should also be aware that all data are preliminary and are currently under revision. Nonetheless, users are encouraged to notify cognizant JFA staff of any problems, errors or inconsistencies found upon examination of these data.

All valuations of purchases except imports are at purchaser prices which include domestic trade and transportation margins and taxes. Imports are included at domestic port value and include the trade margins, duties, and freight and insurance charges incurred up to the time they enter a domestic port. The amounts of trade margins and taxes included in the purchaser's price of domestic goods were developed separately and are described in the JFA report State Estimates of Inputs to Industries, 1977. Transportation margin amounts are described in the separate JFA report The Multiregional Input-Output Accounts, 1977: Interregional Commodity Flows.

All of the final demand estimates are controlled to NIPA values at the national level. Some of the MRIO estimates come directly from NIPA. Where independent data sources are used, estimates of data items that correspond to NIPA values have been scaled accordingly.

DATA DEVELOPMENT METHODOLOGY

Lacking complete data at the state level, most of the final demand estimates were developed by MRIO sector at the national level and subsequently distributed to states based on available data.

National Estimates

Four broad approaches were used to estimate national final demand. The simplest was direct use of a NIPA value, but this was usually not possible because of problems of matching MRIO and NIPA classes. A second approach was to update BEA's 1972 I-O proportions for relative price change. A third was to update particular 1972 BEA I-O values for absolute price change and for quantity change proportional to changes in quantities of complementary purchases. A fourth was to use independent 1977 data. In the second through fourth approaches, data were scaled to appropriate NIPA control totals.

The principal sources of 1977 national data were various surveys of the 1977 censuses. They provided information of generally high reliability on state and local government finances, foreign trade, construction, business expenditures for equipment, retail sales of commodities and services, manufacturer shipments by SIC code and customer class, and features of personal travel (origin, destination, mode, and various kinds of expenditure). These were supplemented with a wide variety of trade association and other government statistics, including, most notably for Federal purchases, tabulations of contract awards by product and service codes. All the sources are described in detail in the chapters related to their use.

State Estimates

The state estimates were subject to conceptual and empirical problems. The conceptual problems concerned the definition of a state of purchase. The empirical problems centered on utilizing available state-level data for estimating state purchases as defined. Moreover, the availability of data sometimes affected the definition of the state of purchase.

Final demand estimates were primarily allocated to the state wherein the purchase was made, rather than the state of residence of the purchaser (or state location of the government entity). Thus, state final demand estimates cannot always be associated with the economy of the state of the purchaser. The final MRIO model will use distribution sectors for each industry in each state to link state production to consumption by state. An explanation of the distribution sector allocation mechanism is included in Appendix C.[1] However, the production-to-consumption link is complicated by some of the final demand estimates which do not necessarily locate purchases

[1] *Under MRIO Procedures No. 3, it is contemplated that purchases of a given product by all using sectors of a state be considered as made from a real or dummy distribution sector in the same state, and that the distributing sector be assumed to buy from producers of that product in the same and other states in fixed proportions. This implies an assumption that the ultimate geographic distribution of all purchases of any given product in a state is the same for all consuming sectors of that state, and need not to be estimated separately for each consuming sector.*

in the state where the purchaser resides or where the purchase is used.[1] This interferes with estimation of transportation costs by the normal MRIO procedure. However, the transportation costs at issue have usually been minor.

In the case of personal consumption expenditures, much of the distribution to states is in proportion to retail sales of commodities or in proportion to service sector outputs. To the extent that consumers commute or travel among states and buy in retail stores, eat in restaurants, patronize beauty salons, etc., the state of purchase is not the state of residence of the purchaser. Moreover, since personal transportation costs are not included in the transportation costs of individual purchases in the model, this treatment of PCE does not affect the allocation of transportation services within the model. A bridge is required, however, when users link the MRIO with disposable income, by state. The state distribution of non-local type service industries such as finance and insurance were estimated based on state data on underwriting and similar proxies indicative of state consumption and are therefore compatible with disposable income by state.

The data available to estimate final demands for private investment in fixed plant and equipment created difficulty in assigning purchases by state. Equipment purchases were frequently available by the state where the buyer used the equipment rather than the state of production. Purchases of major items of transportation equipment (ships and aircraft) were considered to be purchases of the state where the equipment was produced. Moreover, since much of the construction demand was based on data regarding construction establishments rather than construction projects, and since adjustments made to convert the data to state-of-performance could not be made in sufficient detail, there may be some inaccuracies in the construction detail by state although the totals for each state should be reasonably accurate.

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[1] *There are departures here from the general rule of the procedures memorandum. For Federal purchases, the state distribution is by location of the supplier (ordinarily the producer, but sometimes a wholesaler), not by location of the particular Federal activity that uses the product. For imported goods, the state of import is defined as the state where the imported item enters the United States, not where the item is to be used. In PCE, some of the purchases are in states where the seller conducts his business, without regard to where the consumer has his residence. This is particularly important for purchases associated with tourism and with purchases of commuters across state borders. There are also problems of distinguishing gross private capital formation between states of location of construction establishments and states where the construction is put in place.*

Reliable estimates of inventory change by state were developed for agriculture and mining industries from available state-level data. Inventory changes for other industries, including manufacturing and retail sectors, were developed from national totals distributed to states based on limited state data in conjunction with proxies such as sales or output. Though estimates for some sectors may be inacurate at the state level, the value of changes in inventories wherever held for these industries is not large enough to warrant the intense research that would be required to improve the state estimates.

Estimates of imports/exports were allocated to states by port of entry/exit from available data. In the determination of interstate transportation flows, effort will be made to identify the states of consumption for imports and the producing state of exports. The data on purchases abroad and imports of services have been developed at the national level.

Determining the state location of Federal purchases is a difficult conceptual problem. Locating Federal purchases by the state location of the purchasing office would fail to reflect the state of production (and therefore the state of primary economic impact) and, in many cases, not reflect the state of use of the purchase. In the MRIO, final demand estimates of Federal government purchases were located primarily by the state of production.[1] This treatment does complicate the assignment of common carrier transportation charges, but the Federal government makes less use of common carriers than other comparable purchasers in the private sector. In the estimates of Federal government purchases of goods and services developed in this report, purchases are distributed to states based on data locating the seller, which may be a distributor rather than the producer. Where the producer is in a different state, the impact on production activity is incorrectly located.

[1] *To the extent that Federal purchases are located by the state of production, their distribution will not be determined by the distribution sector allocation mechanism described in Appendix C. The state of production for these Federal purchases will instead be "fixed" by the distribution of Federal final demand, by state.*

REPORT OVERVIEW

Chapters 2-7 describe the detailed methodology used to develop estimates of final demand by state for the MRIO. A complete concordance of MRIO sectors with BEA I-O sectors and 1977 SIC's appear in Appendix A. Appendix B contains coding translations used in the development of Federal government final demands. A procedures paper which describes the mathematical formulation of the MRIO is included in Appendix C. Appendix D provides a reference guide to all data sources referred to in this report, including complete bibliographic data.

CHAPTER 2

PERSONAL CONSUMPTION EXPENDITURES

Personal consumption expenditures (PCE) are the largest category of final demand. Moreover, the estimates of PCE are supported by a considerable amount of available data. The data sources used and the general methodology for developing requisite data are described below. Later sections of the chapter supply methodological details by MRIO sector.

NATIONAL ESTIMATES

In many instances, the MRIO elements of PCE correspond exactly to one or a combination of NIPA categories. Thus it was frequently possible, particularly for services, to estimate an MRIO component of PCE directly from NIPA. Additionally, one or two NIPA lines can frequently be used to control a comparatively small number of MRIO categories, which limits the potential error. The 1977 economic censuses also provided useful national data on manufacturer and retail sales of consumer goods and on sales of service establishments that specialize in service to households. The usefulness of data from the Censuses of Manufactures and Retail Trade is limited, however, because in many cases the goods sold to households cannot be identified and/or the data do not match with MRIO sector definitions.

Where there were no clearly useful data for particular MRIO sectors, which occurred most often for commodities, the method used was to update estimates for 1972 from BEA's 1972 Interindustry Study. The updating involved price and quantity, sometimes separately and sometimes combined in a value index, to yield 1977 value estimates. The PCE estimates do not include deductions for purchases by foreign travelers in the U.S., amounting in NIPA data to $6,982 million, or $251 million of personal remittances in kind to foreigners.

STATE DISTRIBUTION

Lacking comprehensive state-specific data the state distributions were necessarily less accurate than the national totals. Nevertheless, it was usually possible to develop reliable methods for state distribution. The Census of Retail Trade provided distrib-

utors for groups of MRIO sectors producing commodities. Because services tend to be less mobile and more frequently sold to households than commodities, many services were distributed based on the distribution of MRIO outputs by state developed previously by JFA. There were also a variety of data sources used that were unique to particular MRIO sectors.

When direct data for state distribution were lacking, e.g., when state distributions of MRIO outputs were too heavily weighted with purchases by other than PCE, distributions were made in proportion to indexes such as population and personal income. Where these indexes were used, the effect was to provide estimates by state of residence of the consumer rather than the producing state. This may significantly understate purchases made in states that do a great deal of their business with commuters or tourists from other states or overstate purchases in states where residents frequently make purchases in adjoining states.

States that border Mexico or Canada have a further problem in that state distributions based on total sales or output will give weight to purchases by foreigners. No attempt was made to adjust state distributions for such distortions.

Consumption of energy commodities were developed separately for all categories including PCE. These data are described in JFA's report State Estimates of Inputs to Industries, 1977 (Source 23017).

COMMODITY SECTORS

Two approaches have been used to estimate national PCE in 1977 for MRIO categories 001-007, 020-049, 051-084, which include food commodities, and manufactured food and other goods included in the 1977 Census of Retail Trade (Source 03101).

The first approach estimates 1977 I-O PCE directly from 1977 NIPA, where one or more NIPA categories coincide with 120-order MRIO, or 496-order BEA I-O classification. This method was used for MRIO 029, Tobacco Products, and part of MRIO 078, New Automobiles.

The second approach consists of various operations on a matrix of 1977 PCE values, where the columns correspond to published NIPA categories and the rows to 1972 BEA

I-O industries in 496 order detail. The operations update the matrix of 1972 values to 1977 values.

In this approach, it was assumed that the value change of a 1972 BEA I-O commodity approximates the value change of an observable commodity group in (1) NIPA, (Source 03501), (2) Census of Manufactures, (Source 03105), (3) Census of Retail Trade, (Source 03101), or (4) a USDA set of food consumption indexes. For the updating procedure, the change was expressed as a 1977/1972 value ratio. Thus, the 1972 values of I-O commodities were multiplied by the value ratio of a commodity group in one of four sources above.

Five alternative ways to update the elements in the matrix were considered:

1. A ratio in current dollars from a NIPA category is applied to a 1972 BEA I-O value of the same NIPA column. A similar operation is sometimes applied to an unpublished subcategory of a NIPA category indicated as a non-integer code in the unpublished breakdown of published NIPA categories shown in Exhibit 2-1.

2. A 1972 BEA I-O value is multiplied by a 1977/1972 value ratio in constant dollars from a NIPA category of the same column, and by a price ratio from the Consumer Price Index (CPI) or the Producer Price Index (PPI). Exhibit 2-2 presents each BEA I-O commodity and the value of its corresponding price ratio.

3. A 1977/1972 value ratio from the Retail Census is applied to the 1972 BEA I-O value. The ratio is in current dollars.

4. A 1972 I-O value is multiplied by a value ratio in current dollars from the Census of Manufactures (and import and export statistics (Source 03118) if available for the SIC code of the I-O commodity). Where a price ratio from CPI is applicable, the 1972 value is further multiplied by the CPI price ratio, and then divided by the PPI ratio of the same BEA code as the I-O commodity. This substitutes a consumer price change for the producer price change incorporated in the Census value ratio.

EXHIBIT 2-1:

NIPA CATEGORIES AND SUBCATEGORIES

NIPA Line	Description
3.00	Food purchased for off-premise consumption
3.04	Fish
3.05	Meat
3.07	Dairy
3.06	Poultry
3.01	Eggs
3.02	Fresh fruits
3.03	Fresh vegetables
3.08	Processed fruits and vegetables
3.09	Grain mill products
3.10	Bakery products
3.11	Fats and oils
14.00	Women's and girl's clothing
14.10	Without luggage
14.20	Women's luggage
15.00	Men's and boys' clothing
15.10	Without luggage
15.20	Men's luggage
32.00	Other durable home furnishings
32.10	Floor coverings
32.20	Durable home furnishings, n.e.c.
32.30	Writing equipment
32.40	Hand tools
34.00	Cleaning, Polishing, Paper, Miscellaneous
34.10	Lighting supplies
34.20	Cleaning preparations
34.30	Household paper products
67.00	Other motor vehicles
67.10	New and used trucks
67.20	Recreational vehicles
86.00	Wheel goods, durable toys, sporting equipment
86.10	Wheel goods
86.20	Boats
86.30	Pleasure aircraft
68.00	Tires, tubes, accessories and parts
68.10	Tires and tubes
68.20	Accessories and parts

Source: *Lines with identifying numbers ending in .00 are categories with data published in National Income and Product Accounts, 1976-1979, (Source 03501), Table 2.4. Line numbers with nonzero digits following the decimal identify categories for which unpublished data were supplied by BEA staff in telephone conversations.*

EXHIBIT 3-2:

I-O COMMODITY AND ASSOCIATED PRICE RATIOS

I-O COMMODITY	CPI	PPI
10300	1.5497	—
20202	—	1.9657
20401	1.4931	—
20402	—	1.3320
20501	1.5340	—
20503	—	1.1931
20600	—	1.9541
20702	—	1.4650
30000	—	1.4650
40000	—	1.5380
130500	—	1.4005
130600	—	1.3956
140101	1.3483	—
140102	1.3483	—
140103	1.4194	—
140104	1.5497	—
140200	1.4782	—
140300	1.4782	—
140400	1.4782	—
140500	1.4782	—
140600	1.4782	—
*140700	1.5865	1.7613
140800	—	1.5318
140900	1.5868	—
141000	1.5868	—
*141100	1.5055	1.5541
141200	1.5893	—
141300	1.5868	—
141401	—	1.1900
141402	1.7898	—
141403	1.4134	—
141501	—	1.5400
141502	—	1.7600
141600	1.6861	—
141700	—	1.6530
141801	1.4407	—
141802	1.8775	—
141900	1.5730	—
142001	—	1.8961
*142002	2.1163	1.5792
142003	—	1.6156
142101	1.2609	—
142103	1.2748	—
142104	1.0820	—
*142200	1.5853	1.5672
142300	—	1.2962
142500	—	1.8134
142800	3.7788	—
142900	1.5933	—
143000	—	1.9650
143100	—	1.5657
143200	1.5292	—
160100	—	1.2720
160200	—	1.4810
160300	—	0.9442
160400	—	1.5070
170100	1.2542	—
170200	—	1.2400
170300	—	1.2400
170900	—	1.4599
171901	—	1.2400
180101	0.7584	—
180102	—	1.2775

*Both CPI AND PPI ratios are used to substitute consumer for producer price ratio.

EXHIBIT 2-2:

I-O COMMODITY AND ASSOCIATED PRICE RATIOS

I-O COMMODITY	CPI	PPI
10200	1.5497	—
20202	—	1.9657
20401	1.4921	—
20402	—	1.8320
20501	1.5240	—
20503	—	1.1931
20600	—	1.9841
20702	—	1.4650
30000	—	1.4650
40000	—	1.5380
130500	—	1.4005
130600	—	1.3956
140101	1.5483	—
140102	1.5483	—
140103	1.4184	—
140104	1.5497	—
140200	1.4782	—
140300	1.4782	—
140400	1.4782	—
140500	1.4782	—
140600	1.4782	—
*140700	1.5865	1.7613
140800	—	1.5318
140900	1.5668	—
141000	1.5668	—
*141100	1.5055	1.5841
141200	1.5693	—
141300	1.5668	—
141401	—	1.1000
141402	1.7898	—
141403	1.4134	—
141501	—	1.5400
141502	—	1.7600
141600	1.5861	—
141700	—	1.5530
141801	1.4407	—
141802	1.5775	—
141900	1.5730	—
142001	—	1.5961
*142002	2.1163	1.5792
142003	—	1.6156
142101	1.2809	—
142103	1.2748	—
142104	1.5820	—
*142200	1.5853	1.5672
142300	—	1.2962
142500	—	1.5134
142800	2.7789	—
142900	1.6933	—
143000	—	1.9650
143100	—	1.5657
143200	1.5292	—
160100	—	1.3720
160200	—	1.4810
160300	—	0.9442
160400	—	1.5070
170100	1.2542	—
170200	—	1.5400
170300	—	1.5400
170900	—	1.4599
171001	—	1.5400
180101	0.7884	—
180102	—	1.2775

*Both CPI AND PPI ratios are used to substitute consumer for producer price ratio.

EXHIBIT 2-2:

I-O COMMODITY AND ASSOCIATED PRICE RATIOS (Cont.)

I-O COMMODITY		CPI	PPI
180300		—	1.1980
180400	(Women's)	1.1902	—
180400	(Men's)	1.2833	—
180100		1.3140	—
180200		1.3714	—
180302		—	1.3640
180303		—	1.3640
180304		—	1.3640
180305		—	1.3640
180306		—	1.3640
200100		—	1.7350
200903		—	1.4791
220101		—	1.4048
220102		—	1.4220
220103		—	1.4220
220200		—	1.3499
220300		—	1.4055
220400		—	1.3153
230600		—	1.3600
230700		—	1.3600
240200		—	1.6707
240400		—	1.5433
240500		—	1.9420
240701		—	1.7702
240702		—	1.5939
240704		—	1.4461
240705		—	1.5433
240706		—	1.5546
250000		—	1.5643
260100		1.4528	—
260200		1.5346	—
260301		—	1.4120
260400		—	1.4120
260501		—	1.5130
260502		—	1.5130
260700		—	1.5130
260801		—	1.5130
270100		—	2.2125
270201		—	2.1879
270300		—	2.0480
270401		—	1.5680
270402		—	1.5680
270406		—	1.7523
280100		—	1.3641
*290201		1.0727	1.5228
290202		—	1.4210
*290300		1.4328	1.2785
300000		—	1.5458
320100		1.1881	—
320200		—	1.3901
320302		—	1.4741
320400		—	1.5984
320500		—	1.5441
340100		—	1.4285
340301		—	1.3550
340302		—	1.4305
340301		—	1.7224
340302		—	1.2882
340303		—	1.2882
340304		—	1.2882
340305		—	1.6267
350100		—	1.3137
350200		—	1.5848

EXHIBIT 1-2:

I-O COMMODITY AND ASSOCIATED PRICE RATIOS (Cont.)

I-O COMMODITY	CPI	PPI
360701	1.6414	—
360702	—	1.5029
360900	—	1.5029
361100	—	1.5271
361500	—	1.6200
361600	—	1.5877
361800	—	1.6200
362200	—	2.0087
370101	—	1.8125
370103	—	1.8383
370402	—	1.7820
381000	—	1.3422
381100	—	1.8900
400300	—	1.4619
400901	—	1.3982
410100	—	1.5228
410202	—	1.5720
410203	—	1.5720
420100	—	1.2410
420201	—	1.6730
420202	—	1.3590
420300	—	1.4556
420500	—	1.5790
420700	—	1.5934
421000	—	1.3195
421100	—	1.5790
430200	—	1.6254
440001	—	1.6492
440002	—	1.6148
470100	—	1.7163
470701	—	1.2914
470403	—	1.6514
480300	—	1.4940
500001	—	1.6759
510102	—	0.9627
510200	—	1.2104
510300	—	1.4049
510400	—	1.9842
520300	—	1.5390
530200	—	1.5794
530300	—	1.5610
530400	—	1.6439
530800	—	1.5222
540100	1.2931	—
540200	1.2923	—
540300	1.3167	—
540400	—	1.2290
540500	1.2071	—
540600	—	1.5527
540700	—	1.2485
550100	1.2279	—
550200	—	1.4191
560100	—	0.9672
560200	—	0.8898
560300	—	1.6380
560400	—	1.3650
570100	—	1.2515
570300	—	1.1557
580100	—	1.4398
580200	—	1.3058
580400	—	1.5023
580500	—	1.5223
590301	—	1.3107

EXHIBIT 2-2:

I-O COMMODITY AND ASSOCIATED PRICE RATIOS (Cont.)

I-O COMMODITY	CPI	PPI
590302	—	1.5524
600100	—	1.5110
610200	—	1.5310
610500	—	1.4370
610601	—	1.4190
610700	—	1.4186
620200	—	1.3370
620400	—	1.4990
620500	—	1.4990
*620700	0.9420	1.3058
630100	—	1.2620
630200	—	1.2620
*630300	1.2255	1.3111
640101	—	1.5670
640102	—	1.5670
640104	—	1.7627
640105	—	1.5670
640200	—	1.3919
640301	—	1.3869
640302	—	1.1815
640400	—	1.3225
640501	—	1.2284
640502	—	1.2515
640504	—	1.4671
640600	—	1.4480
640701	—	1.2860
640702	—	1.6150
640800	—	1.3809
640900	—	1.6459
641200	—	1.4480

Source: *Producer Prices and Price Indexes (12107); CPI Detailed Report (12108)*

5. The USDA ratios are from a USDA index of per capita food consumption which indicates physical consumption levels for food groups to a base year using average prices from 1967-69. A USDA ratio, therefore, is equivalent to a value ratio in constant dollars (i.e., quantity ratio), which is combined with a price ratio to update a 1972 value to 1977.

Selection of Updating Indexes

The principal problem in selection of updating indexes was determining a quantity ratio (or value ratio in constant dollars) of some observable commodity group which could best approximate the change in physical quantity of an I-O commodity between 1972 and 1977. Selection of an index, therefore, depended on the relationship between an I-O commodity and the commodity groups which could be observed. One possible relationship was where the value of the I-O commodity, either in 496-order detail or in aggregation with commodities of the same MRIO category, constituted a dominating fraction of the value of an observed group of products. In this case, it seemed valid to conclude that the quantity and price change of the I-O commodity would approximate that of the group.

Another conceivable but less reliable relationship was a complementarity between an I-O commodity and the products covered by the observed ratio. The complementarity could be direct, in the sense that the values of the two groups of commodities are enhanced when used in relatively fixed proportions. It could also be indirect, in the sense that the consumption of each commodity relates to some commonly perceived need or condition such as a change in life style or fashion.

An example of the more direct relationship would be that between tennis racquets and tennis sneakers, where more of one suggests a need for the other. An example of indirect complementarity would be that between tennis balls and golf balls if it is believed that the conditions which generate an interest in tennis for some people, say warm weather, will create interest in golf for others. In the latter illustration it may be argued that an increased interest in one sport causes substitution of that sport for others. For this reason, the first kind of complementarity was considered more reliable.

Since component commodities of a NIPA category share a common end-use or function, some complementarity was always considered to exist among them. Given this general

condition, if the value of an I-O commodity (or group of commodities in aggregation up to 126-order MRIO detail) also comprised at least 50% of the 1972 value of the NIPA category, the updating ratio was the NIPA ratio in current dollars.

However, if a Consumer Price Index specific to the I-O commodity was available, it was considered superior to the price change incorporated in the NIPA value ratio. Although the 1972 I-O PCE was a dominating part of the value of the observed commodity group in NIPA, the NIPA ratio nevertheless encompasses commodities other than the I-O commodity being updated. In this case, therefore, the 1972 I-O PCE was multiplied by a NIPA value ratio measured in constant dollars and by a CPI price ratio.

Where the I-O category was less than 50% of the NIPA category, alternatives were considered. Data contained in the Census of Retail Trade failed to provide a viable alternative. Where retail sales refer to more than household consumption, we felt that merchandise lines were too excessively aggregated to justify considering household purchases of a single commodity complementary to retail sales of a class of products contaminated by non-household usage. In other cases, the level of detail was no better than for NIPA, which was considered a superior source for national changes in consumption.

Although the Census of Manufactures also pertains to intermediate and other final users, it was sometimes a practical alternative. Because production totals are given at a high level of commodity detail, there were frequently cases where household consumption of a particular four-digit SIC commodity could be considered dominating relative to total production, thereby justifying the conclusion that the value change in household consumption of a particular commodity approximated the change in value of total production of the same commodity.

The proportion of consumer use relative to total production was capable of being checked objectively for 1972, and where it exceeded 70 percent, the relationship between total production and household consumption of a commodity was more reliable for updating purposes than a complementarity of commodities in an alternative NIPA ratio where the BEA I-O PCE was less than 50% of the NIPA value in 1972.

In summary, a NIPA ratio in current dollars (or in constant dollars and combined with a CPI price ratio) was considered the most reliable updating ratio where the 1972 BEA

I-O PCE was a dominating part of the value of the NIPA category or subcategory. Refer to Exhibit 2-3 for a list of I-O commodities which met this condition and for the associated value ratio measured in constant or current dollars, depending on whether a CPI price ratio was available.

Where I-O PCE was not a dominating part of a NIPA category, but where 70% of total production was for household production, a value ratio from the Census of Manufactures was used. Exhibit 2-4 indicates commodities updated in this manner.

The USDA indexes for food were used only for two food commodities, nuts and sugar. For other food commodities, NIPA value ratios were available with equal commodity detail and without the problems of adjustment for population change and restaurant consumption.

The least preferred updating alternative was a NIPA ratio justified primarily because of a complementarity of physical quantities between commodities. Since price movements could be different, the value ratio in this case was always measured in constant dollars and combined with an appropriate CPI price ratio if available, and otherwise, a PPI ratio.

National Controls

The procedures described so far provided a preliminary updating of cells of the 1972 matrix of I-O rows and NIPA columns. They did not, however, generate column sums equal to NIPA control totals for 1977. Columns were therefore scaled to yield the correct sums.

The scaling factors are useful for evaluating the accuracy of the preceding procedures. If the scaling factor is close to unity, the updating procedure effectively estimated the value change of the set of commodities in the column. In Exhibit 2-5, the scaling ratios and corresponding NIPA categories are shown. The mean was 0.9833 and the standard deviation was 0.045. In addition, no column sum differed from a control total by more than 10%. This suggests an accurate updating procedure.

State Distribution

Two approaches were used to distribute national totals among states. In the first approach, the scaled elements of a NIPA column were distributed in proportion to sales

EXHIBIT 2-3:

I-O COMMODITIES AND ASSOCIATED NIPA VALUE RATIO

BEA #	I-O COMMODITY DESCRIPTION	NIPA Category	Ratio Type*
10200	Poultry and eggs	3.01	Constant-$
20401	Fresh fruits	3.02	Constant-$
20501	Fresh vegetables	3.03	Constant-$
20702	Nursery products	89.00	Current-$
30000	Commercial fishing	3.04	Current-$
140101	Meat packing plants	3.05	Constant-$
140102	Sausages and other meats	3.05	Constant-$
140103	Poultry dressing plants	3.06	Constant-$
140104	Poultry and egg processing	3.01	Constant-$
140200	Creamery butter	3.07	Constant-$
140300	Cheese, natural and processed	3.07	Constant-$
140400	Condensed and evaporated milk	3.07	Constant-$
140500	Ice cream and frozen desert	3.07	Constant-$
140600	Fluid milk	3.07	Constant-$
140900	Canned fruits and vegetables	3.08	Constant-$
141000	Dehydrated food products	3.08	Constant-$
141300	Frozen fruits, vegetables, and specialties	3.08	Constant-$
141401	Flour and other grain mill	3.09	Current-$
141402	Cereal breakfast foods	3.09	Constant-$
141403	Blended and prepared flour	3.09	Constant-$
141501	Dog, cat and other pet food	3.09	Current-$
141600	Rice milling	3.09	Constant-$
141700	Wet corn milling	3.09	Current-$
141801	Bread, cake, and related	3.10	Constant-$
141802	Cookies and crackers	3.10	Constant-$
142101	Malt beverages	9.00	Constant-$
142103	Wine, brandy and spirits	9.00	Constant-$
142104	Distilled liquor	9.00	Constant-$
142900	Shortening and cooking oils	3.11	Constant-$
150101	Cigarettes	7.00	Current-$
150102	Cigars	7.00	Current-$
150103	Chewing and smoking tobacco	7.00	Current-$
170100	Floor coverings	32.20	Constant-$
180400	Apparel from purchased materials (women's)	14.10	Constant-$
180400	Apparel from purchased material (men's)	15.10	Constant-$
190100	Curtains and draperies	33.00	Constant-$
190200	Housefurnishings, n.e.c. (textiles)	33.00	Constant-$
190303	Pleating and stitching	33.00	Current-$
220101	Wood household furniture	29.00	Current-$
220102	Household furniture, n.e.c.	29.00	Current-$
220200	Upholstered house furniture	29.00	Current-$
220400	Mattresses and bedsprings	29.00	Current-$
240500	Sanitary paper products	29.00	Current-$
240701	Paper coating and glazing	34.30	Current-$
240702	Bags, except textile	34.30	Current-$
240704	Pressed and molded pulp goods	34.30	Current-$
240708	Converted paper products, n.e.c.	34.30	Current-$

A 1972 value updated by a constant-dollar NIPA ratio is further updated by a price ratio from the CPI.

EXHIBIT 2-3:

I-O COMMODITIES AND ASSOCIATED NIPA VALUE RATIO (Cont.)

BEA #	I-O COMMODITY DESCRIPTION	NIPA Category	Ratio Type*
260100	Newspapers	84.00	Constant-$
260200	Periodicals	84.00	Constant-$
260301	Book publishing	83.00	Current-$
260400	Miscellaneous publishing	35.00	Current-$
260501	Commercial printing	35.00	Current-$
260602	Blankbooks and looseleafs	35.00	Current-$
260700	Greeting card publishing	35.00	Current-$
260801	Engraving and plate printing	35.00	Current-$
290100	Drugs	45.00	Current-$
290201	Soap and other detergents	34.20	Constant-$
290202	Polishes and sanitation goods	34.20	Current-$
320100	Tires and inner tubes	68.10	Current-$
340201	Shoes, except rubber	12.00	Current-$
420100	Cutlery	32.40	Current-$
420201	Hand and edge tools	32.40	Current-$
420202	Hand saws and blades	32.40	Current-$
420300	Hardware	32.40	Curernt-$
440001	Farm machinery and equipment	32.40	Current-$
440002	Lawn and garden equipment	32.40	Current-$
470100	Machine tools	32.40	Current-$
470401	Power driven hand tools	32.40	Current-$
470403	Metalworking machinery	32.40	Current-$
480300	Woodworking machinery	32.40	Current-$
340202	House slippers	12.00	Current-$
510200	Typewriters	32.30	Current-$
510300	Scales and balances	32.30	Current-$
510400	Office machines, n.e.c.	32.30	Current-$
530300	Switchgear and transformers	34.10	Current-$
550100	Electric lamps	34.10	Current-$
540100	Home cooking equipment	30.00	Constant-$
540200	Home refrigerators and freezers	30.00	Constant-$
540300	Home laundry equipment	30.00	Constant-$
540400	Electric housewares and fans	30.00	Constant-$
540500	Home vacuum cleaners	30.00	Constant-$
540600	Sewing machines	30.00	Current-$
540700	Home appliances, n.e.c.	30.00	Current-$
560100	Radio and TV receiving sets	87.00	Current-$
560400	Radio and TV communication	87.00	Current-$
590301	Motor vehicles and car bodies	65.00	Current-$
600100	Pleasure aircraft	86.00	Current-$
610200	Boat building and repair	86.20	Current-$
610500	Motorcycles, bicycles	86.10	Current-$
610700	Transportation equipment, n.e.c.	86.10	Current-$
630200	Ophthalmic goods	46.00	Current-$
640101	Jewelry, precious metal	18.00	Current-$
640102	Jewelers' materials	18.00	Current-$
640105	Costume jewelry	18.00	Current-$
640310	Games, toys, and children's vehicles	85.00	Current-$
640302	Dolls	85.00	Current-$
640400	Sporting and athletic goods, n.e.c.	85.00	Current-$

Source: *CPI Detailed Report — December 1972, December 1977 (12108)*
Unpublished breakdown of NIPA (03511)
Detailed Input-Output Commodity Composition of 1972 PCE in NIPA (03510)

EXHIBIT 2-4:

I-O COMMODITIES WITH VALUE RATIOS FROM CENSUS OF MANUFACTURES

I-O Commodity (BEA #)	SIC #	1972 PCE/Total Prod.	*1972 PCE/Total Supply
140700	2091	—	.85
140800	2032	.94	—
141100	2035	—	.72
142001	2065	—	.78
**142002	2066	—	—
142003	2067	—	.92
142200	2086	.90	—
**142300	2087	—	—
**142500	2075	—	—
142800	2095	—	.74
143100	2098	.81	—
143200	2099	.75	—
180102	2252	.81	—
**240500	2647	—	—
290201	2841	.70	—
290300	2844	.89	—
320200	3021	—	.96
340303	3171	—	.96
360702	3263	—	.93
420100	3421	—	.75
560200	3652	—	.88
**580100	36913 12	—	—
580200	3692	—	.75
**620700	3873	—	—
**630300	38611	—	—
640104	3914	—	.73
640200	3931	—	.60

Net imports are added to 1977 Census. Hence, the value change ratio equals 1977/1972 ratio of total supply.

**Since production refers to less than the 4-digit SIC Commodity Code, ratio of PCE to Total Production is unavailable.*

Source: 1977 Census of Manufactures, (03105), 1977 Exports, (03118), 1977 Imports (03118).

EXHIBIT 2-5:

SCALING, RATIOS OF NIPA COLUMNS

NIPA #	
3	0.9638
5	0.9802
6	0.9683
12	0.9327
14	1.0006
15	0.9969
16	0.9891
21	0.9894
30	0.9808
31	1.0171
32	0.9154
33	0.9975
34	1.0962
35	1.0290
45	0.9552
46	0.9873
67	1.0635
68	0.9351
85	0.9005
86	0.9626
87	0.9745

Mean = 0.9833
Standard Deviation = 0.045

We have excluded NIPA categories 18, 29, 65, 66, 83, 84 and 89 from statistical analysis because the elements in these columns were updated by current-dollar value ratios from NIPA, generating scaling ratios , which are necessarily equal to one, and therefore of no significance for evaluting the validity of the updating procedure.

Source: Detailed Input-Output Commodity Composition of 1972 PCE in NIPA (03510).

of a merchandise line in the Census of Retail Trade that matched the NIPA category in end-use. Exhibit 2-6 shows where NIPA classification corresponds with merchandise line classification.

The second approach was used for matrix elements without corresponding merchandise lines. In this approach, data elements were distributed in proportion to state income, except for food and clothing furnished to military personnel. Military food and clothing were distributed in proportion to armed forces payroll by state.

Exhibits 2-7 and 2-8 present the distribution approach used for each cell of the matrix. Where all the elements in a column were distributed in proportion to sales of one merchandise line or to state income, we have listed only the NIPA column and the associated distribution approach in Exhibit 2-7. For columns where some elements were distributed in proportion to sales of one merchandise line, other elements in proportion to sales of another, and a third group in proportion to state income, Exhibit 2-8 indicates the particular approach for each BEA I-O commodity of the NIPA column.

Aggregation to MRIO Classification

After state distribution, the 496-order BEA I-O values are aggregated to 126-order MRIO classification.

SERVICE SECTORS

The general approach to estimating service sector purchases by PCE is described below. Details of the method used for each individual sector follow.

National control totals for services come from the 1977 data reported in Table 2.4, "Personal Consumption Expenditures by Type of Expenditures," in the National Income and Product Accounts 1976-1979: Special Supplement to the Survey of Current Business, July, 1981 (03501). Published, numbered line items labeled "other" were supplemented with breakdowns from BEA and represent unpublished data.

Exhibit 2-9 provides the NIPA values and a concordance of NIPA line numbers and MRIO sectors for the NIPA line numbers discussed in this section. It should be noted that this concordance includes both the published NIPA lines and the unpublished breakdowns. In almost all MRIO's, the national totals obtainable from these published

EXHIBIT 3-6:

CORRESPONDENCE BETWEEN NIPA AND THE CENSUS OF RETAIL TRADE

NIPA		RETAIL CENSUS	
#	Category Description	#	Merchandise Line Description
3	Food purchased for off-premise consumption	100	Groceries and other foods
7	Tobacco products	150	Cigars, cigarettes, and tobacco
9	Alcohol purchased for off-premise consumption	140	Packaged alcoholic beverages
12	Shoes and other footwear	260	Footwear, except infants'
14	Women's and children's clothing	220	Women's, girl's wear
15	Men's and boy's clothing	200	Men's, boy's clothing
18	Jewelry and watches	400	Jewelry
21	Toilet articles and preparations	180	Health and beauty aids
29	Furniture, including bedding	340	Furniture and sleep equipment
30	Kitchen and other household appliances	300	Major household appliances
31	China, glassware, tableware, and	360	Kitchenware and home furnishings
32	Other durable house furnishings	280	Curtains, draperies and dry goods
		310	Small electric appliances
		360	Floor coverings
		600	Hardware and tools
		620	Lawn and garden equipment and supplies
33	Semidurable house furnishings	280	Curtains, draperies and dry goods
		600	Hardware and tools
45	Drug preparations and sundries	160	Drugs
46	Opthalmic products and orthopedic appliances	490	Optical goods
65	New automobiles	700	Automobiles, trucks, other powered transportation vehicles
67	Other motor vehicles	700	Automobiles, trucks, other powered transportation vehicles
		580	Recreational vehicles
68	Tires, tubes, access. and parts	740	Auto tires, batteries, access.
86	Wheel goods, durable toys, sports equipment, boats and pleasure aircraft	500	Sporting goods
		580	Recreational vehicles
87	Radio and TV receivers, records and musical instruments	320	Televisions
		330	Audio, musical equip. and supplies

Source: *Merchandise Line Sales 1977 Census of Retail Trade*, (03101).

EXHIBIT 2-7:

STATE DISTRIBUTION OF WHOLE NIPA COLUMNS

	NIPA COLUMN	Distributed According to
3	Food Purchased For Off Premise Consumption	ML-100
5	Food Furnished Employees (Including Military)	A.F. Payroll
5	Food Furnished Employees (including Civilians)	State income
6	Food Produced and Consumed on Farms	State income
7	Tobacco Products	ML-150
12	Shoes and Other Footwear	ML-260
14	Women's & Children Clothing	ML-220
15	Men's & Boy's Clothing	ML-200
16	Clothing to Military	A.F. payroll
18	Jewelry & Watches	ML-400
21	Toilet Articles & Preparations	ML-180
29	Furniture, Mattresses & Bedsprings	ML-340
30	Kitchen & Other Home Appliances	ML-300
31	China, Glassware, Tableware & Utensils	ML-380
34	Cleaning & Polishing, Preparation & Other Miscellaneous Home Supplies	State income
35	Stationery & Writing Supplies	State income
61	Funeral & Burial Expenses	State income
65	New Autos	ML-700
66	Net Purchases of Used Autos	State income
68	Tires, Tubes, Accessories & Parts	ML-740
83	Books & Maps	State income
84	Magazines, Newspapers & Sheet Music	State income
85	Nondurable Toys & Sport Supplies	State income
89	Flowers, Seeds & Potted Plants	State income
97	Other Recreational Expenses	State income

Sources: Merchandise Line Sales, 1977 Census of Retail Trade (03101).

EXHIBIT 2-6:

NIPA COLUMNS DISTRIBUTED IN PROPORTION TO SALES OF MORE THAN ONE MERCHANDISE LINE AND/OR STATE INCOME

IO Commodity	
NIPA #32	
170100	ML-300
170200	ML-200
171001	State Income
190200	ML-200
190302	ML-200
200903	State Income
230600	ML-200
250501	State Income
320302	State Income
320400	State Income
340305	State Income
350100	State Income
350900	State Income
361100	State Income
362200	State Income
400901	State Income
420100	ML-600
420201	ML-600
420202	ML-600
420300	ML-600
420500	ML-600
421100	ML-600
440001	ML-620
440002	ML-620
470100	ML-600
470401	ML-600
470402	ML-600
480300	ML-600
510102	ML-310
510200	ML-310
510300	ML-310
510400	ML-310
530400	State Income

IO Commodity	
530600	State Income
540400	ML-310
550200	ML-310
560300	State Income
610700	State Income
620200	ML-310
620700	ML-310
640501	State Income
640800	ML-300
641200	State Income
800000	State Income
810000	State Income
NIPA #33	
160100	ML-200
160300	ML-200
160400	ML-200
170300	ML-200
170800	ML-200
190100	ML-200
190200	ML-200
190303	ML-200
190305	ML-200
190306	ML-200
250501	State Income
320302	State Income
320400	State Income
320500	State Income
350100	State Income
370103	State Income
370402	State Income
410100	ML-600
640800	State Income
640702	ML-200

IO Commodity	
640800	State Income
641200	State Income
800000	State Income
810000	State Income
NIPA #45	
240500	ML-100
270100	State Income
290100	ML-100
310100	State Income
320302	State Income
540400	ML-310
550100	State Income
550200	State Income
620200	State Income
620400	State Income
620500	State Income
NIPA #46	
580200	State Income
620400	State Income
620500	State Income
630200	ML-400
NIPA #47	
590301	ML-700
610601	ML-500
610700	ML-700
810000	ML-700
NIPA #56	
130500	State Income
190302	State Income

IO Commodity	
190306	State Income
320100	State Income
320302	State Income
340305	State Income
420100	State Income
420500	State Income
430200	State Income
580100	ML-500
600100	State Income
610200	ML-500
610500	ML-500
610700	ML-500
630100	State Income
630300	State Income
640301	State Income
640400	State Income
641200	State Income
720200	State Income
730100	State Income
810000	State Income
NIPA #57	
340302	ML-330
560100	ML-320
560200	ML-330
560400	ML-330
570100	ML-320
570300	ML-330
580200	ML-320
640200	ML-330
810000	State Income

Sources: *Merchandise Line Sales, 1977 Census of Retail Trade (03101)*

Detailed Input-Output Commodity Composition of 1972 PCE in NIPA (03510)

EXHIBIT 2-9:

NIPA PCE VALUES AND ASSOCIATED MRIO SECTORS
(values in millions of dollars)

NIPA Line[1]	NIPA Description	NIPA Value	Included MRIO Codes
4.00	Purchased meals and beverages	65,250	098
17.00	Cleaning, storage and repair of clothing and shoes	4,719	107
19.00	Clothing, accessories, and jewelry - other (services)	1,641	107
22.00	Barbershops, beauty parlors, baths, and health clubs	6,202	107
24.00	Owner occupied non-farm dwellings - space rent	125,414	105
25.00	Tenant occupied non-farm dwellings - space rent	47,763	105
26.00	Rental value of farm dwellings	7,074	105
27.00	Housing - other	6,584	*
27.01	Hotels and motels	4,565	106
27.02	Membership lodging	308	106
27.03	Lodging in private higher education institutions	1,377	106
27.04	Lodging in private elementary and secondary schools	32	106
27.05	Tenant group room and board	275	106
27.06	Tenant group employee lodging	27	106
39.00	Water and other sanitary services	6,553	096
41.00	Telephone and telegraph	21,152	092
42.00	Domestic service	5,864	123
43.00	Household operation - other	9,021	*
43.01	Rug and furniture cleaning	192	107
43.02	Upholstery and furniture repair	955	107
43.03	Electrical repair	724	107
43.04	Postage and express charges	2,968	118
43.05	Moving and storage	2,259	087
43.06	Household insurance	1,210	104
43.07	Household operation - other, n.e.c.	713	Unallocated
47.00	Physician	29,066	112
48.00	Dentists	10,020	112
49.00	Other professional services cost	3,510	112, 114
50.00	Privately controlled hospitals and sanitariums	49,976	113
51.00	Health insurance	9,231	104
56.00	Brokerage charges and investment counseling	3,574	103
57.00	Bank service charges, trust services, and safe deposit rental	3,517	103
58.00	Services furnished without payment by financial intermediaries, except life insurance carriers	24,678	103

EXHIBIT 2-9:

NIPA PCE VALUES AND ASSOCIATED MRIO SECTORS (cont.)
(values in millions of dollars)

NIPA Line[1]	NIPA Description	NIPA Value	Included MRIO Codes
59.00	Expenses of handling life insurance	12,011	104
60.00	Legal services	9,008	109
61.00	Funeral and burial expenses	3,309	107
62.00	Personal business - other	4,377	*
62.01	Employment agencies	525	108
62.02	Classified advertisements	205	108
62.03	Personal business, n.e.c.	342	108
62.04	Accounting services	662	109
62.05	Professional associations	287	116
62.06	Labor union expenses	2,233	116
62.07	Postal money order fees	83	103
62.08	Telegraph money order fees	40	103
69.00	Repair, greasing, washing, parking, storage and rental (autos)	23,919	110
71.00	Bridge, tunnel, ferry and road tolls	900	091
72.00	Insurance premiums less claims paid (autos)	8,104	
74.00	Transit system	2,208	086
75.00	Taxicab	2,234	086
76.00	Railway commutation	230	085
78.00	Railway (excluding commutation)	350	085
79.00	Bus	716	086
80.00	Airline	6,101	089
81.00	Other	488	088, 091
88.00	Radio and television repair	2,668	107
91.00	Motion picture theaters	2,376	111
92.00	Legitimate theaters and operas, and entertainment of nonprofit institutions (except athletics)	868	111
93.00	Spectator sports	1,753	111
94.00	Clubs and fraternal organizations (except insurance)	1,811	111, 116
95.00	Commercial participant amusements	4,414	111
96.00	Parimutual net receipts	1,712	111
97.00	Other (recreation)	10,204	*
97.01	Sports and recreational camps	789	106
97.02	Photographic studios	1,226	107
97.03	Film development	987	108
97.04	Other, n.e.c.	3,471	111
97.05	Veterinary services	1,395	114
97.06	Admission fees to high school events	71	115
97.07	Pets and pet care	531	004
97.08	Cable TV	931	092
97.09	Lotteries	803	108
99.00	Higher education	7,530	115

EXHIBIT 2-9:

NIPA PCE VALUES AND ASSOCIATED MRIO SECTORS (cont.)
(values in millions of dollars)

NIPA Line[1]	NIPA Description	NIPA Value	Included MRIO Codes
100.00	Elementary and secondary schools	5,947	115, 117
101.00	Other (private education)	4,627	*
101.01	Commercial and vocational education	2,756	115
101.02	Nonprofit research and foundation expenses	1,871	116
102.00	Religious and welfare activities	16,732	*
102.01	Religious organizations	9,752	116
102.02	Museums, libraries, and galleries, etc.	507	116
102.03	Social welfare	6,022	116, 117
102.04	Political organizations	290	116
102.05	Foundation expenses, religious and welfare grant administration	161	117
104.00	Foreign travel by U.S. residents	10,314	088, 089, 120
105.00	Expenditures abroad by U.S. residents	1,545	120
107.00	Personal remittances in kind to foreigners	251	Unallocated

**Included MRIO codes are given immediately below separately for the breakdown of this NIPA line.*

[1] *Line numbers XX.00 are as identified in BEA Table 2.4 of National Income and Product Accounts, 1976-1979: Survey of Current Business Special Supplement, July 1981 (Source 03501). The line numbers with non-zero decimals identify unpublished values components of the corresponding XX.00 lines. The component values were supplied by BEA staff in telephone conversations.*

and unpublished data were sufficiently detailed for direct estimation of an MRIO sector as the sum or difference of one or more NIPA line numbers.

Distribution across states required a variety of data. For some sectors, it was possible to use the Census of Service Industries (Source 03103). Another frequent basis for distribution was by the MRIO sector output. General indicators such as personal income and population were used for state distribution when more specific ones appropriate to particular national totals were not available.

MRIO 004: Fruits, Nuts, Vegetables, and Miscellaneous Crops and Services

The national PCE total for MRIO 004 is NIPA line 97.07 (Pets and pet care). Distribution is by number of households[1].

MRIO 085: Railroads

The national PCE value of MRIO 085 is NIPA line 76.00 plus line 78.00. Although the 1977 Census of Transportation National Travel Survey contains data that would permit distribution of the total by state of residence of nonbusiness travelers, the state distribution here is in proportion to the state outputs of the MRIO.

MRIO 086: Local Passenger Transportation and Intercity Bus

The national PCE value for MRIO 086 is the sum of NIPA values at lines 74.00, 75.00, and 79.00.

State distribution of NIPA lines 74 and 75 was relatively simple. The economic censuses of 1977 had revenues of municipally owned and of non-regulated (by Interstate Commerce Commission) local bus companies,[2] and NIPA line 74 was distributed in proportion to sums of the two kinds of transit revenues. NIPA line 75 was distributed in proportion to wages and salaries of taxicab drivers of BLS unemployment insurance data.[3]

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[1] *Table 6.5, Statistical Abstract, 1979 (Source 03120).*

[2] *Municipally owned transit revenues are from U.S. Department of Commerce, 1977 Census of Governments Compendium of Government Finances, Table 50 (Source 03110). The local bus company revenues are from 1977 Census of Transportation Non-regulated Motor Carriers and Public Warehousing, Table 13 (Source 03107).*

[3] *Taxicabs expenditures by households is less satisfactory for taxicabs than for local transit because some of the use of taxicabs is business use and because the fraction of privately owned cabs may vary among states.*

No convincing basis was found for distributing intercity bus transportation. It presents the same theoretical problem as railroad transportation, and there is the same problem regarding residence of traveler. The practical solution for railroads of distributing by MRIO output was not practical here because the intercity bus transportation is too small a fraction of the MRIO industry to which it belongs. Moreover, there are no available statistics of distribution of intercity bus wages and salaries.

Since NIPA line 79.00 is only about 14 percent of the total of MRIO Sector 086, the distribution of the entire MRIO among states was made in proportion to the sum distribution of the sum of NIPA lines 74.00 and 75.00.

MRIO 087: Motor Freight

The national PCE value for MRIO is the value of NIPA line 43.05.

For state distribution, household moving and storage is too small a part of MRIO 087 and of parts of MRIO 087 with available employment statistics for such data to seem very useful in distributing the national value among states. It was therefore decided to distribute in proportion to state populations.

MRIO 088: Water Transportation

A national MRIO 088 estimate of $263 million for the international component of MRIO 088 was derived in the discussion of MRIO 089, below. The domestic portion was estimated for the 1947 Interindustry Study at what amounted to 14 percent of NIPA line 81. For 1977 that would be $68 million, bringing the total for MRIO 088 to $331 million.

A state distribution of MRIO 088 cannot, as in the cases of other transportation modes, be in proportion to all the state outputs, because the state outputs are dominated by freight movements on inland waterways that have nothing to do with PCE. The decision was made to distribute the $263 million of international in proportion to outputs of only the states that have main ocean ports: Massachusetts, New York, Maryland, Virginia, Georgia, Florida, Louisiana, Texas, California, and Washington. The remaining $68 million was distributed in proportion to the outputs of all states.

MRIO 089: Air Transportation

The national PCE total for MRIO 089 is equal to all of NIPA line 80.00 (for the domestic air transportation plus part of NIPA line 104.00 (for international).

The international portion is included in $4,473 million of total fares for all transportation modes[1] by both PCE and other travelers. The air transportation portion of this may be estimated as the product of 7.36 million travelers and an average fare of $572,[2] which equals $4,210 million, leaving $263 million as a residual estimate for total use, presumably all PCE, of MRIO 088, water transportation. There are no direct data on how much of the international air transportation is PCE.

One possible approach to estimation of the PCE portion of air transportation is to assume that international air transportation for PCE moved between 1972 and 1977 in proportion to the domestic portion. The domestic portion according to NIPA data of line 80 increased from $3,108 million to $6,101 million, or a factor of 1.963, and the 1972 interindustry study expenditures on air transportation for PCE were $5,805.9. Multiplying the 1972 value and the factor of increase yields $11,397 million of total PCE for 1977, and subtracting the domestic portion yields $5,296 million of international. This is not reasonable, if the previous estimate is correct that the PCE expenditure for international air transportation are included in $4,210 million of total U.S. resident expenditure.

A second alternative, the one adopted, is to rely on an unpublished NIPA assumption, based on benchmark data from the 1972 Interindustry Study, that 86.5 percent of all foreign travel expenditures for international travel by U.S. residents is PCE. If this is assumed to apply to the fare component, the equation is .865 times $4,473 million for all transportation modes, which equals $3,869 million of total fares. Then, if it is assumed that 100 percent of the water transportation is PCE, the $263 million of total water transportation is subtracted from the $3,869 million of PCE for air and water combined, leaving $3,606 million of air transportation for PCE. This implies that the 86.5 percent of fares that are PCE amounts to 100 percent for water transportation and 85.7 percent for air.

As in the case of railroads, the state distribution for MRIO 089 is in proportion to the MRIO outputs.

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[1] *Survey of Current Business*, *May 1981*, *p. 29 (Source 03501).*

[2] *Ibid*, *p. 32.*

MRIO 091: Transportation Services

MRIO 091 consists essentially of part of NIPA lines 81.00 plus all of 71.00, corresponding to SIC codes that cover travel agent services and operation of such facilities as toll highways, toll bridges, etc., respectively.

It is estimated that 80 percent of NIPA line 81 is SIC 4722, the travel agent, etc., category. This is consistent with information received from the National Income and Product Division that they use a 1972 interindustry estimate of 80 percent (14 percent for water transportation and six percent for baggage handling) in some current estimates.

NIPA line 71.00 and the estimated MRIO content of NIPA line 81.00 were distributed to states separately. NIPA line 71.00 was distributed in proportion to state government receipts from tolls, from the 1977 Census of Governments.[1]

The travel agent component was distributed to states in proporton to state data of the Census of Service Industries described as receipts of travel agents, tour operators, and related services.[2]

MRIO 092: Communications

The national PCE total for MRIO 092 is NIPA line 41.00 plus NIPA line 97.08. State estimates have been compiled as follows.

Telephone

The sources of telephone data for state distribution were:

1. Bell System Administrative Reports, Monthly Report No. 4, December 1977 and December 1980.

2. Statistics of Communications Common Carriers, Year Ended December 31, 1977 (Source 16203).

3. Statistics of the Independent Telephone Industry (Source 22041).

[1] *Magnetic Tape, Census of Governments (Source 03110).*

[2] *U.S. Bureau of the Census, 1977 Census of Service Industries, Volume 1, Service Statistics, Section 7, pp. 3-6 (Source 03103).*

These sources were used to estimate national and state expenditures for telephones as follows:

1. National PCE telephone expenditures by Bell system customers in 1977 are estimated from source 1 above. For each service (local, toll, etc.) with identified custom classes, residential and other PCE revenues were calculated as a percent of total revenues of that service for 1980. The percent figures were then applied to 1977 total revenues of each service to estimate PCE revenues in 1977.

2. Pay telephone expenditures were assumed to be PCE, and 1/2 of the "Other Services" categories were allocated to PCE. The latter are very small.

3. National PCE telephone expenditures by non-Bell customers were estimated from revenue figures on p. 20 of source 3 above, using the same Bell percentage figures from 1980, and the same assumptions stated in step 2 above.

4. Total PCE expenditures in 1977 were distributed among the states by the number of residential telephones in each state, as reported in table 6 of source 2.

Telegraph

The national total derived by the foregoing procedure represents 91 percent of the NIPA line 41 total. Much of the discrepancy between the NIPA total and the estimated telephone expenditures is due to telegraph expenditures, but there are no state telegraph data. The telegraph expenditures and discrepancies were assumed to be proportional to telephone expenditures, so that NIPA class 41 is distributed among the states according to the estimated telephone expenditures.

Cable Television

The NIPA total for cable TV was distributed among the states in proportion to reported cable TV revenues from the Federal Communications Commission, p. 1[1] (Source 16206. The NIPA value for national PCE cable expenditures is only 77 percent of the FCC

[1] *The FCC figures used have been adjusted using percentages supplied with the table to account for cable subscribers not covered by the data.*

value, which is explainable by the inclusion of non-PCE revenues in the FCC's data. It has been assumed that PCE cable revenues are distributed in proportion to total cable revenues.

MRIO 098: Water and Sanitary Services

The PCE total for MRIO 096 is NIPA line 39.00. The total for NIPA class 39 is distributed among the states based on the data from the American Water Works Association as follows:

1. Operating Data for Water Utilities 1970 & 1965, American Water Works Association, AWWA No. 20112 (no date) (Source 22181).

2. 1978 Water Utility Operating Data, American Water Works Association, Biennial, 1980 (Source 22181).

3. CPI Detailed Report, U.S. Department of Labor, Bureau of Labor Statistics, December 1978. (Source 12108)

4. Statistical Abstract of the U.S., 1979 (Source 03120).

Calculations were made according to the following procedures:

1. From table 3 of source 1 above, an average monthly rate for 500 cf of water was calculated for each state in 1970. (Average of rates for companies reporting.)

2. The same average was computed for 1978 from table 2 of source 2 above.

3. The average prices for each state in 1978 were deflated to 1977 prices using a national inflation figure for water and sanitary services of 8.7 percent (1977 to 1978) from source 3, table 11.

4. An inflation adjustment factor by state was prepared by dividing 1977 average prices by 1970 average prices.

5. The residential water revenue and total populations served in 1970 were calculated from tables 5 and 1 respectively of source 1. Population served includes only the populations served by respondents who also reported residential revenues in table 5.

6. Residential revenue per capita in 1970 is calculated for each state by dividing revenues by total population served.

7. Total residential revenues by state for 1977 are calculated by multiplying the average residential revenue per capita in 1970 times the inflation adjustment factor (from step 4 above) times the total 1977 population of the state (from Statistical Abstract of the U.S., source 4 above).

Note: Data by state for sanitary services are not available, but these expenditures are assumed to be distributed in approximately the same proportion among the states. This assumption is weaker where irrigation systems are important.

MRIO 098: Eating and Drinking Places

The national PCE for MRIO 098 is the $65,250 million of NIPA line 4.00. The state distribution is in proportion to MRIO outputs.

MRIO 103: Banking, Credit Agencies, and Investment Brokers

The national PCE total for MRIO Sector 103 is the sum of NIPA lines 56.00, 57.00, 58.00, 62.07, and 62.08. The total of national PCE for these three classes is distributed among the states in proportion to state personal income for 1977 as reported in the Survey of Current Business, July 1981, Table 3 - Personal Income by Major Sources, Selected Years, 1969-1980 (Source 03501).

MRIO 104: Insurance

The national PCE total for MRIO Sector 104 is the sum of NIPA lines 43.06, 51.00, 59.00, and 72.00. The NIPA values were distributed individually among the states as follows:

1. NIPA line 43.06

Source 24031, AM Best's Executive Data Service: Property and Casualty Insurance, report B4, 1977 By-state Summary, Homeowners Multiple Peril, published 1978.

The total for NIPA line 44.00 was distributed among the states in proportion to total direct premiums written for Homeowners Multiple Peril insurance as reported by AM Best Co. Homeowners Multiple Peril includes insurance on the value of the home itself, which is not part of PCE and is not included in NIPA line 44.00. However, it is assumed that the proportion of household personal property insurance (also included in Homeowners Multiple Peril) to insurance on the house itself is relatively constant among the states.

2. NIPA line 51.00

Source 22171, Sourcebook of Health Insurance Data, Table 3.4: Health Insurance Premiums by Type of Insurer in the United States by State, 1977. Prepared for Health Insurance Association of America.

The total for NIPA line 51.00 was distributed among the states in proportion to total health insurance premiums written by state as reported in the Sourcebook of Health Insurance Data.

3. NIPA line 59.00

Source 22071, Life Insurance Fact Book, p. 60.

NIPA line 59.00 was distributed among the states in proportion to total life insurance premiums written by state as reported in the Life Insurance Fact Book.

4. NIPA line 72.00

Source 24031, AM Best's Executive Data Service: Property and Casualty Insurance, report B4, 1977, by State Summary, All Private Passenger Auto, published 1978.

NIPA line 72.00 was distributed among the states in proportion to total private passenger auto insurance premiums written by state as reported by AM Best Co.

MRIO 105: Real Estate and Rental

The national PCE total for MRIO Sector 105 is the sum of NIPA lines 24.00, 25.00, and 26.00. The state distributions were prepared as follows:

NIPA line 24.00: Owner-Occupied Nonfarm Dwellings

The rental value of owner occupied non-farm dwellings was disaggregated by state in proportion to the total value of owner occupied dwellings by state. State level value of owner-occupied dwellings for 1970 was calculated as the product of median value of dwellings and number of units from the 1970 Census of Housing (Source 03112). These values were scaled to 1977 values using for each region separately the product of 1970 value and the ratio between 1977 and 1970 median values. The 1977 median values are from the 1977 Survey of Housing (Source 03115).

NIPA line 25.00: Tenant-Occupied Nonfarm Dwellings — Rent

The imputed rental values of tenant-occupied non-farm dwellings were estimated using the same techniques and data sources as for owner occupied dwellings, substituting total rents paid in place of total value of dwellings. Total rents are the product of median rents paid times the number of rental units by state.

NIPA line 26.00: Rental Value of Farm Dwellings

The total rental value of owner and tenant occupied farm dwellings was the NIPA value published in Survey of Current Business, NIPA, 1976-79 (Source: 03501). State-level values summing to this control total were available in unpublished data from the U.S. Department of Agriculture, Economic Research Service.

Note that according to MRIO Procedures No. 2, room receipts from permanent guests in lodging places are to be included in MRIO 105. According to Survey of Current Business, Table B, p. 54, April, 1979, NIPA class 25 includes rent paid in lodging houses, and so this element of MRIO Sector 105 has been incorporated in the national total, even though no state-specific data were available.

MRIO 106: Hotels and Lodging Places

The national total of MRIO 106 is the sum of NIPA lines 27.01 through 27.06 and 97.01.

The state PCE distribution for MRIO 106 is the sum for each state of the distribution developed separately from MRIO outputs and sections of the Census of Service Industries (Source 03103) for each of the several components of the sector, as detailed below:

Component	Basic Data Source	Procedure Detail
Hotels and motels	Tasks 1 & 2 Report	Sorting of expenditure in proportion to the MRIO outputs.
Sporting & recreational camps	03103 SC 77-S-2	Sum "Sporting & Recreational Camps" expenses, Table 16 and receipts, Table 1, in "Hotels, Motels, and Other Lodging Places," and scale to NIPA US total.[1]
Clubs, fraternities	03103 SC 77-S-2	Sum "Membership Lodging" expenses, Table 19 and receipts, Table 18, in "Hotels, Motels, and Other Lodging Places," and scale to NIPA US total.
Tenant group room and board	03103 SC 77-S-2	Scale "Rooming & Boarding Houses" receipts, Table 17, in "Hotels, Motels, and Other Lodging Places," to NIPA US total.
Higher education plus elementary and secondary private schools plus tenant group employee lodging.	03103 SC 77-5-9	The national total is distributed by expenses of "Colleges, universities and professional schools, and junior colleges" in Tax-Exempt Service Organizations, Table 21, for SIC 822.

[1] *The Census of Service Industries uses two dollar volume measures. The dollar volume measure for taxable establishments is "receipts;" the dollar volume measure for tax-exempt establishments is "expenses." Where a service is provided by both taxable and nontaxable establishments, a summing of receipts and expenses, respectively, is required.*

It should be noted that the distribution of lodging in institutions of education is imperfectly accomplished by the use of expenses of SIC 822 — "Colleges, universities and professional schools, and junior colleges." SIC 8221 — "Colleges, universities, and professional schools," is reportedly the Census of Service Industries reports at only the three-digit level. This same allocation was also used for elementary and secondary schools and for tenant group employee lodging; these categories represent only a few million dollars each, so separate allocation of these amounts was not undertaken.

MRIO 107: Personal and Repair Services Except Auto

The national total for MRIO 107 is the sum of NIPA lines 17.00, 19.00, 22.00, 43.01, 43.02, 43.03, 61.00, 88.00, and 97.02, plus the six percent of NIPA line 81 (see MRIO 091) estimated for baggage handling assumed to be porter services (SIC 7299). This sector distributes almost all of its output to personal consumption expenditures, as indicated by examination of the use of BEA commodities 72.0200 (Personal and repair services, except auto repair and beauty and barber shops) and 72.0300 (Beauty and barber shops) in Table 1 of BEA's The Detailed Input-Output Structure of the U.S. Economy: 1972, Volume I (Source 03504). The entire output of 72.0300 went to PCE, and 64.45 percent of 72.0200 output went to PCE. The balance of the 72.0200 output in the 1972 study was spread across many industries in small amounts, with some concentration among those industries such as eating and drinking places and health services that utilize laundry services or uniforms.

It is assumed that the state distribution of the relatively small non-PCE purchases from this sector does not vary enough from the PCE distribution to affect the distribution of the aggregate significantly. Therefore, the state distribution of PCE MRIO 107 was in proportion to output.

MRIO 108: Miscellaneous Services and Advertising

The national PCE total for MRIO 108 is the sum of NIPA lines 62.01 through 62.03, 97.03 and 97.09. This is a small fraction of total production of the MRIO, making it inappropriate to distribute the PCE over states in proportion to total output. The alternative selected for all except NIPA line 97.09 was 1977 personal income by state, taken from Table 3, "Personal Income by Major Sources, Selected Years 1969-80," Survey of Current Business, July, 1981 (Source 03501). NIPA line 97.09 was distributed in proportion to households.[1]

[1] *Table 5, Statistical Abstract, 1979 (Source 03120).*

MRIO 109: Miscellaneous Professional Services

The national PCE total for MRIO 109 is the sum of NIPA lines 60.00 and 62.04.

Personal consumption expenditures for legal services and accounting services are less than 20 percent of total sector output, as shown in an examination of BEA commodity 73.0300, Table 1, Input-Output Structure cited in sector MRIO 107 (Source 03504). Again, therefore, it was inappropriate to use the sector's total ouput for PCE distribution. On the plausible assumption that PCE for lawyers and accountants are responsive to income, the national total is distributed on the basis of 1977 personal income by state (source shown under MRIO 108).

MRIO 110: Auto Rental, Repair and Maintenance

The national PCE total for MRIO 110 is NIPA line 69.00.

The output for Task 1 for MRIO Sector 110 is less than $2.5 billion above the NIPA Line 69 total. The national total is therefore distributed according to the MRIO output for this sector.

MRIO 111: Amusements

The national PCE total for MRIO 111 is the sum of NIPA lines 91.00, 92.00, 93.00, 95.00, 96.00, 97.04, and part of 94.00 total of $1,811 million. The Census of Service Industries has total receipts of membership sports and recreation clubs at $1,148 million.[1] This was taken to be the MRIO 111 part of the NIPA line 94.00.

The state distribution for this sector is in proportion to the output from Task 1 for the sector less receipts for SIC 781, 782 — "Motion picture production, distribution, services," from the Census of Service Industries, Subject Series, Motion Picture Industry (Source 03103, SC 77-S-4, Table 1). Removing motion picture production activities eliminated a major component of the MRIO that is not PCE.

MRIO 112: Doctors and Dentists, Including Outpatient Care Facilities

The national PCE total for MRIO 112 is taken as the sum of NIPA lines 47.00 and 48.00 plus the part of line 49.00 estimated to be osteopathic physicians. The Census of Service Industries reports receipts of SIC 803 (Osteopathic Physicians) as $776 million.[2]

[1] *Census of Service Industries, Volume 2, p. 45.*

[2] *Ibid, Volume 1, Section 8, p. 3.*

The national PCE total for the sector is distributed according to the MRIO output for the sector, scaled to the NIPA PCE total. PCE was 92.42 percent of total demand for the output of this sector in the 1972 BEA input-output study cited in the discussion of MRIO 107; it was assumed that PCE was still of dominating importance in 1977.

MRIO 113: Hospitals and Nursing

The national PCE total for MRIO 113 is taken to be NIPA line 50.00.

Personal consumption expenditures for this sector are allocated to states by MRIO output for the sector.

MRIO 114: Other Medical and Health Services

The national PCE total for MRIO 114 is the sum of NIPA line 97.05 and the part of 49.00 remaining after allocation of the osteopathic physicians part to MRIO 112.

The NIPA line 97.05 is distributed according to data developed from a 1979 veterinarian practice analysis conducted by the American Veterinary Medical Association (Source 22191). The analysis of gross income by practice type and by Census region provided veterinarian small-animal-exclusive practice income for the Census region; these results were scaled to the NIPA part 97 total and assumed to represent consumer expenditures for veterinarians. Within the region, these expenditures are allocated according to the number of households by state within the region, for 1977 Statistical Abstract of the United States, 1979, Table 65 (Source 03120). The use of households prevents persons residing in institutions from affecting the distribution.

MRIO 115: Educational Services

The national PCE for MRIO 115 is the sum of NIPA lines 97.06, 99.00, 101.01, and all of 100.00 except for the part of children's day care services in line 100.00 that NIPA considers not to be educational service. The fraction, according to BEA staff is assumed to be a 1972 benchmark estimate of 33.4 percent. The Census of Service Industries gives the 1977 value of children's day care services as $1,588.8 million,[1] and 33.4 percent of that is $531 million that, at least conceptually — they did not use the Census of Service Industries for 1977 — is in NIPA's educational services but should be excluded from MRIO 115.[2]

[1] *Census of Service Industries, Vol. 2, Section 9, sum of entries for SIC 835 on p. 8 (taxable), and p. 9 (tax-exempt).*

[2] *The allocation of the full $531 million for educational services leaves no allowance for the possibility that some of that money is used to provide lunches or other services that NIPA would allocate to PCE items other than education.*

Personal consumption expenditures for educational services are distributed in proportion to output totals for MRIO 115. PCE represents 85.85 percent of all final demand for educational services in the 1972 BEA study, and 82.6 percent of total sector demand. It is assumed that PCE patterns for the sector accurately mirror sector output patterns.

This procedure generates several distortions. Students purchases of educational services in other than their state of residence will appear in the state producing the service. This procedure also yields values too high for those states in which educational institutions conduct extensive contract or grant research and development work.

MRIO 116: Nonprofit Organizations

The national PCE total for MRIO 116 is the sum of NIPA lines 62.05, 62.06, 101.02, 102.01, 102.02, 102.04, and parts of 94.00 and 102.03.

The part of NIPA line 94.00 is all of the line's $1,811 million minus the estimate of $1,148 million that was allocated to MRIO 111 as sports and recreation clubs, leaving $663 million for MRIO 116.

The $663 million of NIPA line 102.03 must be distributed between MRIO 116 and MRIO 117. The NIPA line has parts that conceptually are sums of components of the following Census of Service Industries categories, in millions of dollars:[1]

MRIO 116:	
SIC 864	3,606.5
SIC 869	1,290.0
MRIO 117:	
SIC 083 - SIC 835 (part)	9,802.7
Total	14,699.2

[1] *Data from Volume 2, Section 9, pp. 8-9.*

This sum is considerably more than the NIPA estimate of $6,022 million for social services. The discrepancy is explainable partly by the fact that NIPA uses 1972 benchmark data for 1977 rather than the 1977 Census, and partly by the fact that some of the Census value for these establishment outputs (or expenses) is for transfer payments or for such items as food, lodging, and medical care that NIPA allocates to corresponding NIPA lines other than line 102.03.

The scaling of the Census of Service Industries values to total $6,022 million yielded $2,006 million for MRIO 116 and $4,016 million for MRIO 117.

State distribution was in three parts. The $9,752 million of NIPA line 102.01 was in proportion to the ouput distribution of SIC 866. The $1,871 of NIPA line 101.02 was distributed in proportion to expenses of SIC 892 from the Census of Service Industries.[1] The remainder $5,986 million was distributed in proportion to personal income.

MRIO 117: Other Social Services

The national PCE total for MRIO 117 is the portion of NIPA line 102.03 just estimated, plus all of line 102.05 plus the 33.4 percent of children's day care services in NIPA line 100.00 not allocated to MRIO 115.

The state distribution was in proportion to MRIO output. In the 1972 Interindustry Study, PCE accounted for 91 percent of the national output of the sector.

MRIO 118: Federal Government Enterprises, Except Utilities and Local Transit

National PCE for MRIO 118 is NIPA line 43.04.

The sources for state distribution were

1. University of Michigan, Institute for Social Research, Household Mailstream Study, 1978 (Source 26111).

2. Current Population Reports, series P-60, No. 117, Money Income in 1977 of Households in the United States (Source 03116).

3. Statistical Abstract of the U.S., 1978 (Source 03120)

[1] *Volume 2, part 4, SIC 892 lines of Table 1 for each state.*

4. U.S. Postal Service, "Revenue Cost Analysis Report for FY 1977," unpublished data (Source 16904).

The state distribution was undertaken in three steps. The religious expenditures of NIPA line 102.01 were distributed in proportion to SIC 866 based on output. NIPA line 101.02 was distributed by expenses of SIC 892 from the 1977 Census of Service Industries, Volume 2, Part 4. The remainder was distributed by personal income.

From Table 10, page 29 of source #2 above, the households in each standard Federal region were aggregated into the following income categories: under $5,000, $5,000 - $9,999, $10,000 - $14,999, $15,000 - $19,999, $20,000 - $24,999, and $25,000 and over. From these, a percentage distribution by region was prepared. This percentage distribution was applied for each region to the states within that region by multiplying the percentage of households in each income class times the number of households in each state in the region (source of households per state is table 65, p. 48, source #3 above).

Next, the average expenditure on postage per household was calculated by income class from sources 1 and 4 above. Pages 9, 13, 14, and 17 of source 4 show average revenue per piece for each class of mail. Household first class mail postage per piece was assumed to consist of the average for all letters and sealed parcels, second class figures are unavailable (but unimportant), third class is evaluated at the single piece rate, and fourth class is evaluated at a weighted combination of the zone rate and the special rate. The weights were the total number of zone and special rate pieces sent by households (from table 11.1, volume II, source #1).

The next step was to find the total number of pieces of each class of mail sent by each income category. This was taken from table 14.11, volume II of source #1. Then, for each income class the average postage expenditure per household was calculated as follows. Multiply the total number of pieces times average revenue per piece for each type of mail, then sum the products and divide by the total number of households in the income class.

With the average expenditure per household on postage by income class, and the number of households in each state in each income class, the total expenditure on postage in each state was calculated as the sum of the expenditures by each income class in each state.

MRIO 120: Directly Allocated Imports

The PCE total for MRIO imports includes purchases of noncomparable imports of commodities that have been covered earlier in the section on PCE plus expenditures abroad represented by NIPA line 105.00 and the portion of NIPA line 104.00 that is not accounted for by fares and costs of travel agents, as estimated above in the discussion of MRIO 089. The latter is $6,045 million, and adding $1,545 million for NIPA line 105 yields a control total of $7,990.

The state distribution is by personal income.

MRIO 123: Household Industry

The national PCE total for MRIO 123 is NIPA line 42.00.

It was distributed among the states by state personal income, as reported in Survey of Current Business, July 1981, Table 3 - Personal Income by Major Sources, Selected Years 1969-1980 (Source 03501).

CHAPTER 3

PRIVATE FIXED CAPITAL EXPENDITURES

Capital expenditures on fixed capital have been developed separately by plant and equipment for each state. These data have been reconciled with the NIPA data on private expenditures for producer durable equipment and for structures at the national level.

There are two possible approaches to estimating private capital expenditures at the state level. One approach is first to develop data on capital expenditures for each private sector, and then to distribute these expenditures by type of equipment and by type of structure using a capital transactions matrix developed for a historical period for national level data. The use of this matrix for distributing capital expenditures assumes that the distribution of the historical period is valid for the current period (the most recent capital transactions matrix is for 1972) and also that the distribution for each sector at the national level is valid for each sector at the state level. The general lack of consistent capital expenditure data at the state level except for mining, manufacturing and construction further weakens the merits of this approach. The excessive adjustments that are required to reconcile the state data to the national level so distort the data as to render it of questionable value.

The other approach is to proceed directly to estimate capital expenditures by state for each type of equipment and structure irrespective of the sector making the capital expenditure. This approach is also not supported well by the available data. However, the approach does make use of what solid information is available while avoiding computational procedures that add little new information.

Elements of both procedures were employed. The principal industries that purchase each type of producer durable equipment were identified from the BEA capital transactions Table for 1972.[1] Proxy statistical series available at the state level were then selected to distribute the NIPA data to the states. For the industries wherein capital expenditure data were available consistently on an establishment basis at the state level (manufacturing, construction, and mining), these data were used as proxies.

[1] *New Structures and Equipment by Using Industries, 1972: Detailed Estimates and Methodology, (Source 03517).*

However, the general lack of reliable capital expenditure data at the state level resulted in various proxy series being used for capital expenditures outside of mining, manufacturing and construction. Further details on the procedures used to distribute producer durable equipment investment totals to the states are given below.

Investment in plant and structures was distributed to the states based primarily on data on construction receipts from the 1977 Census of Construction, (Source 03104) supplemented by estimates of force-account construction by state. The procedures are discussed in more detail below.

PRODUCER DURABLE EQUIPMENT

The national totals for private investment in producer durable equipment are given for detailed types of equipment in Exhibit 3-1. The first column of data shows net purchases of new and used equipment as published in the Survey of Current Business (Source 03501). The second column of data shows purchases of new equipment only from unpublished worksheets at the Bureau of Economic Analysis (BEA) of the Department of Commerce; these are the totals that are relevant to the MRIO accounts.[1] The further columns show the MRIO sector detail corresponding to the NIPA categories of equipment and the weight of each MRIO sector in the NIPA categories of equipment.

To distribute the equipment totals in the NIPA accounts to the corresponding MRIO accounts, one must first determine which MRIO accounts compose the NIPA accounts. There are no tables that show such a conversion. However, the BEA publication, "New Structures and Equipment by Using Industries, 1972: Detailed Estimates and Methodology," has a table and appendix that supports a conversion based on 1972 capital equipment expenditures. The 1977 NIPA account numbers were distributed across the MRIO accounts in approximately the same proportion as existed in 1972.

[1] *Used equipment sales and purchases enter into the accounts only to the extent that transactions take place between the public and private sector (and then only as an aggregate amount reflecting the net sales or purchases between the private and public sectors or between the Federal government and state and local governments), or that used equipment is imported or exported. Commissions on the sale of used equipment are capitalized for purchases by the private sector and treated as a cost on purchases by the public sector (commissions apply to gross as distinguished from net transactions and also apply to transfers within the private or public sectors as well as transactions between these sectors).*

EXHIBIT 3-1:

PRODUCER DURABLE EQUIPMENT INVESTMENT, 1977
(Million of Dollars)

NIPA Product Classifications	Net Purchases[1]	New Purchases[2]	MRIO Product Classifications	Weight	MRIO Code
Furniture & Fixtures	5,584	5,531	Household Furniture	.20	038
			Other Furniture & Fixtures	.80	039
Fabricated Metal Products	4,783	4,783	Metal Containers & Miscellaneous Metal Products	.40	058
			Structural Metal Products	.60	059
Engines and Turbines	2,152	2,152	Engines and Turbines	1.00	061
Tractors	4,651	4,500	Farm and Lawn Equipment	1.00	062
Agricultural Machinery, Except Tractors	5,414	5,407	Farm and Lawn Equipment	1.00	062
Construction Machinery, Except Tractors	6,123	5,953	Construction and Mining Equipment	1.00	063
Mining and Oilfield Machinery	3,044	2,996	Construction and Mining Equipment	1.00	063
Metalworking Machinery	7,969	7,933	Metalworking Equipment	1.00	065
Special Industry Machinery, n.e.c.	6,283	6,290	Special Industry Machinery	1.00	066
General Industrial, Including Materials Handling Equipment	7,934	8,007	Materials Handling Equipment	.43	064
			General Industrial and Other Non-Electrical Machinery & Equipment	.57	067
Office, Computing, and Accounting Machines	10,010	9,930	Office and Computing Equipment	1.00	068
Service Industry Machinery	4,045	3,953	Service Industry Machinery	1.00	069
Electrical Transmission & Distribution, and Industrial Apparatus	7,053	6,848	Electrical Transmission & Electrical Industrial Equipment	1.00	070
Communications Equipment	12,455	12,453	Communications, Except Radio and Television	.32	092
			Primary Nonferrous Metal and Prod.	.01	057
			Receiving Sets, Records & Tapes	.038	073
			Communications Equipment	.632	074
Electrical Equipment, n.e.c.	2,939	2,939	Other Electrical Equipment	.88	076
			Electronic Components	.02	075
			Electrical Lighting & Wiring Equip.	.10	072
Trucks, Buses, and Truck Trailers	18,178	18,319	Motor Vehicles and Parts	1.00	077
Autos	12,516	19,101	Motor Vehicles and Parts	1.00	077
Aircraft	2,285	2,663	Aircrafts and Parts	1.00	078
Ships and Boats	1,805	1,930	Other Transportation Equipment	1.00	081
Railroad Equipment	2,842	2,846	Other Transportation Equipment	1.00	081
Instruments	9,747	9,744	Scientific and Photo Equipment	.63	082
			Medical, Dental, and Optical Equip.	.37	083
Other	3,642	3,599	Nonferrous Ores	.10	008
			Crude Petroleum	.02	010
			Ordnance	.03	020
			Industrial Chemicals	.06	043
			Other Manufactured Products	.49	084
			Real Estate and Rental	.30	105
Residential	2,301	2,301	Household Furniture	.08	038
			Household Appliances	.61	071
			Floor Coverings & Miscellaneous Textile Products	.28	031
			Receiving Sets, Records and Tapes	.03	073
Total	143,755	150,178			

[1] SCB, *Table 5.6. Represents net of purchases of new equipment and purchases (sales) of used equipment.*

[2] *Unpublished BEA data. Represents new purchases only.*

After breaking down the 1977 NIPA numbers for capital equipment expenditures into the corresponding MRIO accounts, the next step is to distribute those data across the states. Capital expenditures data for specific industries, or for aggregate industry groups, were used to distribute the data for most expenditures.

Table 2 of the BEA publication referred to above is the 1972 matrix used to provide the flow of capital goods to the user industries. Since 1972 was the last year that such an analysis was done, it was assumed that the flows for 1977 were more or less proportional to those in 1972 as reflected in the matrix. To distribute a capital item across the 50 states, the first step is to determine the principal industries in which the capital item was used, then to distribute the value of the item across the states in the same proportion that the individual states expended funds on capital equipment in the relevant industry or industries. For example if capital item X was used in industries "A" (75%) and "B" (25%), then 75% X would be distributed to the states in the same proportions that the industries "A" within each state spent funds on capital equipment and 25% X would be distributed to the states in the same proportion that the industries "B" within each state spent funds on capital equipment.

Before making the state distribution, two preliminary steps were required. The first was to group the 100+ capital items shown in Table 2 of the BEA publication to correspond to the MRIO accounts. This was done by referring to the appendix of "New Structures and Equipment by Using Industries, 1972: Detailed Estimates and Methodology," which lists the corresponding I-O number and was easily converted to the MRIO account. The second preliminary step was to determine each state's expenditures for capital equipment by industry. For the manufacturing industries, the Census provides summary data that indicate equipment expenditures by state for all manufacturing industries in total and also gives state data for individual manufacturing industries although much of that data is suppressed. The Census provides similar data for the construction, mining, and agricultural services industries. For other industries that type of data were not readily available so proxies had to be developed to serve the same purpose.

For the communications industry a combination of new telephones put in place in 1977 by state and total number of phones placed by state at Dec. 31, 1977 was used. This data was available in the Statistics of Communications Common Carriers (Source 16203). Equipment expenditures in the electrical industry were distributed by comparing differences in installed generating capacity between Dec. 31, 1976 and Dec. 31, 1977 for each state. This information was available in EEI's "1977 Statistical Year Book" (Source 22021). Table 16 of The 1978 Census of Agriculture (Source 03109) gives the estimated market value of all machinery and equipment in place of 12/31/78. These data were used as the proxy for the agriculture industry. To develop proxies for the remaining industries, Table 7 of the 1977 Census of Construction was used. That table provides data on new construction receipts by type of construction, by state. For instance, there are data on receipts for religious buildings, educational buildings, amusement, social and recreational buildings, etc. Since producer durable equipment purchases can be expected to be related to new construction in the associated industries, this was deemed to be the best proxy available for distributing these equipment expenditures, especially for non-profit operations for which other data are very limited.

With capital expenditure for each state by industry developed from the Census and the other sources listed above, and with a determination of which industry or industries the product was used in based on the aforementioned 1972 matrix, one has only to multiply the national total for a product by the appropriate percentage to determine expenditures in a particular industry. The product is then multiplied by the appropriate percentage for the individual states to determine the state expenditure for an individual product.

A different method was employed in distributing capital equipment expenditures for transportation items, the rationale being that transportation items are unique when compared to other capital expenditures. The factor that makes them unique is their mobility. Neither the point of expenditure nor the source of funds can generally be defined and neither is as significant as the place of production since the equipment has no fixed location in use. Accordingly, the 1977 Census of Manufactures (Source 03105) was used as the source for determining a state breakdown. Instead of using capital equipment expenditures, the production value for each specific transportation item was used. The exception is business autos for which a further procedure was used.

To distribute capital expenditures for autos, 1977 automobile gasoline sales to the business sector was used as a proxy for state distribution. This information was derived from the publication by the ETHYL Corp. — "Yearly Report of Gasoline Sales by States - 1977" (Source 23071). Gasoline sales to the business sector were used because it was assumed that gasoline sales are fairly representative of the sales of new autos. This method was the most cost-efficient since information on actual auto sales to businesses is very costly to obtain.

Exhibit 3-2 lists the industry groups in which capital items were purchased and the proxy employed in distributing equipment expenditures across the states.

STRUCTURES

The national totals for private investment in structures are taken from the NIPA accounts as published in the Survey of Current Business (Source 03501). These data are shown in Exhibit 3-3. Net sales of used structures by the business sector are shown separately. Sales commissions on both new and used structures are shown separately and are treated as part of business investment.

Residential structures, shown in the second part of the table, are also treated as private investment, whether owned by individuals or by businesses. Government purchases of structures, shown in the last part of the table, are not included in private investment and are shown for reference purposes only.

The principal source of comprehensive state data on expenditures for new construction is the Census of Construction for 1977. This source provides data on contractor construction by state in which the establishment performing the work is located, and differs from the amount of construction work performed in the state. It was necessary to adjust these data to represent state of performance, using incomplete Census data and data from other sources to adjust the detail as possible for various types of construction. Unfortunately, this adjustment could only be made for aggregative types of construction, omitting much of the detail.

Contractor construction excludes an important part of construction outlays which are included in the NIPA accounts, i.e., force-account construction performed "in-house" by employees of specific industries. It was necessary to develop data for this construction

EXHIBIT 3-2:

DISTRIBUTION OF CAPITAL EQUIPMENT EXPENDITURES TO STATES

Industry	Proxy	Source
Manufacturing	1977 Production Levels	1977 Census of Manufactures
Construction	1977 Capital Expenditures	1977 Census of Construction
Mining	1977 Capital Expenditures	1977 Census of Mineral Industries
Agricultural Services	1977 Capital Expenditures	1978 Census of Agriculture
Agriculture	1978 Value of Machinery & Equipment in Place	1978 Census of Agriculture
Communications	New Telephones Put In Place In 1977 Total Telephones Put In Place In 12/31/77	1977 Statistics of Communication Common Carriers
Electrical	1977 Installed Generating Capaticy	1977 EEI Statistical Yearbook
Finance & Insurance	1977 Construction Receipts - Office Buildings	1977 Census of Construction
Wholesale & Retail Trade Services	1977 Construction Receipts - Stores, Restaurants, etc.	1977 Census of Construction
Health, Education, and Nonprofit	1977 Construction Receipts - Hospitals, Schools, and Religious Buildings	1977 Census of Construction
Real Estate and Rental	1977 Construction Receipts - Apartment Buildings	1977 Census of Construction
Transportation Equipment (except autos)	1977 Production Levels	1977 Census of Manufactures
Business Autos	Gasoline Sales to the Business Sector	Ethyl Corporation, Yearly Report of Gasoline Sales by State, 1977.

EXHIBIT 2-2:

PURCHASES OF STRUCTURES BY TYPE

	1977
Purchases of structures[1]	197,555
Private	158,108
Nonresidential	64,606
New	64,547
Nonresidential buildings, excluding farm	29,790
Industrial	7,712
Commercial	14,860
Religious	1,046
Educational	660
Hospital and institutional	3,290
Other[2]	2,141
Public Utilities	18,893
Railroads	737
Telephone and telegraph	6,278
Electric light and power	11,199
Gas	1,482
Petroleum pipelines	1,197
Farm	4,877
Mining exploration, shafts, and wells	10,067
Petroleum and natural gas	9,135
Other	932
Other[3]	1,361
Brokers' commissions on sale of structures	331
Net purchases of used structures	-173
Residential	93,495
New	84,066
Nonfarm	82,572
New housing units	66,012
Permanent site	65,031
1-unit structures	54,553
2-or-more unit structures	10,478
Mobile homes	3,881
Additions and alterations	13,880
Other[4]	80
Farm	1,496
New housing units	897
Additions and alterations	799
Brokers' commissions on sale of structures	10,992
Net purchases of used structures	-665
Government structures and new construction force-account compensation	39,435
New	38,617
Buildings, excluding military	12,872
Residential	1,186
Industrial	1,947
Educational	6,489
Hospital	1,581
Other[5]	3,639
Highways and streets	9,380
Military facilities	1,838
Conservation and development	3,583
Sewer and water systems	7,154
Sewer systems	5,274
Water supply facilities	1,810
Other[6]	3,681
Net purchases of used structures	838

[1] In this table, purchases of structures includes compensation of government employees engaged in new force-account construction. In table 1.1 this compensation is classified as a service and is included as part of government compensation of employees.

[2] Consists of hotels and motels, buildings used primarily for social and recreational activities, and buildings not elsewhere classified, such as passenger terminals, greenhouses, and animal hospitals.

[3] Consists of streets, dams and reservoirs, sewer and water facilities, parks airfields, etc.

[4] Consists of dormitories, fraternity and sorority houses, nurses' homes, etc.

[5] Consists of general office buildings, police and fire stations, courthouses, auditoriums, garages, passenger terminals, etc.

[6] Consists of electric and gas facilities, transit systems, airfields, etc.

Source: SCB, Special Supplement, July 1981, p.44.

by state and to add it to contractor construction by state. The procedure is described in detail in the separate report on output, State Estimates of Outputs, Employment, and Payrolls, 1977.

The Census detail by type of construction does not sufficiently distinguish public construction from private construction for purposes of allocating the output between private investment and public investment (Federal and state and local government purchases of structures). The adjustments to the state data to convert it to a state-of-performance basis, described above, made the distinction even more tenuous since the adjustments were not possible in the original detail but had to be made for more aggregative types of construction.

Under these conditions it was necessary to derive private investment in structures for each state as a residual. State output by MRIO code, consisting of contractor construction plus imputed force-account construction, is by definition all allocated to final demand and must agree with the separate NIPA totals for private investment, Federal purchases, and state and local government purchases. A table reconciling the various components of output with final demand allocations (as controlled to NIPA) at the national level is included as Exhibit 3-4. Given this reconciliation, the data are then distributed to states. Since outlays by the Federal and state and local governments have been derived independently by state (described in the relevant chapters in this report), and since there is no overall control on private investment in structures by state, a reasonable estimate is obtained as a residual for each state for each MRIO sector, after accounting for Federal and state and local government purchases. This is probably the best estimate possible since the incomplete data on capital expenditures for structures that can be pieced together from various sources are not definitionally compatible within themselves, nor with the Census of Construction detail, making any attempt at reconciliation of very limited value.

Allocation to Final Demand: New Construction

Exhibit 3-4 shows the allocation of new construction to the final demand sectors. The total final demand shown in column one of Exhibit 3-4 is identical to that shown in state estimates of Outputs, Employment and Payrolls, 1977, Exhibit 4-6, column 11 - MRIO Totals. Private final demand is a residual, found by deducting public final demand from total final demand. The procedures used to estimate public final demand are described in State Estimates of Final Demands, 1977, (Source 23018).

EXHIBIT 3-4

ALLOCATION OF NEW CONSTRUCTION TO FINAL DEMAND

MRIO/ Activity	Description	Total Final Demand	MRIO 151 Private	Public	Federal Government Total Federal	MRIO 156 Defense	MRIO 154 Non-Def.	MRIO 155 SLG
014	Residential	67,005	66,061	944	138	80	58	806
1	Single	57,919	57,743	176	5	3	2	171
2	Apartment	9,086	8,318	768	133	77	56	635
015	Nonresidential	42,822	30,546	12,276	2,462	620	1,842	9,814
3	Nonhousekeeping	1,951	1,774	177				177
5	Industrial	14,352	12,986	1,366	1,366	503	863	
6	Office, Bank	6,974	5,288	1,686	200		200	1,486
7	Stores, Garages	4,866	4,866	—				
8	Amusement	443	443	—				
9	Religious	1,382	1,382	—				
10	Educational	6,077	916	5,161	90		90	5,071
11	Hospital	5,199	3,486	1,713	434	117	317	1,279
12	Other Nonresidential	1,578	(595)[1]	2,173	372		372	1,801
016	Utilities	32,192	22,879	9,313	376	153	223	8,937
25	Communication Trans. Lines	4,241	4,241	—				
28	Subways	739	—	739				739
29	Railroads	735	735	—				
31	Electric Utilities	12,693	11,123	1,570	111	36	75	1,459
27	Petroleum Pipelines	1,412	1,412	—				
32	Gas Utilities	1,740	1,642	98	41	18	23	57
26	Sewer, Water Mains	7,646	2,829	4,817	138	61	77	4,679
33	Sewage, Water Plant	2,986	897	2,089	86	38	48	2,003
017	Highways	15,121	5,490	9,631	370	—	370	9,261
14	Highways	12,897						
19	Bridges, Tunnels	2,224						
018	Other Construction	26,117	20,402	5,715	3,652	1,638	2,014	2,063
4	Farm Buildings	2,881	2,881	—				
15	Swimming Pools	385	385	—				
16	Airports	—	—	—				
17	Parking	—	—	—				
18	Fencing	44	44	—				
21	Dams, Reservoirs	316	316	—				
22	Marine Construction	541	541	—				
23	Harbors, Ports	72	72	—				
24	Cons. & Devel.	1,664	(1,179)[2]	2,843	1,826		1,826	1,017
30	Heavy Industry	5,519	5,519	—				
34	Oil fields	121	121	—				
35	Other	4,628	1,756	2,872	1,826	1,638[3]	188	1,046
37	Const. NSK							
39	Drilling	9,014	9,014	—				
40	Mining	932	932	—				
TOTALS		183,257	145,378	37,879	6,998	2,491	4,507	30,881

See next page for footnotes.

Notes: Exhibit 3-4

1. The negative $595 million for private other nonresidential buildings results from the fact that public other nonresidential buildings is overstated. The amount of $2,173 million for public other nonresidential buildings ideally should be distributed to the specific public nonresidential buildings, but was not done so due to lack of data.

2. The negative $1,179 million for private conservation and development could result from understating public FAC of conservation and development facilities, and from the inclusion by the Census of conservation and development facilities in other activities (i.e., dams and reservoirs, nonresidential buildings, and industrial facilities.)

3. The amount of $1,638 million under Federal government, defense, represents construction of military facilities. The Census includes such construction in specific activities, such as residential construction, hospitals, etc.

CHAPTER 4

NET INVENTORY CHANGE

For the purposes of input-output modeling net inventory change should measure changes in physical quantities of inventories evaluated at current prices. Regrettably, the lack of data on physical quantities of inventories precludes utilizing this approach. Instead, the inventory change measures used are change in the book values of inventories. These book values are converted to net inventory changes via the inventory valuation adjustment, a single cell entry. The one exception to this procedure is inventories held by farms, which are measured in physical quantities valued at 1977 prices. The all-industry change in book value of inventories and the inventory valuation adustment are controlled to NIPA data as published in the Survey of Current Business, National Income and Product Accounts, 1976-1979: Special Supplement, July 1981, (Source 03501).

To estimate inventory change of producing sectors wherever held, inventory change by holding industry was distributed to producing sectors. Inventory change by holding industry was controlled to NIPA based on unpublished documentation on the development of NIPA supplied by the Bureau of Economic Analysis, U.S. Department of Commerce. See Exhibit 4-1.

It is important to note that inventory change should be on a commodity basis, not an industry basis. Inventory change for each sector should measure the inventory change for the commodities it produces, not the commodities it holds. Inventory change for a commodity is counted regardless of whether the commodity is held by producers or consumers. However, because goods accrue transportation and trade margins as they move from the producer to the wholesaler, retailer or consumer, the distinction on where the inventory is held remains important. For this reason, inventory change is divided into four components depending on where the inventory change is held. These four components are: (1) inventory change of producers; (2) inventory change of wholesalers; (3) inventory change of retailers; and (4) inventory change of consuming industries.

EXHIBIT 4-1:
NIPA DATA ON INVENTORIES

Sector Holding Inventories	Change in Book Value of Inventories, $, Millions	MRIO Sectors
Farm	772[1/2/]	001, 002, 003 pt. 004
Mining	553[3/]	007-013
Construction	934[3/]	014-019
Manufacturing	13,431[3/]	020-084
Wholesale Trade	10,171[3/]	097
Retail Trade	9,744[3/]	098-102
Transportation	719[3/]	089-091
Communications	106[3/]	092, 093
Public Utilities	2,111[3/]	094-096
Services	1,013[3/]	108-117
Other	300[3/]	pt. 004, 005, 006, 103-107
TOTAL	39,854[1/]	
Inventory Valuation Adjustment	-18,867[1/]	
Net Inventory Change	20,987[1/]	

[1/] *Survey of Current Business, National Income and Product Accounts, 1976-79: Special Supplement, July 1981, (Source 03510).*

[2/] *Inventories held by farms are measured in physical units evaluated at current prices. They are not in book values. The inventory valuation adjustment does not apply to them.*

[3/] *Unpublished NIPA data.*

INVENTORY CHANGE HELD BY PRODUCING INDUSTRY

Inventory change held by producers included all farm inventories, inventories of "mined or quarried products" held by mining industries and inventories of "finished products" and "work in process" held by manufacturing sectors.

As noted above, inventory change held by farms are treated in a dissimilar fashion in the NIPA's. Inventory change held by farms in the NIPA's were calculated by U.S. Department of Agriculture utilizing physical quantities valued at current prices. The U.S.D.A. calculates inventory change by commodity and by state. Unpublished worksheets from the U.S.D.A. were utilized to calculate inventory change by MRIO sector and state. This was accomplished by assigning each commodity to an MRIO sector and then summing each commodity within each MRIO sector to yield the final estimates.

Data on beginning and end of year inventories of "mined or quarried products" by four-digit SIC and state were available from the 1977 Census of Mineral Industries (Source 03106). Beginning of year inventories were subtracted from end of year inventories to yield inventory change. Data were then summed by four-digit SIC to achieve estimates at the MRIO sector level.

Data on beginning and end of year inventories on "finished products" and "work in process" are available from the 1977 Census of Manufactures (Source 03105). However, these data are available by either four-digit SIC or state but not both. Therefore, change in book value of inventories of finished goods and work in process were computed as value-added plus cost of materials consumed less value of sales (all Census data) by four-digit SIC by state. Four-digit SIC data were then summed to produce estimates by MRIO sector.

INVENTORY CHANGE HELD BY WHOLESALERS

The control total for change in book values of inventories held by wholesalers was taken from unpublished NIPA data. This estimate was derived from preliminary unpublished data released to the Bureau of Economic Analysis from the Bureau of the Census.

In order to develop producing industry detail, data were utilized from the 1977 Census of Wholesale Trade (Source 03102). This source contained data on inventories by kind of business for beginning and end of year as well as data on sales of commodity lines by kind of business. The first step was to subtract beginning of year inventories from end of year inventories to yield inventory change by kind of business. Second, each commodity line was assigned a ratio of inventory change to sales based on a sales-weighted average of inventory change to sales ratios for the kind-of-business groups which sold the majority of the merchandise line. Third, the inventory change-to-sales ratio was multiplied by sales for the commodity line to yield an initial estimate of inventory change for each commodity line. Fourth, the initial estimates were scaled to agree with the control total discussed above. Fifth, commodity lines were assigned to MRIO sectors based on a concordance supplied by the Bureau of Economic Analysis.

In order to develop state detail, commodity line inventory changes were allocated to states proportional to a weighted aggregate average of sales for the kind-of-business groups which sold the majority of the commodity line.

INVENTORY CHANGE HELD BY RETAILERS

In accordance with NIPA methodology, inventory change held by retailers was controlled to data from the Current Business Reports (Source 03119). This source contained end-of-year inventories for 1976 and 1977, by kind of business. No detail were available for either state or producing industry detail.

In order to develop producing industry detail, data on sales of merchandise lines by kind of business were utilized from the 1977 Census of Retail Trade (Source 03101). Inventory changes were assigned to merchandise lines based on sales-weighted averages of inventory-change-to-sales ratios for the kind-of-business groups which sold the majority of merchandise line. For example, 89 percent of the merchandise line 100, Groceries and Other Foods, was sold by SIC 541, Grocery Stores. Therefore the inventory-change-to-sales ratio for SIC 541 was assigned to merchandise line 100. After inventory-change-to-sales ratios were developed for each merchandise line, they were multiplied by sales for the merchandise line to yield initial estimates of inventory change. These initial estimates were then scaled to agree with the NIPA control total for inventory change in retail trade. Finally the data by merchandise line were converted to data by MRIO sector. This was accomplished utilizing a map of

merchandise lines to personal consumption expenditures provided by the Bureau of Economic Analysis, U.S. Department of Commerce.

In order to develop state detail, merchandise line inventory changes were allocated to states proportionally to sales by state for the kind-of-business groups which sold the majority of the merchandise line. Thus, in the example above, inventories of grocery products were divided among states according to on the distribution of sales by grocery stores.

INVENTORY CHANGE HELD BY CONSUMING INDUSTRIES

Inventory change held by consuming industries consists of inventories of materials, fuels and supplies. Very little data is available on the commodities contained in these inventories and thus no suitable means exists with which to distribute these inventories among the sectors that produce them. Some attempts were made to quantify inventory change for some of the larger bulk raw materials. Data on stocks of coal and oil held by electric utilities were obtained from the Energy Data Reports (Source 06103). Data on stocks of minerals and ores at consuming plants were available from the Minerals Yearbook (Source 10101).

The remaining unspecified inventory change was not distributed due to the lack of information. These values will be distributed as part of the balancing of consumption and production to be performed in the latter stages of the development of the MRIO.

CHAPTER 5

FOREIGN TRADE

IMPORTS

This section describes the data sources and methodologies used to develop 1977 estimates of Imports (MRIO 159) by state. It begins with detailed descriptions of the primary sources used for data on merchandise imports and service imports, and of the supplementary sources used to adjust the primary data to reflect MRIO definitions and conventions. Following the description of data sources is a discussion of the methodology. This section includes a summary of the conceptual treatment of imports in input-output accounts and lists the steps in estimating MRIO imports. The section concludes with a discussion of differences in the BEA I-O and MRIO estimates, assumptions that were made in developing the estimates that should be considered when interpreting the results, and notes concerning analyses to be undertaken in subsequent tasks.

The import data developed according to the procedures described here are consistent with the imports reported in the National Income and Product Accounts.

Data Sources

The two primary sources of data on imports were the Bureau of the Census' 1977 U.S. Imports for Consumption and General Imports: IA 245-A (Source 03118), and an article by Anthony J. DiLullo in the November, 1981 Survey of Current Business entitled "Service Transactions in the U.S. International Accounts, 1970-80" (Source 03501) (hereafter referred to as IA 245 and "Service Transactions," respectively). IA 245 was the source of merchandise imports, providing 1977 foreign port values of imports and the freight, insurance, and other charges (excluding duties) incurred in transporting them to the U.S. The data are available by customs district of entry, by seven-digit TSUSA commodity code,[1] and by mode of transportation (water, air, other). Imports to

[1] *The TSUSA commodity classification system is one of several commodities classification systems developed by the U.S. Department of Commerce and used in statistical publications on foreign trade.*

Puerto Rico and the Virgin Islands are included. "Service Transactions," the most detailed source of data on international service transactions for 1977, contains dollar values for service imports and exports by type of service, at the national level.

The data in IA 245 and "Service Transactions" were supplemented with data from several other sources. One important source was Commodity Detail on Noncomparable Imports BEA 1977, August 1981 (Source 03512). This source lists the 1977 foreign port values of noncomparable imports, both merchandise and service, by seven digit TSUSA commodity code. It also includes charges for air transportation, water transportation, insurance, and wholesale taxes, by commodity. Noncomparable Imports was used in the important step of separating noncomparable imports from the data on total imports in IA 245 and "Service Transactions," described later in this chapter.

Other sources of data were BEA's Preliminary "1977 Analysis Input-Output Control Total Worksheets" for September 10, 1981 and January 22, 1982. Information in these files was used to support the development of import control totals.

Definitions

The imports portion of final demand includes two categories of goods and services:

1. Comparable imports — imports of goods and services that are similar to goods and services produced commercially by a domestic industry, and

2. Noncomparable imports — imports of goods and services with one or more of the following characteristics:
   - — there is no significant U.S. production of the good or service
   - — the good or service is purchased and used outside the United States
   - — the good or service is part of a group of commodities or services which is unique in expenditures and does not fit neatly into the output of any other commodity or service, such as used goods, architectural drawings, developed film, antiques, and fossils.

Comparable imports are shown in the MRIO data at their domestic port value, a value equal to foreign port value plus freight, insurance, duties, and other charges incurred in transfering the good from the foreign to the domestic port. Noncomparable imports are

shown in the data base at foreign port value. Freight charges associated with transporting them to the U.S. are considered comparable imports, where the service was purchased from a foreign producer, and are included in the data base with other comparable imports. Duties and insurance on noncomparable imports do not appear in the import data. A full description of their treatment is included in the report on Task 6 of this project, State Estimates of Inputs to Industries, 1977 (Source 23017).

Transactions between the U.S. and Puerto Rico and other U.S. possessions are treated as international transactions in the MRIO data base. Therefore, the import total includes Puerto Rican goods and services purchased by the U.S. and does not include imports to Puerto Rico from foreign countries. Other important items are gold and U.S. goods returned from abroad. The former is included in the U.S. import data, while the latter is not.

Imports are depicted in the I-O table as negative or positive values in accordance with MRIO (and BEA I-O) conventions:

- Duties and insurance on comparable imports are shown as positive entries in the wholesale trade and insurance rows, respectively.

- Transportation costs for imports are positive entries in the transportation rows equal to the total freight charges for international transportation of comparable imports, less freight charges for international transportation of comparable and noncomparable imports by foreign carriers.

- Noncomparable and comparable imports of goods and services other than transoceanic margins (duties, insurance, and freight), are negatives entries in the import column of the I-O table.

Methodology for National Estimates

Merchandise Imports

The first step in the development of merchandise import estimates was the aggregation of the import values for customs districts in IA 245 to state values. Next, IA 245 was divided into two data sets: comparable and noncomparable merchandise imports, by subtracting the foreign port values and margins associated with each seven digit TSUSA noncomparable merchandise import code (from Noncomparable Imports) from the

imports in IA 245, by state. The resulting data sets retained the IA 245 format: value by state, by seven digit TSUSA commodity code, and by method of transportation.

The third step was adjusting the data to reflect MRIO definitions. The data in IA 245 for Puerto Rico were subtracted from the comparable and noncomparable merchandise import data sets. U.S. owned goods returned from abroad were also subtracted (Source: IA 245). Data in the Bureau of the Census' 1977 U.S. Trade With Puerto Rico and U.S. Possessions: FT 800 (Source 03118), a source providing import and export transactions between the U.S. and its possessions (by Census Schedule B commodity code), were used to develop imports to the U.S. from Puerto Rico and other possessions. These were added to the import data already assembled. Gold imports, published in the July, 1979 Survey of Current Business (Table 4.3), were also added.

Next, transoceanic margins were added to the foreign port values of merchandise imports, by state, commodity, and method of transportation. The two types of data were kept separate until this stage because the different sources used to adjust the import data in Step 3 (above) varied in whether data were shown at foreign or domestic port values.

The fifth step was the conversion of noncomparable and comparable merchandise imports data from TSUSA commodity codes to MRIO codes. A 1977 Census concordance between SIC and TSUSA codes produced seven digit SIC codes for each TSUSA commodity. (The concordance is available on tape from the Bureau of the Census.) These were converted to MRIO codes using the MRIO/BEA I-O/SIC concordances included in Appendix A of this report.

The transoceanic margins in IA 245 did not include duties. The last step, therefore, was the estimation of duties from the data on duties by two-digit BEA I-O commodity published in Table D of the April 1979 Survey of Current Business. Where commodity groups, were more aggregate than the MRIO commodities, MRIO commodities were combined to reflect the Survey of Current Business commodity classification. The duty for a commodity listed in the Survey was divided among the component MRIO commodities according to their share of the value of imports of that commodity. Duties were then added to the sums of foreign port values and transoceanic margins already developed.

Service Imports

Imports of services were estimated at the MRIO commodity level. The Survey of Current Business' article "Service Transactions in the U.S. International Accounts, 1970-88," lists national values for imports of services, by type of service. In all but one case, the types of services listed are disaggregated to at least the MRIO commodity level; e.g., air freight transportation, water freight transportation, communications, and royalties and fees. In the case of "passenger fares," a category which includes expenditures on all types of transportation, publications of the Air Transport Association and the Maritime Administration provided the information needed to disaggregate the data in "Service Transactions." Next, noncomparable imports of services (listed in Noncomparable Imports) were subtracted from the data in "Service Transactions," leaving sets of data on comparable and noncomparable imports of services that were combined with data on comparable and noncomparable merchandise imports, already developed.

Imports by State

The primary difference in the BEA I-O and MRIO formulations of the import data base is the presence of state level estimates in the MRIO data base. While this distinction may be obvious, the difficulties in estimation associated with the introduction of this disaggregation to import data are more subtle. The current MRIO data file shows import data only in states with customs districts, and contains state data only for merchandise imports. Both merchandise and service imports will be distributed to consuming states in the subsequent development of interregional flows. Note that attempts to integrate the state import data, in its current form, with state production and consumption data might be misleading.

EXPORTS

This section describes the data sources and methodologies used to develop 1977 estimates of Exports (MRIO 153), by state. It begins with detailed descriptions of the primary sources used for data on merchandise export and service exports, and of the supplementary sources used to adjust the primary data to reflect MRIO definitions and conventions. Following the description of data sources is a discussion of the estimating methodology. This section includes a summary of the conceptual treatment of exports in input-output accounts and lists the steps in data development for the MRIO export

data. The chapter concludes with a discussion of the status of the export data base and suggestions for interpreting the data.

The export data developed according to the procedures outlined in this chapter are consistent with the exports values reported in the National Income and Product Accounts.

Data Sources

The two primary sources of data on exports were the Bureau of the Census' 1977 U.S. Exports: EA 622 (Source 03118), and an article by Anthony J. DiLullo in the November, 1981 Survey of Current Business (Source 03501) entitled "Service Transactions in the U.S. International Accounts, 1970-80" (hereafter referred to as EA 622 and "Service Transactions," respectively). EA 622, the source of data on merchandise exports, contains 1977 data on the value at U.S. customs districts of U.S. exports, by Census Schedule B code. Exports from Puerto Rico and the Virgin Islands are included. "Service Transactions," the primary source of data on export of services, is the most detailed source of data on international service transactions for 1977, containing dollar values for service exports, by type of service, at the national level.

The data in EA 622 and "Service Transactions" were supplemented with data from several other sources. The methodology and certain data in BEA's workfile printout for September 10, 1981 were used in developing the national level export control. The Bureau of the Census, 1977 U.S. Trade with Puerto Rico and U.S. Possessions, FT 800 (Source 03118), and 1977 U.S. Imports for Consumption and General Imports: IA 245-A were used to adjust the primary data to reflect MRIO definitions, as were data in the June and July, 1979 issues of the Survey of Current Business (Source 03501).

Methodology for National Estimates

The data presented for MRIO 153 list the domestic port, or f.a.s., values of all U.S. exports, including re-exports.

Exports to foreign countries from Puerto Rico and other possessions, and U.S. goods returned from abroad are not included in the export total, nor are shipments to Israel. Exports are adjusted upwards to reflect shipments from the U.S. to Puerto Rico and other possessions.

The methodology used to develop the exports is very similar to that used for import data, though less complicated since no adjustments were required to account for an export counterpart to the noncomparable imports portion of the import data and because transoceanic margins need not be computed. The steps followed are outlined below.

1. Import values by customs district in EA 622 were aggregated to state values.

2. Export data were adjusted to reflect MRIO definitions and to eliminate inconsistencies. The data in EA 622 for Puerto Rican and other U.S. possessions' exports to foreign countries were eliminated from the export data. U.S. exports to its possessions were added to the export totals and U.S. goods returned from them were subtracted (Source: Bureau of the Census' 1977 U.S. Trade with Puerto Rico and U.S. Possessions. Other adjustments included the subtraction of U.S. goods returned from foreign countries (Source IA 245), and shipments to Israel (Source: Survey of Current Business, July 1979), and the addition of re-exports (Source: EA 622).

3. The merchandise export data were converted from the Schedule B commodity codes to MRIO codes. The Schedule B data were first translated to SIC codes. This step was performed using a 1975 concordance, as no 1977 or 1976 concordance was available on tape. Adjustments were made by hand to account for changes in the 1975 and 1977 classifications. The SIC codes were converted to MRIO codes using the source MRIO/BEA I-O/SIC concordance included in Appendix C of this report.

4. The source of data on exports of service was the Survey of Current Business article "Service Transactions in the U.S. International Accounts, 1970-80," which lists national values for exports of services, by type of service. In all but one case, the types of services listed are disaggregated to at least the MRIO commodity level; e.g., air transportation of freight, communications, and royalties and fees. In the case of "passenger fares," a category which includes expenditures on all types of transportation,

publications of the Air Transport Association and the Maritime Administration provided the information needed to disaggregate the data in "Service Transactions." The result of the data collection was a set of national level estimates of service exports by MRIO category.

Exports by State

At the current time, the merchandise export data are presented by state of foreign embarkation, or "port state," and the service export data are presented only at the national level. Exports will be available in their state of origin after completion of interregional flows. The state export data, in its current form, should not be combined with the state production and consumption data and used in economic analyses without a careful interpretation of the results that acknowledges the preliminary nature of the state export data.

CHAPTER 6

FEDERAL GOVERNMENT PURCHASES OF GOODS AND SERVICES

This chapter presents the methodology for estimation of Federal purchases of goods and services, by state, in calendar year 1977 for each of defense and non-defense activities.[1]

Potential uses of the results of this research are affected by conceptual issues and by problems of data quality and methodology for using the data. The next section discusses conceptual problems in estimating final demand by state. Succeeding sections describe the data sources and the methodology used to develop the estimates.

CONCEPTUAL PROBLEMS

State Distributions

The Federal government differs from other final and intermediate purchasers of goods and services in that it is not a class of similar entities distributed among the states, not even if the government is first disaggregated by function within categories of defense and non-defense. For almost every function, there is considerable complementary between what is done at one government facility and what is done at another. In each case, the interest advanced is largely that of the country as a whole, not just that of a restricted set of people specially related to that facility. For example, if fighter aircraft are purchased for initial use at a base in Nebraska, those aircraft serve the

[1] *The technical proposal for the MRIO also contemplated distinction between current and capital account purchases. If one follows the NIPA practice of defining capital formation as purchases of equipment and structures plus net inventory increases, the capital components can be inferred roughly as sums of all MRIO values for equipment and new construction plus the parts of MRIO values covered by net inventory increases of the Commodity Credit Corporation, (agricultural and dairy products), the Strategic Petroleum Reserve (crude petroleum), and TVA (coal), and strategic stockpiles managed by GSA (mostly minerals and metallurgical products). As indicated later, however, the NIPA definitions of equipment purchases excludes a great deal of research and development that MRIO, like SIC, include in equipment purchases.*

whole country; in fact, they may be moved shortly after purchase to some other state or overseas. In no useful sense is the aircraft purchase a purchase by an economic sector of Nebraska.

In the MRIO, Federal government purchases are not identified by the geographic location of the purchaser, but rather the geographic location of the economic impact of the purchase. Accordingly, the geographic distribution of Federal purchases of goods and services is a geographic distribution of the supply. This has a disadvantage for later stages of model development, when it will be necessary to build requirements for transportation into the model. It is not, however, an important disadvantage for a large fraction of Federal purchases. Many goods of high value in relation to transportation cost move by government transport under Federal transportation contracts. Data on these contracts are available and included in Federal purchases, though not by type of commodity transported. Where the government was the seller, an attempt was made to make the state distribution correspond to the location of the government activity.

Apart from conceptual issues, there are empirical problems of determining impact of government purchases by state. Among items with serious problems of state distribution are purchases of transportation and banking services (imputed value of deposit, check clearing, and other services provided by the banking system). In both cases identifying the state of impact of the purchase of these services is difficult. In the case of banking service, the branch (or central office) where an account is kept could be considered to be a place where a substantial part of the impact occurs, but it is not the only place. Other branches and other banks also use resources to provide the banking service to the government. In the case of transportation, there is surely some impact at each of the origin and destination of the trip. There is also, however, impact at intermediate and other points. For example, any service by Delta Airlines between two points on its route structure is likely to involve some activity by maintenance staff and crews based in Atlanta.

Another empirical source of possible error in assigning impacts to states was the fact that the state where many products were procured was the location of a wholesaler. The state of purchase for a manufactured product should not be assumed by a user of the report to be the state where all of the product is manufactured if purchases from wholesalers may be important. Later stages of the MRIO project will be needed to establish interstate flows from manufactures to wholesalers.

In a few cases where state data on government purchases were lacking, the state distribution of purchases from an MRIO sector was prorated according to state output of the sector.

Purchases by Government Enterprises

Capital but not current expenditures of government enterprises (government agencies deriving more than half of their revenues from sales of services) are included in the purchases of the Federal government. (Current expenditures of government enterprises are recorded in the model as inputs to the appropriate industry in the interindustry transactions.) There is a problem, however, of separating capital from current expenditure. NIPA and I-O classification of GNP and final demand define capital formation, or investment, as the sum of expenditures for equipment, for structures (or new construction), and for net inventory change. The NIPA procedures, however, may be distributing entirely among these three categories values of investment that in some cases cover much more. For example, as described in more detail later in this report, TVA investment data used for NIPA estimates of government expenditures for equipment and structures may include major expenditures for non-construction personnel, for supplies and materials, for imputed interest until plants go into service, and for corporate overhead.

Force-Account Construction

Accounting for force-account construction within NIPA is inconsistent. The NIPA control totals and the contract award data used as a basic source for construction by regular government agencies do not include force-account construction. However, the NIPA construction data for government enterprises appear to include force-account construction at least for the government electric utility enterprises. No adjustment was made to the NIPA controls to correct for this apparent discrepancy.

Distinction Between Defense and Non-defense

Defense has been defined (largely in accordance with available data) as purchases by Department of Defense (DOD) other than for civilian functions of the Corps of Engineers, plus purchases for defense functions of the Department of Energy (DOE) and its predecessor, Energy Research and Development Administration (ERDA). In addition, charges in strategic stockpile maintained by the Government Services Administration (GSA) have been considered defense activities. This definition omits activities of other

agencies related to defense, and it also omits work of civilian agencies in support of agencies classified as defense. For example, it takes no account of any motor vehicles or automatic data processing equipment bought by GSA for DOD use; it counts only equipment bought directly by DOD. In addition, no adjustment is made to account for the support of DOD operations through Federal personnel and retirement systems, the Congress (which also has something to do with defense), the Internal Revenue Service (which collects taxes for defense), the Federal Aviation Administration (in providing for military traffic on or near civilian airways), etc.

FEDERAL PURCHASES ESTIMATED IN OTHER TASKS OF THE MRIO PROJECT

The final demand estimates covered in this report are distributions of Federal purchases by MRIO classification of products. Several categories of Federal product purchases are being estimated indepedently as parts of tasks that distribute particular classes of product across all purchasers. Purchases estimated elsewhere include compensation of employees (MRIO Sector 122) and energy products (MRIO Sectors 9, 11, 50, 94, and 95). Estimates are provided here for the energy products because energy products were sometimes included in the data used to estimate other government purchases. The energy estimates here, though, are subject to change through the special studies of all uses of energy products.

PRINCIPAL DATA SOURCES

Three categories of data form the basis of most of the estimates of Federal government purchases. First are published NIPA statistics of government purchases of goods and services.[1] The second category is Census data of shipments to government. This category consists of the annual MA-175 report for 1977 as revised in the 1978 report[2] and the SR-13 report of the 1977 Census of Manufactures.[3] The third category consists

[1] *U.S. Department of Commerce, National Income and Product Accounts, 1976-1979 (special supplement to Survey of Current Business, July 1981) Source 03501.*

[2] *U.S. Department of Commerce, "Shipments to Federal Government Agencies," Current Industrial Reports, MA-175 (78)-1, Source 03129.*

[3] *U.S. Department of Commerce, "Distribution of Sales by Class of Customer," 1977 Census of Manufactures," SR-13, Source 03105.*

of two tabulations of contract awards: a special tabulation by DOD for this project of its contract awards for FY 77[1] and a special tabulation for this project by the Federal Procurement Data Center of contract awards by DOD and other Federal agencies for FY 79, the earliest year available.[2] The sources are discussed below.

Census Publications

SR-13 contains tabulations of a sampling survey of manufacturing firms to obtain distributions of products produced at their manufacturing establishments, with the distributions classified both by SIC code of product and by whether the customer was a manufacturing plant, a wholesaler, a retailer, the Federal government (including "Government enterprises"), or a state or local government. The publication compares the dollar value of shipments in the complete Census of Manufactures with the total accounted for in the survey. Data are not shown where it would violate Census standards for size of sampling error, for disclosure, or fraction of total shipments accounted for. In general, any data for coverage of less than 60 percent is suppressed. Census editors screened the reports for obvious product coding errors by respondents, but some errors are present in the data.

MA-175 is an annual survey of manufacturing establishments that account for a large part of the business generated by Federal procurements. The special tabulation for this project distinguishes between civil functions of the Corps of Engineers and all other DOD contracts. The data reported include total prime contracts, total subcontracts, and a breakdown of prime and sub-contracts combined among DOD, ERDA, NASA, and all other (including "government enterprises"). Unlike SR-13, the data are total shipments by SIC classification of the supplying establishment, not by SIC classification of products shipped. This is a disadvantage when compared with SR-13 because the final demands within the MRIO are defined as products, wherever produced, but potential product coding errors by respondents is avoided. Another disadvantage is that Federal purchases originating from manufacturers but procurred from wholesalers may

[1] *Washington Headquarters Services, U.S. Department of Defense, Tape of Department of Defense Contract Awards, Fiscal Year 1977, for Jack Faucett Associates, Inc., Source 04204.*

[2] *Federal Procurement Data Center, General Services Administration, Tape of U.S. Government Contract Awards, Fiscal Year 1979, for Jack Faucett Associates, Inc., Source 17303.*

not be included. The number of SIC four-digit industries covered by MA-175 is considerably less than the number of four-digit products covered by SR-13. There is detail by state, but this is too marred by suppressions for disclosure reasons to be useful. The Census shipment data, therefore, provided the bulk of estimates for durable equipment.

Contract Awards

Department of Defense contract award data have a basic weakness of ambiguity as to the timing of the contact activity. They were used to give a general idea of the mix of government purchases among kinds of products or establishments and geographic subdivisions. The FY77 contract awards are for a year starting and ending three months before the calendar year used by Census for shipments data, but it is reasonable to expect an even greater lag between contract award and shipment. In the file modification procedures discussed below, comparability of FY79 data is increased by scaling of the latter with ratios of Federal procurement fund obligations.

In the data files for FY77, there are considerable data on contracts of more than $10,000 each. Data provided by DOD for this study are a distribution of contracts by state and by a coding system that included Federal Supply Catalog (FSC) codes for commodities and special research and development (R&D) and other service codes for services. Although the product and service codes are for quite detailed classes of commodities and services, translation to SIC codes was not clear in all cases because the most detailed FSC classes are products classified by use or purpose rather than by types of establishment that produce them. For example, the four-digit PSC class of "hospital furniture, equipment, utensils, and supplies" involves SIC classes that are different even at the two-digit SIC level.

Contract award data did not become available generally for Federal agencies until FY79, when the DOD system was incorporated into a government-wide system. For this reason, contract award data were obtained for FY79 from the General Services Administration for use in developing non-defense purchases data. The FY77 and FY79 data were found to be similar except for substantial changes in the R&D and other service codes and for the addition in FY79 of SIC codes of supplying establishments for all but DOD contracts. The Federal agencies required to report in FY79 were those whose contracts were subject to annual Congressional appropriations. This distinction fits closely to the requirement within the MRIO to exclude current purchases of

government enterprises, defined as Federal entities that cover at least 50 percent of their expenses with revenues obtained by sales to the public. TVA, however, is covered by the system, so the special tabulation for this project distinguished between TVA and other non-defense. The FY79 data also identifies defense functions of the Department of Energy (successor to the ERDA of the 1977 data.)

NIPA Controls

Exhibits 6-1 and 6-2 provide NIPA values for Federal purchases of goods and services, for defense and non-defense, respectively.

The product information in NIPA posed difficulties because the data generally fail to fit SIC product classifications. The compilers of the NIPA data rely heavily on Treasury financial statements, which are based on the classifications of the budget and appropriations process. In particular, a product class purchase of NIPA is based on a procurement appropriation for the product class. The procurement appropriation will exclude any research and development financed by an appropriation for Research, Development, Test and Evaluation (RDT&E), even where SIC coding would classify the RDT&E work as manufacturing (e.g., development of missiles and production of prototype missiles for test). On the other hand, it may include purchase of production machinery, support equipment for the product described (e.g., avionic test equipment in procurement of aircraft), and other products and services with other SIC codes.

Along with these disadvantages, the NIPA data have a major advantage of having rules for inclusion and exclusion of data that correspond closely to the scope desired for the MRIO project. With proper aggregation, therefore, the NIPA data provide excellent control totals.

PROCEDURE SUMMARY

The procedure used to estimate final demand for the Federal government was undertaken in six steps:

1. Mapping data items in the major data sources into MRIO sectors.

2. Transforming the major data sources to represent as nearly as possible total Federal purchases in calendar year 1977.

EXHIBIT 6-1:

DEFENSE PURCHASES OF GOODS AND SERVICES, 1977
(millions of dollars)

Category	Value
Durable goods	21,308
Aircraft	6,960
Missiles	2,490
Ships	2,914
Vehicles	1,323
Electronics equipment	1,029
Other military equipment	2,112
Other durable goods	4,480
Nondurable goods	5.418
Bulk petroleum products	3,152
Ammunition	990
Clothing and textiles	467
Other nondurable goods	809
Compensation of employees	42,844
Other Services	21,195
Contractual R&D	7,376
Travel	1,310
Transportation	1,980
Communications	639
Dept Maintenance	1,519
Other	8,371
Structures	2,522
Military facilities	1,638
Other	884

Source: *Survey of Current Business, Special Supplement, July, 1981, p. 29 (Source 03501).*

EXHIBIT 6-2:

NON-DEFENSE PURCHASES OF GOODS AND SERVICES, 1977
(millions of dollars)

Category	Value
Durable goods	1,136
Durable sales	-59
Timber sales	-828
NASA equipment	923
Other	1,100
Nondurable goods	6,832
Miscellaneous sales	-100
Petroleum sales	-488
CCC purchases	3,873
Fuels	322
Strategic petroleum reserve	102
Other	3,123
Employee compensation	37,839
Other services	14,429
Service sales	-569
Travel	645
Transportation	186
Rent, communications, and utilities	1,286
Printing and reproduction	319
NASA R&D	1,751
Other R&D	3,986
Imputed interest	554
Other services	6,271
Structures	4,777

Sources: *Survey of Current Business, Special Supplement, July 1981, p. 27 and unpublished detail received by telephone from BEA.*

3. Using the various adjusted data sources according to a data quality priority to develop a set of tentative final demands for each of defense and non-defense.

4. Estimating requisite data that was not included in the major data sources.

5. Reconciling with NIPA Federal purchases of goods and services.

6. Distributing purchases of each MRIO product by state.

Mapping the Data Sources into MRIO Sectors

Mapping the Census data into MRIO sectors presented no problems because Census data have SIC codes, common to MRIO sectors. The data on contract awards, however, were available only by Federal Supply Catalog codes for commodities and with special codes, different for FY79 from FY77, for research and development and for other services. The mapping to an MRIO basis was approximate because the coding systems of the raw data tended to classify products by their uses rather than by industry classification of the establishments that produce them.

Similarly for comparability with respect to timing, the Census data presented no problem; the shipments were available for FY77. The contract award data presented problems because (a) shipments tend to occur after contract awards and (b) contract award data covered FY77 and FY79.

To adjust for the time lag between contract award and actual product shipment, contract award data for the fiscal year ending three months before the corresponding calendar year were used. This presumes an average lag of three months between contract award and shipment. Clearly, some shipments occur much more (or a little less) than three months after a contract award, but there are also shipments during the calendar year that are associated with contract awards of previous fiscal years. Since there is observable similarity in shipment levels over adjacent calendar years, it is not unreasonable to assume that lags of other than three months between contract award and shipment are largely offsetting.

To utilize data that were available for FY79 but not for FY77, FY79 contract awards were deflated to FY77 levels. This was accomplished by multiplication of groups of

FY79 values by ratios between 1977 and 1979 for comparable NIPA or budget value aggregates. This reduced the FY79 aggregates to comparability with 1977 data, although there were undoubtedly errors for individual elements of the aggregates.

Building a Tentative Final Demand Matrix

To develop the available data in a useable framework, the data were arranged into a "tentative" final demand matrix. The matrix consisted of defense and non-defense columns and MRIO sector rows. Data were developed from the major data sources under a priority system. Census shipments data were considered superior to the contract award data and were used to the extent available, and FY77 data were preferred to FY79 data.

Total Federal expenditures were considered to be those of SR-13 for every MRIO covered by that source. The split between defense and non-defense was made in two stages. First, the defense was that of MA-175 (DOD and ERDA) for every MRIO covered by MA-175, with FY77 providing the source of defense for every MRIO covered by SR-13 but not by MA-175. The non-defense in these cases was considered to be the difference between total and defense, with some adjustments for any cases where, because of elements of incomparability between SR-13 and MA-175, the unadjusted procedure would yield a negative non-defense expenditure.

For MRIO sectors not covered by SR-13, which included all the service sector and some commodity sectors, the defense and non-defense expenditures were estimated independently of one another, from MA-175 (in a few cases) and from the FY77 and FY79 contract awards. All of the defense expenditures were taken from MA-175 or the FY77 data, and all the non-defense, except for the Corps of Engineers data of the FY77 contract awards, were taken from the FY79 contract awards.

Reconciliation with NIPA

A first step in reconciliation of the tentative final demands with NIPA values was developing components of the NIPA values that were not covered by the basic data sources, and analyzing data that were contained in the basic data sources but did not appear in NIPA. The former consisted primarily of employee compensation, capital expenditures of government enterprises, travel expenditures of individuals, and sales by government agencies not classified as government enterprises.

There were also serious problems in determining the level of control to NIPA. NIPA tends to classify Federal purchases of goods and services according to Treasury statistics of outlays. These are classified according to funds as defined in appropriations. Expenditures from these funds can be for many different kinds of objects so long as the purposes of the expenditures are those set forth in the legislation. For example, construction of missile test facilities can be accomplished under an appropriation for Research, Development, Test, and Evaluation (RDT&E). The NIPA staff try to adjust for major purchases under RDT&E headings in Treasury statistics that are purchases of other kinds of services, but RDT&E in NIPA accounts cannot be considered restricted to the MRIO definition of research and development sectors. There are similar problems for NIPA categories such as aircraft purchases wherein the NIPA account includes purchases other than aircraft. Under these circumstances, it was necessary to apply NIPA values as controls for MRIO only in broad aggregates: durable goods, construction, and all other. Even then, possibilities of error persisted.

State Distribution

For MRIO sectors whose products were included in the SR-13, MA-175, or the contract award data, the state distributions were made in proportion to contract awards. National estimates for individual travel expenditures (fares, lodging, and meals) were distributed among states in proportion to civilian personnel, as were some Federal sales of services. Other Federal sales of services and sales of timber were prorated to states according to acreage of national forests or national parks. Sales of some other items were not identified by state. Some construction and equipment purchases of Federal utility enterprises could be indentified as being for restricted aggregations of states, but no state allocations were made.

MRIO CODING

There is no serious problem in coding Census data to MRIO sectors, because both have SIC building blocks. The major problems are determination of the MRIO sectors associated with the contract award data and determination of the MRIO codes associated with the NIPA and related data published by the Department of Commerce. Comments on the two types of mapping follow. Appendix B contains computer listings of these maps.

FY77 Contract Awards

A translation of FSC codes to MRIO had two stages. In the first stage, judgments were made of the best MRIO for each four-digit FSC code, the judgments being based on product descriptions in the official FSC and SIC coding manuals. The second stage made use of a special resorting of the 1979 contract award data to give a distribution of each FSC product code purchases among SIC codes of supplying establishments. No judgment coding was accepted if a substantial fraction of the product did not come from conforming SIC manufacturing establishments or from wholesaler categories that could have been handling kinds of SIC products covered by the MRIO. However, the SIC establishment distributions were frequently among SIC establishments in many MRIO industries, with no heavy concentration in particular industries. In a substantial number of cases, the judgment of the best single MRIO was modified to distribute the FSC code in some judgmental proportion between two MRIO codes.

The R&D and other service sector mapping for FY77 was done without the aid of either a standard manual of definitions or a tabulation of SIC codes of supplying industries. The tape supplied by DOD, however, did include 20 characters of English description along with each code number. The entries with major dollar value usually had descriptions that named a major type of procurement, such as F-16 aircraft. Under standard SIC and Census rules, which apply also to the MRIO, R&D performed by an establishment that produces the kind of product being developed is classified as a primary product of the industry to which the establishment belongs. Mapping a large part of the R&D thus became a matter of coding an adequately described product that was being developed. Other R&D coding was mapped either to MRIO 108 or MRIO 109, for Miscellaneous Services and Advertising, and Miscellaneous Professional Services, respectively. As noted earlier, the NIPA controls do not recognize any expenditures under RDT&E appropriations as expenditures for durable goods, so provision was made in the data processing of the tapes to maintain an identification of all dollar values that were originally classified as R&D. A 0.1 was added to the MRIO coding of every item that was originally coded as R&D.

The information available for the FY77 service codes other than R&D was similar to that for the R&D. Again, there was information linking some purchases to particular kinds of procurement, as installation, modification, or repair of named procurement items. A 0.2 was added to the MRIO code for every service code of the source that was given an MRIO manufacturing code except for modifications, which were coded to

manufacturing without decimals because modification is included in appropriations for procurement.

FY79 Contract Awards

The mapping of R&D and other service contracts was easier for the FY79 tape because a manual of original code definitions was available for comparison with the SIC manual and because the SIC classification of supplying establishments helped determine whether an item was supplied principally by a manufacturing or a service industry.

NIPA and Related Data

The NIPA data are classified largely by category of congressional appropriations which are classified by program, type of function (e.g., operation and maintenance procurement, etc.) and a highly aggregated object class. As indicated earlier, MRIO sectors can be associated only with aggregations of NIPA categories.

TRANSFORMATIONS OF MAJOR RAW DATA FILES

Each of the major data files required one or both of summarization and application of the mapping translations. Also needed in some cases was estimation of supplementary data.

FY79 Contract Awards

As indicated earlier, the original file for FY79 contract awards has values classified by FSC or service code of the product, SIC code of supplying establishment, state where contract was performed, and purchasing agency classified as DOD, TVA, DOE (defense only), and ALL OTHER. The operations described below were performed separately for all the agency categories other than TVA.

For each of the three agency aggregations a file for the aggregate of all states was produced, and files with state detail were produced for DOE and ALL OTHER. Each file had the original coding translated to MRIO codes. There was additional coding for the national files. Where the original code started with the letter "A", indicating R&D, a 0.1 was added to the MRIO code. If the first character of the original code was a letter character other than "A" or "K" , indicating a service other than R&D or equipment modification; and if the MRIO code was between 20 and 84 (inclusive), which

are the manufacturing MRIO codes, a 0.2 was added to the MRIO code. Where the original code started with a digit, indicating a commodity code, a 0.3 was added to the MRIO code for the fraction of total value of the MRIO that came from establishments having SIC codes starting with either 50 or 51, the codes for wholesale trade. The two national files were called DEN, and DAN, for DOE and ALL OTHER, respectively; and the two files with state detail were called DES and DAS, for DOE and ALL OTHER, respectively.

Finally, the FY79 data were scaled for comparability to 1977 data. The MRIO values for DOE (file DEN) were scaled by the ratios of FY77 to FY79 for groups of budget categories from annual Budget Appendices (Source 01102). For the ALL OTHER (File DAN), the ratios were between FY77 and FY79 obligations, as published in the Treasury Bulletin (Source 15002), Exhibit 6-3 has details for both the DEN and ALL OTHER data.

This procedure provided a very rough adjustment for comparability. The aggregates used were broad and differences may still remain between budget and MRIO (SIC) classification in distinguishing among construction, equipment, and other.

SR-13 Shipments

The aggregation of the SR-13 data SIC-based to the MRIO level was straight-forward, though judgment was needed to decide whether the absence of data for one of several SIC codes belonging to an MRIO was sufficient reason for considering that MRIO as not covered by the data. A judgment to include the MRIO was clearly correct where the missing SIC code was identified by Census as equal to less than one half of the unit of measurement. The decision to include the MRIO was almost as clearly correct where the exclusion of the SIC was stated by Census to be for excessive error in relation to size of the Census estimate, because such cases of large relative error were generally for small dollar values. In other cases, however, the decision was based on the aggregate values and number of SIC codes for which Census did present its estimates and by judgments about whether the missing SIC codes referred to commodities of types that the Federal government might reasonably be expected to buy in significant quantities. Absence of the SIC code from MA-175, which covers those SIC codes that the Census Bureau considers significant for Federal purchases, was sometimes used as confirmation that a missing SIC should not be considered to disqualify the MRIO to which the SIC belongs. The final list of MRIOs considered covered by SR-13 appears in Exhibit 6-4, together with shipment values as estimated below.

EXHIBIT 6-3:

OBLIGATION AGGREGATES FOR FY79 AND FY77
(values in millions of dollars)

	Land and Structures	Equipment	Other[3]
DOE:[1]			
FY79	350.4	160.7	2,119.5
FY77	296.9	123.7	1,547.9
Ratio 77/79	.8473	.7698	.7304
ALL OTHER (non-defense):[2]			
FY79	3,933	2,171	38,568
FY77	3,516	1,630	28,731
Ratio 77/79	.8940	.7508	.7449
MRIO codes	14-18	20, 61-83	All other

[1] *Sources are the Appendix to the Budget of the U.S. for each of FY81, pp. 396-7, and FY79, p.358 (Source 01102).*

[2] *Treasury Bulletin, March 1978 and March 1980, at Table FO-4 (Source 15002).*

[3] *All purchases of goods and services other than personnel compensation and obligations incurred abroad.*

EXHIBIT 6-4:

MRIO VALUES COVERED BY SR-13

MRIO Code	MRIO Description	Value Reported	Adjusted Value[1]
21	Meat products	407.30	559.75
22	Dairy products	187.30	302.53
23	Canned and frozen foods	452.80	642.25
24	Grain mill products	138.10	189.84
25	Bakery product	44.20	53.88
26	Sugar and confectionary products	73.10	121.18
27	Beverages extracts, and sirups	86.50	305.43
28	Other food products	126.50	173.14
29	Tobacco products	216.40	239.54
31	Floor coverings and miscellaneous textile products	36.30	54.59
35	Logging and lumber	19.70	25.25
36	Wood products	16.40	155.04
37	Pre-fabricated buildings and mobile homes	9.90	12.86
38	Household furniture	50.90	66.90
39	Other furniture and fixtures	92.50	127.26
40	Paper and allied products	105.40	193.10
41	Paperboard containers and boxes	34.90	44.56
44	Agricultural chemicals	13.70	17.34
45	Other chemical products	68.40	96.04
46	Plastics and synthetics	6.50	7.72
47	Drugs	204.20	240.88
48	Cosmetics and cleaning products	113.20	139.58
50	Petroleum refining and allied products	1,055.70	1,722.24
56	Iron and steel foundries	243.20	691.22
68	Office and computing equipment	722.60	931.36
70	Electrical transmission and electrical industrial equipment	588.90	1,057.14
71	Household appliances	34.50	53.99
74	Communication equipment	4,901.40	7,416.85
78	Aircraft and parts	6,446.10	7,574.72
79	Missile, spacecraft and parts	5,136.40	5,350.97
80	Aircraft, missile, and spacecraft propulsion units	3,026.20	2,984.85
Total		24,659.20	31,551.90

[1] *Includes estimated shipments scaled upward for undercoverage in the Census sample and includes further adjustment for estimated shipments through wholesalers.*

As noted earlier, the SIC coverages for most SICs were less than total shipments of the products as reported in the complete Census of Manufactures (Source 03105). An estimate was therefore needed of the fraction of the shortage that was in shipments to the Federal government. Extreme values of the government portion would be all or none of the shortage. A plausible intermediate value would be the same fraction of the shortages as the government fraction of shipments reported in the survey. This is too large a fraction, though, if one accepts the plausible hypotheses (a) that manufacturers with size sufficient for them to be included in the survey are more likely to have had significant government sales than smaller manufacturers and (b) that among manufacturers included in the survey, those with government sales are more likely to have had records adequate for SIC product coding. Accordingly, the fraction of the shortage attributed to Federal sales was the fraction of Federal reported sales in total reported sales multiplied by a reduction factor of 0.75. The 0.75 was a judgment based on (a) and (b) above.

In addition to the value supplemented for unreported sales, a supplement in sales through wholesalers was considered necessary. The 1979 contract award data showed that a significant portion of Federal purchases of manufactured products is from wholesalers. The adjustment for shipments through wholesalers consisted of an addition calculated as the shipments directly to government in 1977 multiplied by the FY79 government purchases from wholesalers as a fraction of government purchases from all other sources, with a condition that the value of indirect shipments so calculated would not be allowed to exceed 20 percent of the reported shipments to wholesalers.

The file of adjusted 1977 shipments and MRIO codes was labeled File A.

MA-175 Shipments

Aside from MRIO coding, the only adjustment of the MA-175 data was an adjustment to estimate the distribution of prime contracts among DOD, ERDA, and ALL OTHER. The raw data distributes the sum of prime contracts and subcontracts in combination. For this adjustment, it was assumed that the fraction of prime alone going to each of these agency classes was the same as the fraction of prime contracts and sub-contracts combined. This required scaling the distribution of the two kinds of contracts combined by the ratio of total prime contracts to total of the two kinds of contracts combined. The new files were called BD and BE, for DOD and ERDA respectively. The data on sales to other Federal agencies were not used. The final distributions are presented here as Exhibit 6-5.

EXHIBIT 6-5:

MRIO DEFENSE VALUES COVERED BY MA-175
(millions of dollars)

MRIO Code	MRIO Description	Value
20	Ordnance	1,528.41
50	Petroleum refining and allied products	1,386.25
61	Engines and turbines	88.51
63	Construction and mining equipment	84.16
64	Materials handling equipment	20.27
67	General industrial and other non-electrical machinery and equipment	41.22
68	Office and computing equipment	577.21
70	Electrical transmission and electrical industrial equipment	324.18
74	Communications equipment	5,294.75
75	Electronic components	207.97
76	Other electrical equipment	43.70
78	Aircraft and parts	8,497.75
79	Missiles, spacecrafts and parts	3,331.09
80	Aircraft, missiles and spacecraft propulsion units	3,258.18
81	Other transportation equipment	2,796.22
82	Scientific and photographic equipment, watches and clocks	370.94
Total		27,850.81

Source: Original data are from MA-175 (Source 03129). The shipments of prime contractors plus subcontractors were adjusted to reflect prime contractors only by the text estimating procedure.

FY77 Contract Awards

The only operation required for the FY77 data was reaggregation to MRIO codes and decomposition into files CCN and CDN, for national Corps of Engineers (civil functions) and all other DOD, respectively, and files CCS and CDS for the files with state detail.

DEVELOPMENT OF DEFENSE AND NON-DEFENSE NATIONAL ESTIMATES FROM MAJOR DATA FILES

The procedure for using major data files starts with an empty table having columns for each of DOD, defense energy, and total non-defense, and having rows corresponding to MRIO sectors with separate rows for MRIO codes augmented by decimals 0.1 and 0.2. This table hereafter referred to as TFD, was completed in two stages. In the first stage, entries are made for those MRIO codes that are covered by total shipments to government (with an estimated augmentation for shipments through wholesalers) in SR-13. SR-13 serves in these estimates as a total from which to subtract defense estimates from MA-175 and FY77 files to yield non-defense as a residual. This first stage covers a large fraction of all Federal purchases of goods, giving SR-13 a crucial place in estimation of the sum of defense and non-defense purchases of goods. The second stage of filling the empty table uses the contract award data to fill nearly all the remaining empty spaces of the table. The defense data come from the MA-175 file the FY77 file, and from the DOE part of the FY79 file. The non-defense data come from the Civil Functions of Corps of Engineers part of the FY77 file and from the ALL OTHER part of the FY79 file. Details of the two stages follow.

MRIO Rows Using SR-13

The first step in using SR-13 is to insert DOD and ERDA values of the MA-175 values (Files BD and BE) as entries in the empty table for all MRIO codes covered by MA-175. The corresponding non-defense entry in each MRIO row for every MRIO covered by SR-13 (File A) is the difference between the SR-13 total for that MRIO and the defense entries, except where that would produce a negative. In every such case, the true non-defense is assumed to be zero rather than negative, and the defense estimate from MA-175 are reduced by prorated shares of one-half of the amount the initial non-defense estimate has to be raised to reach zero. This assumes that one half of the minimum error (negativity of non-defense) is an overestimate of defense in MA-175, and that the other half is an underestimate of the non-defense part of SR-13.

The second step is to transfer from the manufacturing MRIO entries all the values that could be associated with MRIO codes that have been augmented with 0.1 or 0.2 in contract award data, and place those values in the rows for corresponding decimal codes. For defense, the fraction to be removed for a particular one of the two decimal codes in the case of any entry without decimals is estimated as a ratio between the sum of entries for the code with the decimal in Files CDN and DEN (DOD part of FY77 and DOE part of FY79) and the sum of all entries in those two files, with and without decimals, for that basic MRIO code. The procedure is the same for non-defense, except that sources for the ratios are files CCN and DAN (Corps of Engineers for FY77 and ALL OTHER for FY79).

MRIO Rows Not Using SR-13

The first step in estimates not using SR-13 is to copy into TFD from the DOD part of FY77 (File CDN) and the DOE part of FY79 (File DEN) the value sum for every MRIO that has no defense entry yet in TFD. The TFD entries distinguish MRIO codes with each of 0.1 and 0.2 from corresponding MRIOs without decimals, but do not distinguish any 0.3.

The second step is to do the same thing for non-defense using the Corps of Engineers part of FY77 (File CCN) and the ALL OTHER part of FY79 (File DAN) as the sources.

RECONCILIATION OF TENTATIVE FINAL DEMANDS WITH NIPA

Aggregation of the two defense columns yielded a tentative final demand matrix (TFD) consisting of two columns of defense and one column of nondefense purchases of goods and services at the national level. The next step was a reconciliation of these purchases with NIPA, including in the reconciliation both explanation of differences that should exist and adjustments to correct for differences that should not exist. Cases explained here are those where NIPA coverage is broader than that of TFD, where TFD coverage is broader than that of NIPA, and where the classification of the two sets of data is different for goods or services that are in both sets of data. There are also comments on force account construction, which is not covered in either set of data.

Broader Coverage in NIPA

Broader coverage in NIPA implied insufficient coverage in TFD. The standard remedy was to estimate the amount of missing value in TFD and subtract that from the relevant NIPA element before using the NIPA values to scale groups of TFD values. This maximized the detail with which NIPA values could be used. The references to NIPA values that follow all relate to Exhibits 6-1 and 6-2 above, which have both published and unpublished NIPA detail.

Compensation of Employees

Compensation of employees is not represented in TFD, but the NIPA value can be used directly as MRIO 122 (Government Industry).

Travel

The NIPA line for non-defense travel consists of expenses of travelers that are primarily for transportation service, car rental, lodging away from home, and meals away from home. None of these expenses are paid for under contracts, so they cannot appear in the contract award files. The non-defense line for transportation does not refer to personal travel. In the case of the defense line for transportation, personal transportation may be involved, as the Military Airlift Command charters aircraft (under contract) to carry both passengers and cargo, sometimes together. The defense travel line, however, may still be considered comparable to that of non-defense for individual travel under per diem or expense accounts.

The major MRIO industries for the NIPA travel lines are 089 (Air Transportation) 106 (Hotels and Lodging Places), 098 (Eating and Drinking Places), and the part of 110 (Auto Rental, Repair and Maintenance) that includes rentals. On the assumption that virtually all of non-defense expenditures for these services in 1972 were included in what NIPA calls travel, Exhibit 6-6 derives 1972 non-defense expenditures as a distribution of the NIPA non-defense control total of $645 million in proportion to the four components as they appear in the 1972 interindustry table multiplied by price indexes. The non-defense proportions were applied to the defense control total of $1,310 million. It is possible, however, that the relative importance of air transportations should be greater for defense because of a probably greater proportion of overseas trips and perhaps because of savings in lodging and meals expense, from availability of such service at military bases.

EXHIBIT 6-6:

DERIVATION OF ELEMENTS OF TRAVEL EXPENDITURE

Industry			Nondefense 1972 Value[1]	Price Index[2]	Nondefense 1972 Value Prices[3]	Nondefense 1977 Value[4]	Defense 1977 Value[5]
1972 I-O Code	MRIO Code	Name					
65.0500	089	Air Transportation	181.5	1.454	263.90	261.0	530.
72.0100	106	Hotel and Lodging	146.3	1.490	217.99	215.6	437.
74.0000	098	Eating and Drinking Places	88.2	1.527	134.68	133.2	270.
75.0000	110	Auto Rental, Repair & Maint.	24.2	1.470	35.57	35.2	70.5
		Total			652.14	645.0	1,310

[1] *Column entry for column 97.0000 in* The Detailed Input-Output Structure of the U.S. Economy: 1972, *Volume I, p.174 (Source 03504).*

[2] *JFA file of price indexes for 1972 I-O commodities.*

[3] *Product of previous two columns.*

[4] *Distribution of NIPA control of 645 in proportion to previous column.*

[5] *Distribution of NIPA control of 1,310 in same proportion as previous two columns.*

The foregoing estimates of MRIO values were added to corresponding MRIO rows of TFD after the general scaling to NIPA controls other than for travel. No scaling to the travel control was needed, because the estimates had been derived as a distribution of the travel control.

Postage

The U.S. Postal Service (MRIO 118, Government Enterprises) billed Federal agencies totals of $611.2 and $626.1 million for mail service (penalty and franked) in FY77 and FY78, respectively.[1] Since no lag between contract awards and performance is involved, the estimated for the calendar year is a weighted average of the two fiscal years with three times as much weight for FY77, as follows: ((3 x 611.2) + 627.1)/4 = $615.2 million.

For FY78, DOD paid $125.0 million, or 20 percent of the total for all Federal agencies. Applying this percentage to the calendar year total yields $123.0 million for DOD in the calendar year and $492.2 million for all other.[2] It is assumed that the DOD value approximated all of defense and that the non-DOD was all non-defense.

Construction for or by Government Enterprises

The NIPA purchases of equipment and structures cover purchases by all government agencies, including enterprises. The equipment shipments of SR-13 include shipments to all government agencies also, but the contract award data, relied on in TFD for construction, do not cover government enterprises. According to telephone information from BEA, the total capital expenditure (plant and equipment plus inventory accumulation) of the enterprises were as follows, in millions of dollars:

[1] *Telephone communication from Government Revenue and Examination Branch; Finance Department, U.S. Postal Service.*

[2] *Military Postal Service Agency, DOD.*

CCC	3,918
Alaska Railroad	6
Bonneville Power Administration	101[a]
VA Canteen Service	3[a]
Federal Home Loan Banks	14
FHA Insurance Fund	289
National Capital Airport	6
Panama Canal Company	25
Postal Service	393
Southwestern Power Administration	1[b]
TVA Fund	1,242[b]
Upper Colorado Storage Project	70
Colorado River Basin	74
Generalized adjustment to exclude land	-58
Total, net	6,083

[a]Estimated informally by BEA source as all inventory.

[b]Estimated informally by BEA source as 20-30 percent inventory, assumed to be coal, at $25 million dollars.

According to the BEA source, there was no explicit breakdown of the capital expenditure described above that would identify the structures portion. The structure costs were covered implicitly, though, in an aggregation of the above data with various capital expenditure data of other government agencies. Therefore, it was necessary to estimate structures versus other capital expenditures. CCC investment was regarded as inventory accumulation. Separate estimates were developed for structures of FHA, Postal Service, TVA, and the other power authorities as explained below.

The $289 million shown for FHA Insurance Fund was clearly net acquisition of houses from delinquent borrowers on FHA-insured mortgages. It did not represent any new construction and was not, therefore, a net component of national gross capital formation. It could, however, be considered a positive element of government investment provided it was also a negative element of private gross capital formation; and this seems to be the NIPA approach. Nevertheless, it was decided to ignore the $289 million here, with a related omission of an equal negative amount in private plant and equipment expenditures. The two omissions make it possible later to avoid the state distribution of 51 pairs of offsetting values.

The BEA estimate of $393 million for the Postal Service is fairly consistent with 1977 data obtained from the Postal Service, as follows, in millions of dollars[1]:

[1]*Obtained by telephone with citation of "Cash Outlay for Capital," in Computer Trial Balance for Accounting Period 13, Fiscal Year 1977, December 8, 1977.*

Construction and building purchase . .		218.0
Equipment		146.5
Vehicles	62.6	
Mail processing equipment .	61.5	
Other	22.4	
TOTAL		364.5

It was the opinion of the Postal Service analyst that about 10 percent of the construction and building purchase was for land value and that about five percent was architect fees, implying that about 50.8 percent of the total investment cost was construction. Applying this to the BEA estimate of $393 million of investment yielded $200 million of Postal Service construction. The architect fees, although justifiable as a capital formation cost, were disregarded in accordance with the NIPA doctrine. This amount was added to MRIO 015 (Nonresidential Construction) after a general scaling that excluded this estimated part of NIPA.

The issue of what costs to include in construction was more serious for TVA. The BEA estimate that total investment during the calendar year by the TVA Fund (the financing source for power activities and, therefore, for nearly all TVA investment) was $1,217 million (after deduction of $25 million for inventory investment, presumably of coal) is reasonably consistent with the FY77 obligations from the Appendix to the Budget of the U.S. for FY79, amounting to $1,402 millions. The share of what is strictly equipment and structures, however, is small. A breakdown of budgeted (not actual) obligations for power program investment in FY77 is as follows, in millions of dollars:[1]

[1] *Telephone information from Office of Planning and Budget, TVA, compiled specially for MRIO project and furnished as preliminary.*

Total	1,330.4
Personnel compensation	255.0
Personnel benefits	83.0
Travel and transportation of persons	1.6
Transportation of goods	0.0
Rent, communications, and utilities	1.0
Other services	23.5
Supplies and materials	104.5
Equipment (incl. nuclear fuel rods)	444.8
Lands and structures[1]	122.6
Interest and dividends (imputed[2])	170.0
Indirect costs[3]	124.5

The nuclear fuel rods are made with enriched uranium produced from unenriched uranium purchased separately by TVA and from spent uranium fuel needing reprocessing. The enrichment of the ore and spent fuel has been done by DOE and its predecessors, making it an intergovernmental transaction and therefore not properly includable in government investment, but the fabrication into rods is done by private industry.

It is not clear which, if any, of the above kinds of cost that TVA considers to be investment are excluded from the BEA estimate of TVA investment. It is clear, however, that any splitting of the BEA estimate between equipment and land and structures would greatly overestimate one or both components, even with a correct investment total. It was therefore decided to estimate land and structures as the BEA estimate of total investment multiplied by the fraction of land and structures in total investment. This shifts any NIPA overestimate of structures purchases to regular government agencies if NIPA has overestimated enterprise structures.

Several adjustments were made to the data before calculating and applying the ratio. First, the BEA investment estimate is for only the power activities of TVA. The contract award data underlying the construction estimates of TFD have neither the power nor other TVA construction. The latter is relatively small, but it can be

[1] *This is well above a total of $81 million of land and structures for all programs combined stated to be actual FY77 expenditures in the Appendix to the Budget of the U.S. for FY79.*

[2] *Imputed capital cost until project completion.*

[3] *This is a sum of allocations of various overhead costs of TVA to the investment activity.*

estimated. The 1979 Budget Appendix has both total investment and the power only investment obligations actually incurred in FY77, and the ratio between the two (1464.4/1402 = 1.0445) can be used to build up the BEA estimate of $1,217 million to represent total investment of $1,271 million for the calendar year. Moreover, the object classification of the TVA budget in that document has a land and structures entry of $81 million which is 5.79 percent of the investment total these of $1,402 million. Applying 95 percent of that (to exclude an unknown but probably small land fraction) to the inflated BEA estimate of $70.5 million yields $67 million.

The same TVA structures fraction (.95 times .058 = .055) was applied to BEA's estimate of $145 million of investments for other power authorities to yield additional structures of $8.0 million.

The sum of structures expenditure for all power authorities combined, $75 million, was coded to MRIO 016 (Public Utility Construction) and added to TFD before the scaling to NIPA structures control. As in the case of Postal Service construction, the estimate here was added to TFD after general scaling that excluded this estimated portion of NIPA structures.

Commodity Credit Corporation Purchases

TDF had no provision at this point for CCC purchases, estimated by BEA as $3,873 million. The BEA estimate is derived from financial data that do not identify particular commodities. A slightly higher estimate, however, can be derived directly from published CCC reports of loan and inventory operations, by commodity. CCC investments are derived for this analysis as sums of net increases in values of commodities held as collateral for non-recourse loans and of commodities in inventories CCC owned outright.[1] The total of such value changes was $4,097.7 million, about six percent more than the BEA estimate. The CCC accounting procedure, however, values loan collateral and owned inventories at the support prices, which frequently exceed market prices. The difference is a subsidy that is properly a transfer payment rather than an investment. Accordingly, the raw increases in loan collateral and inventory values as classified by MRIO sector were scaled to yield the BEA total of $3,873 million, as follows, in millions of dollars:

[1] *U.S. Commodity Credit Corporation periodic financial report tables entitled "Loan Transactions" and "Net Gain (or Loss) on Commodity Inventory Operations, by Commodity," and of each table for the first fiscal quarter of each of FY77 and FY78.*

MRIO	Value
003	3,398.8
004	99.4
022	430.2
024	1.5
028	-56.9
Total	3,873.0

Purchases for Strategic Petroleum Reserve

Another NIPA purchase category not covered by the contract awards, since the purchases are not by annual appropriations, is $102 million of purchases for the strategic petroleum reserve in Louisiana and Texas. These purchases were assigned to MRIO 010 (Crude Petroleum) and were added to TFD after a general scaling that excluded this NIPA control.

Coal Inventory Increase of TVA

The BEA estimate of $25 million of TVA inventory accumulation, assumed to be coal, was not covered by the contract award data and was added to TFD MRIO 009 (Coal), after a general scaling that excluded $25 million of non-defense fuel purchases from the NIPA control.

Imputed Interest

NIPA imputed interest, of $554 million, is an estimate of the value of banking services provided by banks that hold Federal deposits and handle various kinds of financial transactions for the government. The MRIO code is 103 (Banking, Credit Agencies, and Investment Brokers), and the addition to TFD was made after a general scaling that excluded this NIPA item.

Government Sales of Durable Goods

NIPA includes $59 million of sales of durable goods. On the assumption that these were sales of used goods rather than newly produced by the government, the value was made a negative purchase of MRIO 121 (Scrap) after a general scaling that excluded this NIPA value.

Government Sales of Timber

The NIPA data include $828 million of timber sales for which there is no counterpart in TFD. The MRIO code is 005 (Forest Products), and a negative entry was made in this row of the non-defense column after general scaling that excluded the NIPA item.

Miscellaneous Sales of Nondurables

The NIPA data for non-defense include $100 million of miscellaneous nondurable sales. The Treasury Combined Statement of Receipts, Expenditures, and Balances of the United States Government, FY77 (Source 15201) records sales of "timber, wildlife, and other natural land products" of $950 million, well above what BEA reports for timber alone, and there are entries of $15 million for "publications and reproductions," and $60 million of various items of mint revenues and profits. It was decided to adjust the NIPA data by deleting the negative $100 million from purchases of other nondurables and to make corresponding aggregate subtraction of $100 million from TFD after the general scaling, with the aggregate consisting, rather arbitrarily, of $15 million of negative purchases of MRIO 042 (Newspapers, Periodicals and Other Printing and Publishing), $42.5 million of MRIO 005 (Forestry Products), and $42.5 million of 084 (Other Manufactured Products).

The available NIPA detail include no explicit sales entries (as negatives) in defense purchases of nondurable goods. There were, however, in FY77 about $150 million of sales from strategic stockpiles of raw materials ($148 million in the Treasury statement cited above), and nearly $152 million as recorded by GSA (with an apparently slightly different dating of when each sale occurred). It was assumed that the strategic stockpile sales were negative elements of the NIPA $809 million of "other purchases" of nondurable goods. These sales were not covered by any of the sources used so far to build up TFD. It was decided to increase the comparability of the NIPA and TFD for scaling by adding $152 million to the NIPA control of $809 million before scaling of TFD and then to subtract the $152 million in appropriate MRIO codes from TFD after the scaling.

The Stockpile Disposal Division of GSA provided a telephone breakdown of the sales by commodity, and these were coded to MRIO products as follows, in millions of dollars.

Code	Value
007	57.3
008	1.4
012	10.8
043	3.3
054	7.4
055	25.5
057	35.7
084	3.3
120	6.8
Total	151.5

Service Sales

NIPA has a more important unidentified sales category in service sales of $569 million. The previously cited Treasury Statement of Receipts and Expenditures has many candidates for possible inclusion in the $569 million, but does not include any reference to $689 million of uranium enrichment services for domestic and foreign electric utilities other than TVA.[1]

Although the enrichment of uranium is clearly a manufacturing activity in SIC and MRIO coding, the Department of Energy classifies it as a service because the enrichment is done with lower-grade uranium that is supplied by the customer and remains the customer's property. It would be reasonable to expect the NIPA classification to be as a service, and with advice from NIPA staff, it has been assumed that the estimated amount of enrichment revenue from non-governmental customers is a negative element in the $6,271 million of other services. The procedure was to subtract $689 million from the TFD row for MRIO 043 (Industrial Chemicals) after a scaling before which $689 million was added to the NIPA other services.

The adjustment for uranium enrichment did not affect the $569 million of service sales in NIPA. A major source for the NIPA estimate was Department of the Treasury, Combined Statement of Receipts, Expenditures and Balances of the United States Government for the Fiscal Year Ended September 30, 1977, Part II, Details of Receipts. The volume has numerous items of "fees and other charges," summing to $993.8 million dollars. Subtracting $8.0 million of airport landing fees (government enterprise receipts) and $478.1 million for National Service Life Insurance premiums, leaves $508.7 million for the fiscal year, not very different from the $569 million NIPA

[1] *Telephone communication from Department of Energy.*

estimate for the calendar year. The line descriptions in the Treasury document were not sufficiently detailed to permit comprehensive MRIO coding of the services but, codes were assigned to about $485 million of the total. Exhibit 6-7 shows the values and the assigned MRIO codes by individual Treasury lines and by groupings of those lines. Aggregation and scaling of the $443.9 million of coded values to the NIPA control total of $569 million for the calendar year yielded MRIO sales as follows, in millions of dollars:

MRIO	017	3.1
	088	40.4
	096	11.0
	098	29.6
	103	1.9
	105	274.1
	107	3.7
	108	166.6
	111	32.7
	114	3.7
	118	2.2
	Total	569.0

These values were added to corresponding MRIO rows of TFD non-defense after scaling to NIPA control totals.

Tentative Final Demand Coverage Not in NIPA

TFD coverage not found in NIPA represented overcoverage in TFD. The items were (a) purchases of food and clothing to the extent those purchases are already covered by the personal consumption expenditures of NIPA and MRIO and are included in the NIPA compensation of employees for government defense, and (b) defense purchases of military items that are on behalf of foreign governments that reimburse the U.S. government in the same fiscal year. These items were subtracted from the appropriate TFD value.

Purchases of Food and Clothing Included in Employee Compensation

TFD has defense purchases of food and clothing that appear in NIPA for government purchases of goods and services as part of compensation of employees. NIPA records the actual purchase of these items as part of personal consumption expenditures, as if the Department of Defense paid the consumers in cash with which the consumers bought their own food and clothing. Unpublished BEA information is that there was $85

EXHIBIT 6-7:

TREASURY TABULATIONS OF FEES AND OTHER CHARGES FOR FISCAL YEAR 1977 AND THEIR ASSIGNED MRIO CODE NUMBERS

Line as Described by Treasury or Grouped	Value ($mil)	MRIO Code
Administrative and professional service	56.2	108
Commission on telephone pay stations	3.4	105
Postal receipts, Canal Zone Government	1.7	118
Loan guarantees Federal Railroad Administration	1.5	103
Deposits for road maintenance and reconstruction	2.4	017
Charges for subsistence	23.1	098
Charges for laundry	2.9	107
Charges for health services	2.9	114
Testing, inspection, and grading	59.8	108
Business concessions	16.0	105
Fees for special benefits, Reclamation Fund	1.4	105
Grazing fees	8.1	105
Admission permits and fees	25.5	111
Miscellaneous forest use fees	12.7	105
Miscellaneous service lines	40.9	Uncoded
Operation of Indian irrigation systems	8.6	096
Forest Service Cooperative Fund	131.2	105
Various lines of land improvement items of Interior and Agriculture	41.0	105
Technical assistance programs (various lines)	14.0	108
Contributions, rivers and harbors	31.5	088
Total	484.8	

Sources: *Value data are from U.S. Treasury, Combined Statement, Fiscal Year 1977, Part II, Details of Receipts. MRIO codes are as assigned by JFA staff (Source 15201).*

million for food and $544 million for clothing, including shoes. MRIO sectors covering food purchases are 021-028. The clothing sectors are 032, 033, and 052. There was no direct information on the correct distribution within each set of MRIO codes. The food and clothing purchases were distributed in proportion to the distribution of other food/clothing purchases in respective sectors of TFD. These amounts were subtracted from what was already in TFD before any scaling to NIPA control totals.[1]

Purchases of Military Items on Behalf of Foreign Governments

Exhibit 6-8 presents the expenditures as estimated by BEA for purchases by DOD on behalf of foreign governments that reimburse the U.S. government, and as re-estimated for this project. The object clases for military equipment have some of the problems previously mentioned for similar object classes in NIPA; they are derived primarily from government accounting records that are not kept on an SIC basis. Informal advice from BEA suggests, however, that the names are more descriptive of SIC classifications here than in NIPA, and Exhibit 6-8 includes MRIO sectors for each line.

The miscellaneous services reported by NIPA were assumed to be repair, modification and installation of equipment undertaken by the suppliers. The adjustment shown therefore distribute the services among the military equipment items, and the distribution is proportional to the hardware value.

The distribution of the adjusted NIPA aircraft and parts between MRIO 078 and MRIO 080 was in proportion to the previously developed TFD values.

As finally adjusted and coded, all Exhibit 6-8 values but construction were subtracted from TFD before scaling to NIPA controls. The construction was foreign and therefore never included as construction in TFD.

Summary

All of the adjustments discussed above may be classified as (a) subtractions from NIPA controls to exclude items or portions of items already reconciled with elements of TFD, (b) additions to TFD after scaling to NIPA controls totals (corresponding to the subtrac-

[1] *A revision of this report could consider acquisition of independent data on the distributions. The procedure here guarantees no negatives after the subtractions that are not general across all food or all clothing MRIOs. Had there been negatives, they would have been zero, since the government must be a net user of food and clothing rather than a producer.*

EXHIBIT 6-8:

DOD PURCHASES FOR REIMBURSEMENT
BY FOREIGN GOVERNMENTS
(millions of dollars)

Description	Value		MRIO Codes
	As Published[1]	As Adjusted[2]	
Aircraft & parts	2,265	2,907	78, 80
Vehicles & parts	920	1,181	77
Ammunition & other equipment	850	1,091	20
Missiles	708	909	79
Construction	779	779	18
Training	212	212	115
Miscellaneous services	1,345	-	-

[1] *From Survey of Current Business, May 1978, Chart 3, p. 23, (Source 03501).*

[2] *Miscellaneous services pro-rated among goods purchases in proportion to published values.*

tions from NIPA controls), and (c) before scaling subtraction from TFD of purchases that NIPA does not cover and that do not belong in MRIO purchases by government. The items are tabulated in Exhibit 6-9.

Classification Differences

Government purchases of goods and services in NIPA are classified by budgetary accounts rather than by the SIC system on which MRIO is based. For example, procurement of Army aircraft covers

> construction, procurement, production, modification, modernization of aircraft, equipment, including ordnance, ground handling equipment, spare parts, and accessories therefore; specialized equipment and training devices; expansion of public and private plants, including the land necessary therefor,...; and procurement and installation of equipment, appliances, and machine tools in public and private plants; reserve plant and Government and contractor-owned equipment layaway; and other expenses necessary for the foregoing purposes; ...[1]

This includes many items that are in other MRIO categories than MRIO 078 (Aircraft and Parts), and it excludes aircraft development work and other services of aircraft manufacturers that MRIO 078 includes.

A large fraction of these classification differences was handled by aggregating NIPA accounts to fit as closely as possible with a group of MRIO sectors. Even after large-scale aggregation, however, problems remained. Most of research and development, classified by NIPA as included in services, is classified in the SIC system and in MRIO as primary product of the manufacturing industry. Other purchases probably classified by NIPA as services but classified in MRIO manufacturing industries are those associated with maintenance repair and rebuilding of equipment; installation of equipment; and technical representative services. Provision for dealing with this difficulty was made at the time of coding of contract award data when 0.1 or 0.2 was added to any MRIO manufacturing code for data that were classified in the source files as R&D or other services, respectively.

To compare groups of MRIO products and services with the NIPA aggregates, each MRIO manufactured product value was reduced by the amount of any value for MRIO codes that had a 0.1 or 0.2 added to the code number; all MRIO codes having 0.1 were

[1] *Appendix to Budget of the U.S. Government Fiscal Year 1978, p. 239 (Source 01102).*

EXHIBIT 6-9:

SUMMARY OF CONTROL ADJUSTMENTS
(millions of dollars)

		Defense	Non-defense
NIPA			
Subtractions of items not to be used for scaling			
	Travel	1,310	645
	Structures (FHA)		289
	Structures (Postal Service)		200
	Structures (Utility Enterprises)		75
	CCC		3,873
	Strategic Petroleum Reserve		102
	Imputed interest		554
	Sales of timber		-828
	Sales of other durable goods		-59
	Petroleum sales		-488
	Sales of nondurable goods	-152	-100
	Sales of miscellaneous services		-569
	Nuclear enrichment		-689
	Postage	123	492
TFD			
Additions after scaling to NIPA controls			
089	Air transportation	530.1	261.0
106	Hotels and lodging places	437.9	215.6
098	Eating and Drinking Places	270.5	133.2
110	Auto rental, repair, and maintenance	71.5	35.2
015	Nonresidential construction		200.0
016	Public utilities construction		75.0
003	Cotton, grain, and tobacco		3,628.0
022	Dairy production		245.0
010	Crude petroleum		102.0
103	Banking, credit agencies, and investment brokers		554.0
005	Forestry products		-828.0
121	Scrap		-59.0
010	Crude Petroleum		-488.0
042	Newspapers, periodicals & other printing & publishing		-15.0
005	Forestry products		-42.5
084	Other manufactured products	-3.3	-42.5
108	Miscellaneous services and advertising		-166.7
105	Real estate and rental		-274.2
118	Federal government enterprises, except utilities and local transit		-2.0
103	Banking, credit agencies, & investment brokers		-1.9
017	Highways and streets		-3.1
098	Eating and drinking places		-29.6
107	Personal and repair services, except auto		-3.7
114	Other medical and health services		-3.7
111	Amusements		-32.7
088	Water transportation		-40.4
096	Water and sanitary services		-11.0

EXHIBIT 6-9:

SUMMARY OF CONTROL ADJUSTMENTS (Cont.)
(millions of dollars)

		Defense	Non-defense
Subtraction of purchases that are not final demand			
043	Industrial chemicals	-3.3	-689.0
118	Government industry	123.0	492.0
007	Iron and ferroalloys	-57.3	
008	Nonferrous ores	-1.4	
012	Stone, clay, sand and gravel	-10.8	
054	Stone and clay products	-7.4	
055	Iron and steel mills and forging	-25.5	
057	Primary nonferrous metals and products	-35.7	
084	Other manufactured products	-3.3	
120	Directly allocated imports	-6.8	
021	Meat products	[a/]	
022	Dairy products	[a/]	
023	Canned and frozen foods	[a/]	
024	Grain mill products	[a/]	
025	Bakery products	[a/]	
026	Sugar and confectionary products	[a/]	
027	Beverages, extracts, and syrups	[a/]	
028	Other food products	[a/]	
032	Hosiery and knit goods	[b/]	
033	Apparel	[b/]	
052	Leather and leather products	[b/]	
078	Aircraft and parts	[c/]	
080	Aircraft and missile propulsion units	[c/]	
077	Motor vehicles and parts	1,181	
020	Ordnance	1,091	
079	Missiles	909	
115	Training	212	

a/ *Distribution of $85 million of food in proportion to food MRIOs of TFD.*

b/ *Distribution of $544 million of employee compensation clothing in proportion to clothing MRIOs of TFD.*

c/ *Distribution of $2,907 of aircraft and parts in proportion to TFD values of MRIO 078 and MRIO 080.*

included among those with value controlled by the NIPA aggregate for RDT&E; and all MRIO codes with 0.2 were included in the NIPA aggregate for Other Services. After the scaling by these controls, all MRIO values (with and without decimals) were reaggregated and the decimal codes were dropped from the file.

Direct Government Purchases Abroad

The NIPA non-defense purchases of services include $1,359 million of "U.S. Government payments for miscellaneous services,"[1] and the defense purchases of goods and services include all but one of the following items of direct defense expenditure abroad in millions:[2]

Department of Defense	$ 5,824
U.S. military and civilian personnel and dependents	558[3]
Military exchanges and other non-appropriated funds	876
Foreign nationals (direct and contract hire)	1,141
Contractual services	1,299
Construction	811
NATO infrastructure	63
Major equipment	122
Petroleum products	616
Other materials and supplies	299
Military assistance program offshore procurement	1
Military assistance program services	29
Coast Guard expenditures	9

All but the $876 million of purchases by military exchanges and other nonappropriated funds and $779 million of construction are in NIPA defense purchases of goods and services. None are covered by TFD. In the MRIO, all government purchases used abroad and covered by NIPA are classifiable as MRIO 120 (Directly Allocated Imports) except the $122 million for major equipment because it is the only item considered substantially competitive with domestic output. The mix of the major equipment was assumed — with great percentage of error, but for relatively small absolute values — to be the same as for purchases of domestic durable goods for defense. This implied that the NIPA control total for durable goods should be reduced by $122 million before use as a control for domestic purchases, and that a purchase (not allocated to any particular

[1] *Survey of Current Business, March 1979, p.44 (Source 03501).*

[2] *Slight revisions by telephone of estimates of the Department of Commerce published in Survey of Current Business, May 1978, p.23.*

[3] *The compensation spent overseas by recipients.*

states) be recorded for imports of military durables in the same proportion as the domestic purchases. All other purchases of goods and services were subtracted from either personnel compensation, structures, nondurable goods or other services of Exhibit 6-3, and the aggregate was put into MRIO 120 and not allocated to particular states.

Summary

Exhibit 6-10 shows the final NIPA control totals after all subtractions and reclassifications, and it shows the MRIO codes of the controlled values of TFD.

STATE DISTRIBUTION

Distribution by state presented not only empirical problems, but also conceptual problems of how to define state distribution. Alternatives considered were (a) the state location in which the Federal government uses the product or service, and (b) the state in which the product or service is produced.

The state location of production is usually consistent with achievement of the primary purpose of interstate input-output analysis, identification of the state where economic activity is generated. The principal disadvantage in using state-of-production is that it does not easily permit the identification of the transportation requirements from state-of-production to state-of-use. Transportation requirements, however, do not pertain to government purchases of services, and they are relatively unimportant for major purchases of commodities, especially for the Department of Defense. DOD commodities sometimes move under their own power (e.g., aircraft), and at other times they move by contract transportation, which is accounted for in the contract award data.

Where the government is the seller rather than the buyer, the state location of the Federal establishment producing the item sold is required to develop transportation costs, although empirically the transportation costs of goods sold by the government is probably not substantial.

Developing data by state of production was not difficult for commodity purchases and for many services because the contract award data has distributions by state of performance of the contract. The state distribution data of the contract awards were

EXHIBIT 6-10:

NIPA CONTROL VALUES AND CONTROLLED MRIO CODES
(values in millions of dollars)

NIPA Description	Control Values: Defense	Control Values: Non-Defense	MRIO Codes
Durable goods	22,176	2,123	20, 35-39, 55-83
Clothing and textiles (defense)	467		30-34
Bulk petroleum products (defense)	2,536		050, 010, 011
Fuels (non-defense)		322	050, 011
Other nondurable goods (defense)	661		1-9, 12-13, 21-29, 41-49, 51-54, 84
Other nondurable goods (non-defense)		3,123	1-9, 12-13, 21-34, 41-49, 51-54, 84
Research & development	7,376	5,737	All xxx.1
Transportation	1,980	186	85-91
Communications (defense)	639		92, 93
Rent communications and utilities (non-defense)		1,286	105, 92, 94-96
Printing and reproduction (non-defense)		319	42
Other services (defense)	7,387		xxx.2, 19, 93, 94-96, 97-101, 102-104, 105, 106-118
Other services (non-defense)		6,483	xxx.2, 19, 93, 97-101, 102-104, 106-117
Military structures (defense)	1,638		18
Other structures (defense)	852		14-17, 18
Structures (non-defense)		4,213	14-18
Total	44,752	23,455	

sometimes used to provide proportions for MRIOs with national totals derived partly or entirely with data other than the contract awards. For example, MA-175 (Source 03129) shipments of aircraft to DOD were distributed by state in the proportions of contracts for aircraft shipments.

Occasionally, the tabulation of state distributions of contracts for an MRIO yielded a negative for one state, indicating that contract cancellations exceeded new awards in the fiscal year. All such negatives were treated as zeros.

Some Federal purchases were not covered by contract award data. A notable example was commodity purchases of the CCC under price support programs. In these cases, purchases were usually distributed to states in proportion to state outputs of the MRIO industries concerned. This was plausible in the case of the CCC because the CCC is likely to acquire farm products from all regions in which they are produced. Even where it is less plausible to assume that the purchases are made all over the country, though, a distribution in proportion to state outputs was made if no other reliable state data were available.

Purchases by the Federal government of transportation and other services posed special problems. For example, the contract award data have state locations for purchase of transportation services, but these locations may be headquarters of firms providing transportation or, originating points of the persons or goods being transported. In neither case is it correct to consider the transportation activity as occurring only at the state named. The output distributions in the final demand files are in proportion to employment, and such output distributions were sometimes used even when apparently more specific information was available from the contract award. Service flows will be fully developed in the subsequent development of interregional flows.

Government industry (MRIO 122), consisting of total pay and benefits to Federal employees was distributed among states as Federal payrolls were distributed in earlier tasks, after subtraction of the foreign employment. The foreign employment was left as a purchase not allocated to states.

Exhibits 6-11 and 6-12 list all state distributions not based on contract awards. Included are a small number of items and small dollar value that were not allocated.

Exhibit 6-13 presents acreage by state of national forests and parks plus Postal Service employment, referred to in Exhibit 6-12 as the basis of some distributions to states.

EXHIBIT 6-11:

STATE DISTRIBUTIONS OF PURCHASES ON BASES
OTHER THAN CONTRACT AWARDS

MRIO Codes	Portion of MRIO Code		Basis for State Distribution
Purchases included in contract award data:			
85-93, 103-4, 110	(nondefense)	All	MRIO outputs
20, 37-40, 55-83	(defense)	($122 million of direct purchases abroad)	Imports only
Purchases excluded from contract award data (all nondefense except as noted):			
122	All defense and nondefense		Total Federal employment
3, 22	CCC		MRIO outputs
10	Strategic Petroleum Reserve		Texas, 25.8%; Louisiana, 74.2%
103	All		MRIO outputs
89, 98, 106, 110	Parts included in travel		MRIO outputs
15	Postal Service construction part		Population
16	Government utilities part		Unallocated[1]
118	Government industry (postage)		U.S. Postal Service employment

[1] *Within Tennessee and Colorado River areas and State of Washington.*

EXHIBIT 6-12:

SALES (NEGATIVE PURCHASES), MRIO CODES, AND BASES FOR STATE DISTRIBUTION

Item Description	Value[1] ($mil)	MRIO	Distribution Basis
Administrative & professional services	72.0	108	All to D.C.
Commission on telephone pay stations	4.4	105	Government personnel[2]
Postal receipts, Canal Zone government	2.2	118	Unallocated
Loan guarantees, Federal Railroad Admin.	1.9	103	MRIO 085 output
Deposits for road maintenance and reconstruction	3.1	017	Unallocated
Charges for subsistence	29.6	098	Unallocated
Charges for laundry	3.7	107	Unallocated
Charges for health services	3.7	114	Unallocated
Testing, inspection, and grading	76.7	108	MRIO 21 output
Business concessions	20.5	105	Government personnel[2]
Fees for special benefits, reclamation fund	1.8	105	Unallocated
Grazing fees	10.3	105	Government forest acreage
Admission permits and fees	32.7	111	Government park acreage
Miscellaneous forest use fees	16.3	105	Government forest acreage
Operation of Indian irrigation systems	11.0	096	Unallocated
Forest Service Cooperative Fund	168.2	105	Government forest acreage
Various lines of land improvement items of Interior and Agriculture	52.6	105	Unallocated
Various lines of technical assistance	17.9	108	Unallocated
Contributions, rivers and harbors	40.3	088	Unallocated
Nuclear enrichment service	689.0	043	Tennessee, Ohio, Kentucky[3]
Forest products	828.0	005	Government forest acreage
Scrap	59.0	121	Unallocated
Crude petroleum	488.0	010	Unallocated
Newspapers, periodicals and other printing and publishing	15.0	042	All D.C.
Forestry products	42.5	005	Government forest acreage
Other manufactured products	42.5	081	Unallocated
Iron and ferroalloys	57.3	007	Unallocated
Nonferrous ores	1.4	008	Unallocated
Stone, clay, sand and gravel	10.8	012	Unallocated
Industrial chemicals	3.3	043	Unallocated
Stone and clay products	7.4	054	Unallocated
Iron and steel mills and forging	25.5	055	Unallocated
Primary nonferrous metals and products	35.7	057	Unallocated
Other manufactured products	3.3	084	Unallocated
Directly allocated imports	6.8	120	Unallocated

[1] *All but the last entry are values of Exhibit 6-7 scaled to sum to $568.9 million. The last line is derived in text.*

[2] *Sum of defense and non-defense, from Task 2.*

[3] *Equal proportions.*

EXHIBIT 6-13:

ACREAGES OF NATIONAL FORESTS AND NATIONAL PARKS,
AND POSTAL SERVICE EMPLOYMENT BY STATES, 1977

State	Gov't Forests (acres/thous.)	Gov't Parks (acres/thous.)	Employment (1,000)
Alabama	643	45	7.5
Alaska	20,594	1,394	1.2
Arizona	11,270	25	6.0
Arkansas	2,669	28	4.9
California	20,359	643	72.5
Colorado	14,388	159	8.8
Connecticut	7	191	10.5
Delaware	-	7	1.6
Florida	1,084	283	22.4
Georgia	859	47	13.1
Hawaii	-	18	1.9
Idaho	20,411	29	2.0
Illinois	258	287	45.6
Indiana	183	66	13.8
Iowa	-	47	9.0
Kansas	108	24	7.2
Kentucky	663	41	7.7
Louisiana	597	24	8.6
Maine	52	na	3.7
Maryland	-	62	6.8
Massachusetts	-	35	22.5
Michigan	2,714	224	24.1
Minnesota	2,795	175	12.9
Mississippi	1,139	17	4.7
Missouri	1,457	79	17.5
Montana	16,768	35	2.3
Nebraska	352	113	5.4
Nevada	5,143	144	1.8
New Hampshire	683	105	2.5
New Jersey	-	253	27.6
New Mexico	9,245	164	2.5
New York	13	2,978	81.4
North Carolina	1,156	69	12.1
North Dakota	1,106	14	2.2
Ohio	170	204	31.9
Oklahoma	291	74	7.9
Oregon	15,605	90	6.2
Pennsylvania	509	296	39.0
Rhode Island	-	12	3.0
South Carolina	608	63	5.7
South Dakota	1,995	90	2.3
Tennessee	621	116	11.9
Texas	781	102	34.0
Utah	8,046	56	3.0
Vermont	266	35	1.8
Virginia	1,610	48	10.0
Washington	9,070	79	10.4
West Virginia	963	66	4.8
Wisconsin	1,495	106	12.3
Wyoming	9,252	157	1.1
Washington, D.C.	-	-	17.1
Total U.S.	187,791	9,837	

Source: Statistical Abstract, 1979, Tables 403, 1269, and 463 (Source 03120).

CHAPTER 7

STATE AND LOCAL GOVERNMENT FINAL DEMAND

INTRODUCTION

Development of state and local government (SLG) final demand was undertaken in two major steps, as follows:

- Phase I — Convert state-level Census data on SLG expenditures into estimates of SLG net purchases of goods and services (final demand).

- Phase II — Distribute SLG purchases of goods and services over the producing I-O sectors to form final demand vectors.

The set of Census data that is the basis of Phase I is a very high quality source that is both extensive and detailed. In contrast, there are very little data on which to base Phase II. As discussed in more detail below, the general strategy applied in the performance of this task was to maximize use of the high quality detailed data available in Phase I in order to minimize error introduced in Phase II.

The Phase II task of distributing net purchases of goods and services over producing I-O sectors would ideally be based upon a current and comprehensive state-level survey of the bill-of-goods purchased by state and local governments. Unfortunately, no such data exist. The best bill-of-goods information available for state and local governments is contained in the final demand vectors of BEA's national-level I-O studies. The SLG bill-of-goods data in BEA's most recent 1972 I-O table is old and in need of some updating but is nonetheless reasonably useful because it is available in a highly disaggregated form. BEA has broken SLG final demand into 20 vectors representing different governmental functions. These are listed in Exhibit 7-1.

The BEA data, therefore, make it possible to differentiate the I-O pattern of purchases for fire departments, for example, from that for police departments. Working at this fine a level of disaggregation avoids the risk of making an error in the aggregate SLG final demand vector due to changes in the distribution of expenditures between

EXHIBIT 7-1:

FUNCTIONAL CATEGORIES PROVIDED IN BEA DISAGGREGATED 1972 FINAL DEMAND VECTORS

1. Higher Education
2. Elementary and Secondary Education
3. Libraries
4. Other Education
5. Health
6. Hospitals
*7. Sewerage
*8. Other Sanitation
9. Welfare
10. Police
11. Fire
12. Correction
13. General Government:
    - Other and Unallocable
    - Employment Security Administration
    - Veterans Services
    - Protective Inspection and Regulation
    - Financial Administration
    - General Control
    - General Public Buildings
14. Highways:
    - Regular Highways
    - *Toll Highways
15. Natural Resources
16. Parks and Recreation
*17. Airports and Water Transportation
*18. Housing and Urban Renewal
*19. Public Utilities:
    - Water Supply
    - Electric Power
    - Local Transit
    - Gas Supply
*20. Other Commercial Activities:
    - parking lots
    - liquor stores

*Denotes government enterprises.

functions. Furthermore, BEA's disaggregate bill-of-goods data appear by inspection to be plausible (e.g., a reasonable proportion of police department purchases are vehicles).

Thus, a reasonably accurate Phase II methodology can be devised using the BEA 1972 bill-of-goods data (adjusted for relative inflation) provided that the Phase I analysis can be performed at a comparable level of functional disaggregation. This approach follows that employed by Richard Berner and Orani Dixon in a previous state-level I-O study of the 1947, 1958, and 1963 data.[1] They also attempted to carry a maximum of functional detail through Phase I in order to make the best use of available bill-of-goods data in Phase II.

As Berner and Dixon discuss at length, the major difficulty in this approach is presented by the need to perform the very tedious national income accounting steps required to convert state-level expenditure data into estimates of net purchases of goods and services at a fine level of functional detail. The national-level procedure used to derive SLG net purchases of goods and services from SLG expenditures in the National Income and Product Accounts (NIPA) is given in Exhibit 7-2. The problem confronting Berner and Dixon was that many necessary accounting details were not available at a state level for the detailed functional categories. Their approach became one of taking the accounting adjustments as far as possible and then scaling the partly finished state estimates of SLG net purchases by function to national NIPA control totals for SLG net purchases by function.

The present analysis profits from improvements in the Census of Governments that have greatly enhanced the functional detail available. In fact, the Census of Governments is such a thorough and high quality source that it has become the principal basis for the SLG portion of the NIPA accounts and numerous "bridges" between them have undergone substantial development. As a result, it was possible to carry 32 functional categories through the entire Phase I accounting transformation. These are listed in Exhibit 7-3. In the end, it was still necessary to reconcile the Census-derived state estimates of SLG net purchases by function with national NIPA control totals for SLG net purchases by function (Table 3.17 of the 1977 NIPA tables). However, this step was merely a small calibration, adjusting the FY 1977 Census data to calendar year 1977 NIPA controls, and no longer involved substantial error.

[1] *Karen Polenske et. al., State Estimates of the Gross National Product, 1947, 1958, 1963, Lexington Books, Lexington, Mass (Source 27020).*

EXHIBIT 7-2:

NATIONAL INCOME ACCOUNTING PROCEDURE TO DERIVE ESTIMATE OF SLG NET PURCHASES OF GOODS AND SERVICES FROM EXPENDITURE DATA

CONSTRUCTION OF NATIONAL TOTAL, STATE AND LOCAL GOVERNMENT PURCHASES (OFFICE OF BUSINESS ECONOMICS CURRENT PROCEDURE)

	(1)	Total state and local government expenditure (direct general expenditures plus utilities, liquor stores, and insurance trust)
minus:	(2)	insurance benefits
	(3)	interest on debt
	(4)	assistance and subsidies plus payments for foster children in private homes and aid to higher education in schools run by local authorities
	(5)	purchases of land and existing structures
	(6)	current operations of government enterprises
	(7)	new construction
	(8)	personal services to general government (wages plus salaries)
	(9)	wage supplement (income other than wages and salaries) other than payments to self-administered retirement funds
plus:	(10)	general government force account compensation
equals:	(11)	other gross purchases
minus:	(12)	sales other than structures
equals:	(13)	other purchases
plus:	(14)	compensation of general government (employees)
	(15)	structures (including new construction less force account compensation)
	(16)	purchases less sales of existing structures
equals:	(17)	net purchases of goods and services
plus:	(18)	sales of goods and services
equals:	(19)	gross purchases of goods and services

EXHIBIT 7-3:
FUNCTIONAL CATEGORIES PROVIDED IN THE CENSUS OF GOVERNMENTS

1. Higher Education
2. Local Schools
3. Other Education
4. Libraries
5. Public Welfare
6. Hospital
7. Health
8. Employment Security Administration
9. Veterans Services
10. Highways
11. Airports
12. Parking Facilities
13. Water Transportation
14. Police
15. Fire
16. Correction
17. Protective Inspection & Regulation
18. Sewerage
19. Other Sanitation
20. Natural Resources
21. Parks & Recreation
22. Housing & Urban Development
23. Financial Administration
24. General Control
25. General Public Buildings
26. Other and Unallocable
27. Water Supply
28. Electric Power
29. Local Transit
30. Gas Supply
31. Liquor Stores & Other Government Enterprises
32. Toll Highways

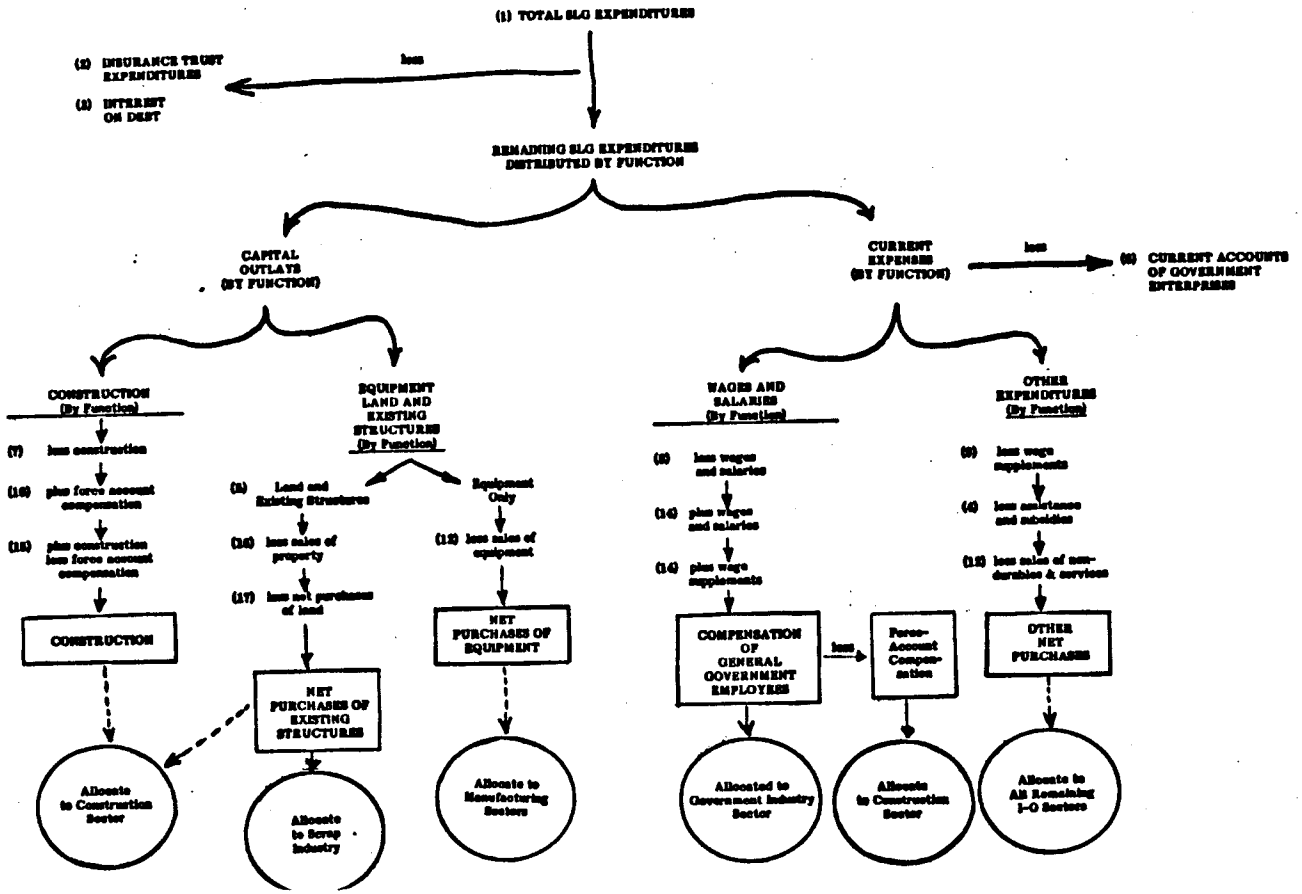
As evident in Exhibit 7-2 the major difficulty of the Phase I accounting procedure stems from the fact that state SLG expenditure data must be disaggregated not only by function but also by character and object classes of expenditures within each function. The character of expenditure is the distinction between capital and current accounts. The specific objects purchased are further differentiated within these categories as between: equipment, structures, land, wages and salaries, and "other" purchases. The 1977 Census of Government provides great detail in these very disaggregated categories of expenditure for each SLG function. In the course of working with these disaggregate data for the Phase I accounting transformation, it become apparent that they could be used also to improve the quality of the Phase II distribution of net purchases over producing I-O sectors. Instead of using a single net purchases control total for each function, subtotals for discrete categories such as construction, compensation, and equipment were used as control totals for appropriate portions of the final demand vectors. As a result of this procedure, the aggregate final demand vectors produced control not only to NIPA control totals for SLG net purchases by function (Table 3.17 of the 1977 NIPA tables) but also to the NIPA control totals for the character and object classes of SLG net purchases (Table 3.7B of the 1977 NIPA tables.)

The overall result produced by the use of the improved Census of Governments data is a state-by-function-by-type-of-expenditure Phase I methodology for developing estimates of SLG net purchases of goods and services. A flow diagram of the methodology is presented in Exhibit 7-4. The numbered steps correspond to the steps in Exhibit 7-2. The state estimates of SLG net purchases of goods and services derived by this procedure control to national NIPA totals by function; and, the type-of-expenditure subtotals, when summed over all functions, control to national NIPA subtotals for specific types-of-expenditures. This two-dimensional control to NIPA control totals provides important limits to the potential for error in use of old bill-of-goods data in Phase II. Exhibit 7-4 also shows the method by which the subtotals were used to control relevant portions of the final demand vectors.

The extra detail provided by this state-by-function-by-type-of-expenditure methodology should prove very useful for policy analysis applications of the MRIO. The final output contains 20 final demand vectors representing the 20 BEA functional categories. The capital and current accounts of each of these 20 vectors are separated, making 40 vectors of output in all. With this level of detail, changes in program spending priorities can be readily simulated. Of particular relevance to modeling concepts of

EXHIBIT 7-4:

FLOW CHART OF STATE-BY-FUNCTION-BY-TYPE-OF-EXPENDITURE METHODOLOGY



"new federalism," the Census tape on which this analysis was based also contains very detailed accounting of the flow of Federal funds to many of these functions in 1977.

PHASE I: METHODOLOGY - ESTIMATION OF SLG NET PURCHASES OF GOODS AND SERVICES FROM EXPENDITURE DATA

This section provides step-by-step explanation of the computer development of Phase I methodology. As noted above, the primary data source for these steps is the quinquennial Census of Governments (Source 03110) for 1977. The analysis for this task was undertaken initially using the published results of this survey appearing in the Compendium of Government Finances. It was subsequently determined that considerably more detail was available on a special computer tape: 1977 Census of Governments State by Type of Government Summary File. The use of this tape filled in a number of gaps and made several scaling and other estimating techniques unnecessary. The tape is the same data source used by the NIPA Division in developing national totals. All references to Census data in the following discussion pertain to the detailed data on this tape.

Census Expenditure Data

The detailed Census tape provided well developed data for the Phase I analysis. An expenditure total is given for each state and each function that is net of insurance trust expenditures and interest on general debt. This expenditure total is given in disaggregate detail as follows:

- capital account
  - — construction = K1 (I,J)
  - — equipment, land and existing structures = K2 (I,J)
- current account
  - — wages and salaries = C1 (I,J)
  - — other expenditures = C2 (I,J)

The I index represents the state codes from 1 to 51 (including D.C.) and the J index represents the 32 individual state and local government functions as listed in Exhibit 7-2. The four disaggregate categories were read from the Census tape into four data

files: K1, K2, C1, and C2 as indicated above. The computer program then proceeded through a sequence of two subprograms that made necessary adjustments to the capital account (K1 and K2) and the current account (C1 and C2), respectively, as described below.

Capital Account Net Purchases

Initially, no further analysis needed to be applied to the new construction element of the capital account data, K1, as it represents the proper concept of net purchases of new structures. Later, it was adjusted to account for force-account compensation and for important nuances of the NIPA definition of new construction. In contrast the equipment, land and existing structures component of capital expenditures, K-2, was broken into its three parts. The Census data provide a split of equipment from land and existing structures but it was not used because the "equipment only" question is not included in the survey of many smaller units of government. The BEA NIPA Division has produced estimates of equipment purchases (Source 03513) by an adjustment of the 1977 Census data according to patterns of the 1972 Census data. It happens that the 1972 five-year Census of Governments did have complete coverage on the "equipment only" question. These national level estimates of equipment purchases by function were obtained from the BEA NIPA Division and distributed to states according to their Census proportions of the aggregate category (equipment, land and existing structures). Deducting the scaled equipment purchases from the original aggregate left a residual that represented purchases of land and existing structures.

In order to arrive at an estimate of net purchases of equipment, it was necessary to deduct sales of new equipment sold by state and local governments from the above derived estimate of total equipment purchases. Sales of used equipment were classified with scrap sales, and were therefore not deducted from equipment purchases. The new equipment sales are included without separate identification in non-tax revenue or service charge data recorded by the Census for each function. BEA has a 1977 national level split of these revenues for each function (Source 03513) that allocates them between durables, non-durables, and services. The BEA split was applied to the Census data to produce estimates of the equipment sales to be deducted from gross purchases. The only functions selling new equipment are school bookstores and correctional institutions. These sales were netted against equipment purchases to yield net purchases. This variable is labeled EQ (I,J) in the computer program.

The data on land and existing structures was also adjusted to represent net purchases. The Census data give state totals for sales of real property and improvements. The only functional detail that is broken out is for Housing and Urban Development. The state total net of the housing function was distributed among the remaining functions by the proportions of previously derived data on purchases of land and structures. These sales were then netted against purchases for each function to yield net purchases of land and existing structures. As purchases of land are not part of GNP, they had to deleted. The BEA NIPA Division has developed a set of assumptions to split net purchases of land and existing structures for each function. These assumptions were used here to produce a final residual: net purchases of existing structures. This quantity (denoted K5(I,J)) was later allocated to the scrap industry via a scaling procedure in the Phase II analysis.

Current Account Net Purchases

For current account purchases, the Census provides the split between wages and salaries, C1, and "other expenditures," C2, by function. To develop final demand estimates it was necessary to separate the current account expenditures into compensation of employees and purchases of goods and services. Compensation consists of the sum of wages and salaries, C1, and wage supplements. In the Census data wage supplements are included in other current expenditures, C2. The Census tape breaks out the state totals of these wage supplements and these had to be deleted from the total of "other expenditures." Lacking functional detail for the wage supplements, scaling procedures were used to distribute the state totals. Retirement contributions were allocated to functions in proportion to wages and salaries. Unemployment insurance, workmen's compensation, and miscellaneous insurance contributions were allocated to functions in proportion to the number of employees (also taken from Census data). It was then possible to delete these wage supplements from the other current expenditures, C2, by function, and to calculate the total compensation for each function. Total compensation is represented in the computer program by C4 (I,J).

Current accounts of 12 of the 32 functions are not included in final demand, because they are defined as government enterprises and treated separately. They were, however, carried as far as the wage supplements step in the procedure because the state totals for wage supplements given in the Census include those paid by government enterprises and these were included in the above described scaling procedure. After wage supplements had been deleted from the "other current expenditures" category, the

remaining "other current expenditures" were designated as C3 (I,J) in the computer program. After this step in the program the C3 entries for the 12 government enterprise functions were set equal to zero.

The remaining purchases in C3 were next converted to net purchases. This was accomplished by subtracting any revenues received by state and local governments for sales indirectly associated with these functions. This step was not performed for the 12 functions that are government enterprises and had already been set to zero in C3 (I, J). Of the remaining 20 functions, data on revenues from current charges are available from the Census for only the following:

- Higher Education
- Elementary and Secondary Education
- Other Education
- Hospitals
- Highways
- Parks and Recreation
- Natural Resources

In the NIPA accounts revenues from current charges are not netted out of expenditures when the charges are a payment for the primary service provided by the SLG function; for example, hospital charges are payments for the primary service. These are treated by the NIPA as a "nontax," which is essentially like the treatment of a "tax." Therefore, the only functions from the above list that involve netting out of current charges are higher education and elementary and secondary education. Only the charges from the auxiliary enterprises carried out in these functions are deleted. These include: dormitory and dining hall fees, bookstore sales, sport events, and school lunches. Tuition payments are a payment for the primary service and are not deleted.

Application of NIPA Control Totals

At this point in the Phase I procedure, the Census state-by-function data on expenditures had been fully converted to net purchases in five character and object categories, summarized as follows:

K1 (I, J) = net purchases of new structures
EQ (I, J) = net purchases of equipment
K5 (I, J) = net purchases of existing structures
C3 (I, J) = net other purchases of goods and services
C4 (I, J) = compensation of government employees

Prior to 1977, the NIPA accounts contained a table for Government Gross Fixed Capital Formation which contained a national control total for SLG purchases of used structures. An examination of the 1972 through 1976 series revealed that the NIPA estimates in this category were based on a linear extrapolation. Projected to 1977, this linear equation gives a value of SLG net purchases of used structures that is consistent with NIPA table 5.4 and reveals the underlying assumption that Federal purchases of used structures are defined as zero. This information was useful in determining a value foR SLG force-account compensation in Phase II. The Census derived state-by-function data on net purchases of used structures, represented by the variable K5(I,J), was scaled to conform to the national level NIPA control, preserving the Census state and functional patterns.

Table 3.7B of the 1977 NIPA tables gives national control totals for the following categories of SLG purchases:

- Durable goods
- Nondurable goods
- Services
  - Compensation of Employees (incl. force-acct.)
  - Other services
- Structures (new and used)

Table 3.17 of the 1977 NIPA tables provides national control totals for all purchases in the 32 SLG functions. Given these two sources, the procedure for using NIPA control was as follows:

(1) The NIPA control total for structures in table 3.7B was reduced by the amount of the already controlled K5 variable representing purchases of used structures. This left net purchases of new structures as the residual.

(2) This residual from above was used as the control total for the K1 variable, new construction. The Census state and functional patterns in K1 were used to distribute the NIPA derived control total.

(3) The equipment variable was known to be already consistent with the NIPA control total for durable goods because the equipment data was obtained from the same office within the NIPA division that produces the durable goods total. Durable goods not defined as equipment were not included in the variable EQ(I,J) but the national total for equipment in EQ(I,J) was the NIPA total.

(4) The compensation variable, C4(I,J) was controlled to the NIPA total from table 3.7B. The Census state and functional patterns in C4(I,J) were used to distribute the national NIPA total.

(5) The national control total for each function from NIPA table 3.17 were used to estimate another NIPA control via the following step:

$$\text{NIPA (J)} - \sum_{I} \text{K5(I,J)} - \sum_{I} \text{K1(I,J)} - \sum_{I} \text{EQ(I,J)} - \sum_{I} \text{C4(I,J)} = \text{RESIDUAL (J)}$$

total functional purchases	-	purchases of used structures	-	new construction	-	equipment	-	compensation	=	Residual: "other purchases"

(6) The residual, above, should be equivalent to the functional NIPA control total for the variable C3(I,J), "other purchases," where "other purchases" is defined to include: non-equipment durables, nondurables, and services. This residual was thus used to control the C3(I,J) variable by function. It was distributed across states using the Census state proportions in C3(I,J).

(7) Due to the nature of the Phase II distribution over I-O sectors, it was next necessary to add K5(I,J) to C3(I,J) to yield NC3(I,J). The K5(I,J) purchases of used structures were to be allocated to the scrap industry in Phase II through a scaling of the more broadly defined NC3(I,J) "other purchases" variable.

One small hitch in this procedure had to be corrected before it performed as expected: in step 2, above, the Census derived K1(I,J) variable for new construction is controlled to the NIPA functional control totals. It was found that this produced some negative residuals in the subtraction performed in step 5. The reason for this was a difference in the definition of new construction between the Census and the NIPA. Census reports "expenditures" for new construction whereas NIPA measures new construction in terms

of the "value-put-in-place." There are several important differences in the functional patterns exhibited by these two concepts. Therefore, step 2 was repeated using the 1977 Value of New Construction Put in Place, Series C-30 (Source 03122) to distribute the NIPA totals across functions and the Census of Governments data in K1(I,J) only for the state distribution. This produced a new variable labelled NGK(I,J).

The final result of the above NIPA control procedures was for estimates labelled as follows:

NK6 (I, J) = net purchases of new structures
NEQ (I, J) = net purchases of equipment
NC3 (I, J) = net "other purchases" of goods and services
NC4 (I, J) = compensation of government employees

These files exhibit the following NIPA control properties:

Table 3.17 Controls

$$\text{NIPA (J)} = \sum^{I} \text{NK6(I,J)} + \sum^{I} \text{NEQ(I,J)} + \sum^{I} \text{NC3(I,J)} + \sum^{I} \text{NC4(I,J)}$$

functional controls

Table 3.7B Controls

$$\text{Structures} = \sum^{I}\sum^{J} \text{NK6(I,J)} + \sum^{I}\sum^{J} \text{K5(I,J)}$$

$$\text{Compensation} = \sum^{I}\sum^{J} \text{NC4(I,J)}$$

$$\text{Durables + Nondurables + Other Services} = \sum^{I}\sum^{J} \text{NEQ(I,J)} + \sum^{I}\sum^{J} \text{NC3(I,J)} - \sum^{I}\sum^{J} \text{K5(I,J)}$$

PHASE II: DISTRIBUTION OF NET PURCHASES CONTROL TOTALS OVER MRIO SECTORS

As noted in the introduction, there is no newly available information on which to base the distribution of SLG net purchases over the I-O sectors. The best that can be done is to update (for price changes) the pattern reflected in the I-O distribution of net purchases in the BEA 1972 I-O table. Fortunately, the BEA Input-Output Division has disaggregated SLG final demand vectors for 20 functional categories (Source 03515). These 20 vectors combine several of the 32 functions carried in the analysis up to this point, resulting in some loss of detail. However, the categories that are combined are not very significant ones in terms of total SLG net purchases. The resulting 20 functions are listed in Exhibit 7-1.

Unfortunately, the BEA final demand vectors represent a national average of the pattern of SLG purchases. The same vectors were used for all states due to the lack of any state-level studies of differences in bill-of-goods patterns. This introduced some unavoidable error in that highway department purchases of road salt, for example, will appear too high for Georgia but too low for Vermont.

The 1972 final demand vectors are given by BEA in 496 sector detail. Price indexes developed at the 496 sector level developed previously by JFA (see State Estimates of Inputs to Industries, 1977, Source 23017) were used to adjust the final demand vectors for changes in relative prices. The assumption implicit in using the adjusted 1972 I-O patterns is that the pattern of purchases has not significantly changed between 1972 and 1977. There are many standard SLG functions (say, sanitation) where this may be very accurate. It is relatively easy, however, to think of occurrences (the advent of computers) that would tend to produce different patterns. Nonetheless, there are no new budget studies from which to develop alternative patterns, and available resources do not permit de novo research of this scope. Changes in these patterns between 1972 and 1977 are not of a completely radical nature for any given function and results produced by the adjusted 1972 patterns should represent reasonable approximations.

Application of 1972 I-O Distribution Patterns

In undertaking the distribution of the 1977 net purchases over the 496 BEA sectors, it was initially intended simply to convert the inflation-adjusted 1972 final demand vectors into vectors of coefficients that could be used to distribute the purchases in

very straightforward fashion. This simplistic approach was confounded by negative entries in the 1972 final demand vectors. The negative entries represented sales of various auxiliary enterprises conducted by a few government functions. These include the activities such as dormitory and school lunch fees that were subtracted from gross purchases in Phase I as well as some other categories such as sales of various manufactured products by penal institutions.

Substituting the 1977 data (discussed in connection with Phase I) for auxiliary enterprises of higher education and elementary and secondary education in place of updated 1972 data for the I-O industries involved eliminated the major negatives. In all other cases, the negatives were comparatively very small and it was simply assumed that the ratio of the negatives to the column total was constant between 1972 and 1977. Special scaling procedures were used for both of the above situations to assure that the column total equalled the NIPA control total for net purchases despite the presence of the negative values.

The 1972 final demand vectors did not differentiate between capital and current accounts. For functions defined as government enterprises, this is not a problem. In these instances, the current account purchases appear in the SLG government enterprises sector (119). Thus the SLG final demand vectors for these functions contain only the capital account purchases. The capital account net purchases for these functions were treated by the same method as described below for ordinary government functions.

For the remaining government functions, the Phase I net purchases subtotals were used as control totals for portions of BEA vectors of the 1972 interindustry study as follows:

- Capital Account

  NK6 (I, J) — net purchases of new structures (including new construction force-account compensation) controlled the construction sector: 110000 to 119999

  NEQ (I, J) — net purchases of equipment controlled the manufacturing sectors:

  130000 to 139999
  220000 to 239999
  390000 to 649999

- Current Account

  NC4 (I, J) — compensation of government employees (excluding new and maintenance force-account compensation) controlled the government industry sector: 820000.

  NC3 (I, J) — other net purchases of goods and services (including purchases of existing structures and maintenance force-account compensation) controlled all sectors not used by the above three categories of purchases.

There were two complications in the above distributions that were handled by special procedures. First, though it is clear that equipment purchases should be allocated to the manufacturing sectors, the manufacturing sectors also produce less durable items that are purchased by state and local governments on current account (NC3). Fortunately, 1972 data on equipment purchases by function were available from BEA (Source 03513). These data were distributed over the manufacturing sectors using the proportions of the original, undeflated 1972 final demand vectors disaggregated by function (Source 03515). The distributed equipment purchases were then subtracted from the 1972 final demand shown in each manufacturing sector, leaving a residual representing other current account purchases from these sectors in 1972. This vector of residuals was adjusted to 1977 prices and used in the distribution of 1977 current account purchases (NC3).

Another complication stemmed from the need to conform with redefinitions pertaining to force-account construction. In the BEA 1972 final demand vectors, the government industry sector (820000) is reduced below NIPA total compensation by the amount of new and maintenance force account compensation. The force account compensation is added to the new construction sectors 110000 to 119999, and maintenance construction sectors 120000 to 129999. BEA working papers for the 1972 study (Source 03516) were obtained that provided the assumptions used for new and maintenance force account compensation by SLG function. The 1972 ratios of force account compensation to NIPA compensation (by SLG function) were adjusted for demographic changes affecting highway and school new construction vs. maintenance trends and then used to adjust the 1977 data. The quantity that was to be allocated to government industry (NC4, the variable for NIPA compensation) was reduced by the 1972 proportions of new and maintenance force account compensation in each function. The amount removed for

new construction was allocated to the new construction industry sectors of final demand. The amount removed for maintenance construction was added to the NC3(I,J) variable to be distributed via the BEA final demand scaling proportions to the maintenance construction sector.

After the distribution step, the resulting vectors were sorted to give separate current and capital account vectors for each function, except for government enterprises, where there is only a capital account. All vectors were then aggregated from BEA 496 sector detail to 125 MRIO sectors. Various summary presentations were then calculated as listed below:

I = State J = Function M = MRIO

Capital Account	Current Account
KFD (I,J,M)*	CFD (I,J,M)*
KFD (I,M)	CFD (I,M)
KFD (M)	CFD (M)

The MRIO and state-by-MRIO results developed according to these procedures are contained on the data tape submitted to HHS with this report. The state-by-function-by-MRIO results (marked by the asterisk above) are not included on the tape due to their size (50 x 20 x 125). These results have been saved on disc, however, and are also available in hard copy.

APPENDIX A

Concordance of MRIO, BEA I-O and SIC Codes

April, 1982

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Agriculture, forestry and fisheries			
001	Dairy farm products	10100	Dairy farm products	0241, pt. 0191, pt. 0259, pt. 0291
002	Livestock and poultry	10200	Poultry and eggs	025 (excl. pt. 0259), pt. 0191, pt. 0219, pt. 0291
		10301	Meat animals	021 (excl. pt. 0219), pt. 0191, pt. 0259, pt. 0291
		10302	Miscellaneous livestock	027 pt. 0191, pt. 0219, pt. 0259, pt. 0291
003	Cotton, grain and tobacco	20100	Cotton	0131, pt. 0191, pt. 0219, pt. 0259, pt. 0291
		20201	Food grains	pt. 011, pt. 0191, pt. 0219, pt. 0259, pt. 0291
		20202	Feed grains	pt. 011, pt. 0139, pt. 0191, pt. 0219, pt. 0259, pt. 0291
		20203	Grass seeds	pt. 0139, pt. 0191, pt. 0219, pt. 0259, pt. 0291
		20300	Tobacco	0132, pt. 0191, pt. 0219, pt. 0259, pt. 0291
004	Fruits, nuts, vegetables, and misc. crops and services	20401	Fruits	pt. 017, pt. 0191, pt. 0219, pt. 0259, pt. 0291
		20402	Tree nuts	0173, pt. 0179, pt. 0191, pt. 0219, pt. 0259, pt. 0291

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Agriculture, cont'd			
004	Fruits, nuts, vegetables, and misc. crops and services	20501	Vegetables	0134, 0161, pt. 0119, pt. 0139, pt. 0191, pt. 0219, pt. 0259, pt. 0291
		20502	Sugar crops	0133, pt. 0191, pt. 0219, pt. 0259, pt. 0291
		20503	Miscellaneous crops	pt. 0119, pt. 0139, pt. 0191, pt. 0219, pt. 0259, pt. 0291
		20600	Oil bearing crops	0116, pt. 0119, pt. 013, pt. 0173, pt. 0219, pt. 0259, pt. 0291
		20701	Forest products	pt. 018, pt. 0191, pt. 0219, pt. 0259, pt. 0291
				pt. 018, pt. 0191, pt. 0219, pt. 0259, pt. 0291,07* (excl. 074)
005	Forestry products			08
006	Commercial fishing and trapping			09
	Mining			
007	Iron and ferroalloy ores	50000	Iron and ferroalloy ores mining	101, 106
008	Nonferrous ores	60100	Copper ore mining	102
		60200	Nonferrous metal ores mining, except copper	103-5, pt. 108, 109
009	Coal	70000	Coal mining	1111, pt. 1112, 1211, pt. 1213

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Mining cont'd			
010	Crude petroleum			pt. 131, pt. 132, pt. 138
011	Natural gas and liquids			pt. 131, pt. 132, pt. 138
012	Stone, clay, sand and gravel	90001	Dimension, crushed and broken stone mining and quarrying	141-2
		90002	Sand and gravel mining	144
		90003	Clay, ceramic, and refractory minerals mining	145
		90004	Nonmetallic mineral services and miscellaneous minerals mining and quarrying	pt. 148, 149
013	Chemical and fertilizer minerals	100000	Chemical and fertilizer mineral mining	147
	Construction			
014	Residential building construction	110101	New residential 1-unit structures, nonfarm	pt. 15, pt. 17
		110102	New residential 2-4 unit structures, nonfarm	pt. 15-17
		110103	New residential garden apartments	pt. 15-17
		110104	New residential high-rise apartments	pt. 15-17
		110105	New residential additions and alterations, nonfarm	pt. 15-17

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Construction cont'd			
015	Nonresidential building construction	110106	New hotels and motels	pt. 15-17
		110107	New dormitories and other group housing	pt. 15-17
		110201	New industrial buildings	pt. 15-17
		110202	New office buildings	pt. 15-17
		110203	New warehouses	pt. 15-17
		110204	New garages and service stations	pt. 15-17
		110205	New stores and restaurants	pt. 15-17
		110206	New religious buildings	pt. 15-17
		110207	New educational buildings	pt. 15-17
		110231	New hospitals	pt. 15-17
		110232	New residential institutions and other health facilities	pt. 15-17
		110241	New amusement and recreation buildings	pt. 15-17
		110250	Other nonfarm buildings	pt. 15-17
016	Public utility construction	110301	New telephone and telegraph facilities	pt. 16-17
		110302	New railroads	pt. 16-17
		110303	New electric utility facilities	pt. 16-17
		110304	New gas utility facilities	pt. 16-17
		110305	New petroleum pipelines	pt. 16-17
		110306	New water supply facilities	pt. 16-17
		110307	New sewer system facilities	pt. 16-17
		110308	New local transit facilities	pt. 16-17
		(cont'd)		

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Construction cont'd			
017	Highways and Streets	110400	New highways and streets	pt. 16-17
018	Other Construction	110501	New farm housing units and additions and alterations	pt. 15, pt. 17
		110502	New farm service facilities	pt. 15, pt. 17
		110601	New petroleum and natural gas well drilling	pt. 138
		110602	New petroleum, natural gas, and solid mineral exploration	pt. 108, pt. 1112, pt. 1213, pt. 138, pt. 148
		110603	New access structures, for solid mineral development	pt. 108, pt. 1112, pt. 1213, pt. 148
		110701	New military facilities	pt. 15-17
		110702	New dams and reservoirs	pt. 15-17
		110703	Other new conservation and development facilities	pt. 15-17
		110704	Other new nonbuilding facilities	pt. 15-17
019	Maintenance construction	120100	Maintenance and repair, residential	pt. 15, pt. 17
		120201	Maintenance and repair of other nonfarm buildings	pt. 15-17
		120202	Maintenance and repair of farm residential buildings	pt. 15, pt. 17

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Construction cont'd			
019	Maintenance construction	120203	Maintenance and repair of farm service facilities	pt. 15, pt. 17
		120204	Maintenance and repair of telephone and telegraph facilities	pt. 16-17
		120205	Maintenance and repair of railroads	pt. 16-17
		120206	Maintenance and repair of electric utility facilities	pt. 16-17
		120207	Maintenance and repair of gas utility facilities	pt. 16-17
		120208	Maintenance and repair of petroleum pipelines	pt. 16-17
		120209	Maintenance and repair of water supply facilities	pt. 16-17
		120210	Maintenance and repair of sewer facilities	pt. 16-17
		120211	Maintenance and repair of local transit facilities	pt. 16-17
		120212	Maintenance and repair of military facilities	pt. 15-17
		120213	Maintenance and repair of conservation and development facilities	pt. 15-17
		120214	Maintenance and repair of highways and streets	pt. 16-17

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Construction cont'd			
019	Maintenance construction	120215	Maintenance and repair of petroleum and natural gas wells	pt. 138
		120216	Maintenance and repair of other nonbuilding facilities	pt. 15-17
	Manufacturing			
020	Ordnance	130200	Ammunition, except for small arms, n.e.c.	3483
		130300	Tanks and tank components	3795
		130500	Small arms	3484
		130600	Small arms ammunition	3482
		130700	Other ordnance and accessories	3489
021	Meat products	140101	Meat packing plants	2011
		140102	Sausages and other prepared meats	2013
		140103	Poultry dressing plants	2016
		140104	Poultry and egg processing	2017
022	Dairy products	140200	Creamery butter	2021
		140300	Cheese, natural and processed	2022
		140400	Condensed and evaporated milk	2023
		140500	Ice cream and frozen desserts	2024
		140600	Fluid milk	2026

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing cont'd			
023	Canned and frozen foods	140700	Canned and cured sea foods	2091
		140800	Canned specialties	2032
		140900	Canned fruits and vegetables	2033
		141000	Dehydrated food products	2034
		141100	Pickles, sauces, and salad dressings	2035
		141200	Fresh or frozen packaged fish	2092
		141301	Frozen fruits, fruit juices and vegetables	2037
		141302	Frozen specialties	2038
024	Grain mill products	141401	Flour and other grain mill products	2041
		141402	Cereal breakfast foods	2043
		141403	Blended and prepared flour	2045
		141501	Dog, cat, and other pet food	2047
		141502	Prepared feeds, n.e.c.	2048*
		141600	Rice milling	2044
		141700	Wet corn milling	2046
025	Bakery products	141801	Bread, cake, and related products	2051
		141802	Cookies and crackers	2052
026	Sugar and confectionary products	141900	Sugar	2061-3
		142001	Confectionery products	2065
		142002	Chocolate and cocoa products	2066
		142003	Chewing gum	2067

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing cont'd			
027	Beverages, extracts, and sirups	142101	Malt beverages	2082
		142102	Malt	2083
		142103	Wines, brandy, and brandy spirits	2084
		142104	Distilled liquor, except brandy	2085
		142200	Bottled and canned soft drinks	2086
		142300	Flavoring extracts and sirups, n.e.c.	2087
028	Other food products	142400	Cottonseed oil mills	2074
		142500	Soybean oil mills	2075
		142600	Vegetable oil mills, n.e.c.	2076
		142700	Animal and marine fats and oils	2077
		142800	Roasted coffee	2095
		142900	Shortening and cooking oils	2079
		143000	Manufactured ice	2097
		143100	Macaroni and spaghetti	2098
		143200	Food preparations, n.e.c.	2099
029	Tobacco products	150101	Cigarettes	211
		150102	Cigars	212
		150103	Chewing and smoking tobacco	213
		150200	Tobacco stemming and redrying	214
030	Fabric, yarn and thread mills	160100	Broadwoven fabric mills and fabric finishing plants	221-3, 2261-2
		160200	Narrow fabric mills	224

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC	
	Manufacturing cont'd				
030	Fabric, yarn and thread mills	160300	Yarn mills and finishing of textiles, n.e.c.	2269, 2281-3*	
		160400	Thread mills	2284	
031	Floor coverings and misc. textile products	170100	Floor coverings	227	
		170200	Felt goods, n.e.c.	2291	
		170300	Lace goods	2292	
		170400	Padding and upholstery filling	2293	
		170500	Processed textile waste	2294	
		170600	Coated fabrics, not rubberized	2295	
		170700	Tire cord and fabric	2296	
		170900	Cordage and twine	2298	
		171001	Nonwoven fabrics	2297	
		171002	Textile goods, n.e.c.	2299	
032	Hosiery and knit goods	180101	Women's hosiery, except socks	2251	Revised
		180102	Hosiery, n.e.c.	2252	Revised
		180300	Knit fabric mills	2257-8	Revised
033	Apparel	180400	Apparel made from purchased materials	231-8*, 39996	Revised
		180201	Knit outerwear mills	2253	Revised
		180202	Knit underwear mills	2254	Revised
034	Other fabricated textile products	180203	Knitting mills, n.e.c.	2259	Revised
		190100	Curtains and draperies	2391	Revised
		190200	Housefurnishings, n.e.c.	2392*	Revised
		190301	Textile bags	2393	Revised
		190302	Canvas and related products	2394	Revised

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing cont'd			
034	Other fabricated textile products	190303	Pleating and stitching	2395
		190304	Automotive and apparel trimmings	2396
		190305	Schiffli machine embroideries	2397
		190306	Fabricated textile products, n.e.c.	2399
035	Logging and lumber	200100	Logging camps and logging contractors	2411
		200200	Sawmills and planing mills, general	2421
		200300	Hardwood dimension and flooring mills	2426
		200400	Special product sawmills, n.e.c.	2429
036	Wood products	200501	Millwork	2431
		200502	Wood kitchen cabinets	2434
		200600	Veneer and plywood	2435-6
		200701	Structural wood members, n.e.c.	2439
		200800	Wood preserving	2491
		200901	Wood pallets and skids	2448
		200902	Particleboard	2492*
		200903	Wood products, n.e.c.	2499
		210000	Wood containers	2441, 2449
037	Pre-fabricated buildings and mobile homes	200702	Prefabricated wood buildings	2452
		610602	Mobile homes	2451
038	Household furniture	220101	Wood household furniture	2511
		220102	Household furniture, n.e.c.	2519
		220103	Wood TV and radio cabinets	2517

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing cont'd			
038	Household furniture	220200	Upholstered household furniture	2512
		220300	Metal household furniture	2514
		220400	Mattresses and bedsprings	2515
039	Other furniture and fixtures	230100	Wood office furniture	2521
		230200	Metal office furniture	2522
		230300	Public building furniture	2531*
		230400	Wood partitions and fixtures	2541*
		230500	Metal partitions and fixtures	2542
		230600	Drapery hardware and blinds and shades	2591
		230700	Furniture and fixtures, n.e.c.	2599
040	Paper and allied products	240100	Pulp mills	261*
		240200	Paper mills, except building paper	262
		240300	Paperboard mills	263
		240400	Envelopes	2642
		240500	Sanitary paper products	2647
		240602	Building paper and board mills	266*
		240701	Paper coating and glazing	2641
		240702	Bags, except textile	2643
		240703	Die-cut paper and board	2645
		240704	Pressed and molded pulp goods	2646
		240705	Stationery products	2648
		240706	Converted paper products, n.e.c.	2649*
041	Paperboard containers and boxes	250000	Paperboard containers and boxes	265

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing cont'd			
042	Newspapers, periodicals and other printing and publishing	260100	Newspapers	271
		260200	Periodicals	272
		260301	Book publishing	2731
		260302	Book printing	2732
		260400	Miscellaneous publishing	274*
		260501	Commercial printing	2751-2, 2754
		260502	Lithographic platemaking and services	2795
		260601	Manifold business forms	276
		260602	Blankbooks and looseleaf binders	2782
		260700	Greeting card publishing	277
		260801	Engraving and plate printing	2753
		260802	Bookbinding and related work	2789
		260803	Typesetting	2791
		260804	Photoengraving	2793
		260805	Electrotyping and stereotyping	2794
043	Industrial chemicals	270100	Industrial inorganic and organic chemicals	281* (excl. 28195), 2865, 2869*
044	Agricultural chemicals	270201	Nitrogenous and phosphate fertilizers	2873-4
		270202	Fertilizers, mixing only	2875
		270300	Agricultural chemicals, n.e.c.	2879
045	Other chemical products	270401	Gum and wood chemicals	2861
		270402	Adhesives and sealants	2891
		270403	Explosives	2892

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing cont'd			
045	Other chemical products	270404	Printing ink	2893
		270405	Carbon black	2895
		270406	Chemical preparations, n.e.c.	2899
046	Plastics and synthetics	280100	Plastics materials and resins	2821
		280200	Synthetic rubber	2822*
		280300	Cellulosic man-made fibers	2823*
		280400	Organic fibers, non-cellulosic	2824*
047	Drugs	290100	Drugs	283*
048	Cosmetics and cleaning products	290201	Soap and other detergents	2841
		290202	Polishes and sanitation goods	2842
		290203	Surface active agents	2843
		290300	Toilet preparations	2844
049	Paint and allied products	300000	Paints and allied products	285
050	Petroleum refining and allied products	310101	Petroleum refining	291
		310102	Lubricating oils and greases	2992
		310103	Products of petroleum and coal, n.e.c.	2999
		310200	Paving mixtures and blocks	2951
		310300	Asphalt felts and coatings	2952
051	Rubber and misc. plastics	320100	Tires and inner tubes	301
		320200	Rubber and plastics footwear	302

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC	
	Manufacturing, cont'd				
054	Stone and clay products	360600	Vitreous plumbing fixtures	3261	
		360701	Vitreous china food utensils	3262	
		360702	Fine earthenware food utensils	3263	
		360800	Porcelain electrical supplies	3264	
		360900	Pottery products, n.e.c.	3269	
		360100	Concrete block and brick	3271	
		361100	Concrete products, n.e.c.	3272	
		361200	Ready-mixed concrete	3273	
		361300	Lime	3274	
		361400	Gypsum products	3275	
		361500	Cutstone and stone products	328	
		361600	Abrasive products	3291	
		361700	Asbestos products	3292	
		361800	Gaskets, packing and sealing devices	3293	
		361900	Minerals, ground or treated	3295*	
		362000	Mineral wool	3296	
		362100	Nonclay refractories	3297	
		362200	Nonmetallic mineral products, n.e.c.	3299	
055	Iron and steel mills and forging	370101	Blast furnaces and steel mills	3312	
		370102	Electrometallurgical products	3313*	Revised
		370104	Cold finishing of steel shapes	3316	
		370105	Steel pipe and tubes	3317	

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC	
	Manufacturing, cont'd				
055	Iron and steel mills and forging	370300	Iron and steel forgings	3462*	
		370401	Metal heat treating	3398	
		370402	Primary metal products, n.e.c.	3399	
056	Iron and steel foundries	370200	Iron and steel foundries	332	
057	Primary nonferrous metals and products	380100	Primary copper	3331	
		380200	Primary lead	3332	
		380300	Primary zinc	3333	
		380400	Primary aluminum	3334, 28195	
		380500	Primary nonferrous metals, n.e.c.	3339	
		380600	Secondary nonferrous metals	334	
		380700	Copper rolling and drawing	3351	
		380800	Aluminum rolling and drawing	3353-5	
		380900	Nonferrous rolling and drawing, n.e.c.	3356	
		381000	Nonferrous wire drawing and insulating	3357	
		381100	Aluminum castings	3361	
		381200	Brass, bronze, and copper castings	3362	
		381300	Nonferrous castings, n.e.c.	3369	
		381400	Nonferrous forgings	3463*	
058	Metal containers and misc. metal products	370103	Steel wire and related products	3315	Revised
		390100	Metal cans	3411	
		390200	Metal barrels, drums, and pails	3412	

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing, cont'd			
058	Metal containers and misc. metal products	420100	Cutlery	3421
		420201	Hand and edge tools, n.e.c.	3423
		420202	Hand saws and saw blades	3425
		420300	Hardware, n.e.c.	3429
		420401	Plating and polishing	3471
		420402	Metal coating and allied services	3479
		420500	Miscellaneous fabricated wire products	3495-6
		420700	Steel springs, except wire	3493
		420800	Pipe, valves, and pipe fittings	3494, 3498
		421000	Metal foil and leaf	3497
		421100	Fabricated metal products, n.e.c.	3499
059	Structural metal products	400100	Metal sanitary ware	3431
		400200	Plumbing fixture fittings and trim	3432
		400300	Heating equipment, except electric	3433
		400400	Fabricated structural metal	3441
		400500	Metal doors, sash, and trim	3442
		400600	Fabricated plate work (boiler shops)	3443
		400700	Sheet metal work	3444
		400800	Architectural metal work	3446
		400901	Prefabricated metal buildings	3448
		400902	Miscellaneous metal work	3449

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing, cont'd			
060	Screw machine products and metal stampings	410100	Screw machine products and bolts, nuts, rivets and washers	345
		410201	Automotive stampings	3465
		410202	Crowns and closures	3466
		410203	Metal stampings, n.e.c.	3469*
061	Engines and turbines	430100	Turbines and turbine generator sets	3511
		430200	Internal combustion engines, n.e.c.	3519
062	Farm and lawn equipment	440001	Farm machinery and equipment	3523*
		440002	Lawn and garden equipment	3524
063	Construction and mining equipment	450100	Construction machinery and equipment	3531*
		450200	Mining machinery, except oil field	3532
		450300	Oil field machinery	3533
064	Materials handling equipment	460100	Elevators and moving stairways	3534
		460200	Conveyors and conveying equipment	3535
		460300	Hoists, cranes, and monorails	3536*
		460400	Industrial trucks and tractors	3537*
065	Metalworking equipment	470100	Machine tools, metal cutting types	3541
		470200	Machine tools, metal forming types	3542

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing, cont'd			
065	Metalworking equipment	470300	Special dies and tools and machine tool accessories	3544-5*
		470401	Power driven hand tools	3546
		470402	Rolling mill machinery	3547
		470403	Metalworking machinery, n.e.c.	3549
066	Special industry machinery and equipment	480100	Food products machinery	3551
		480200	Textile machinery	3552
		480300	Woodworking machinery	3553
		480400	Paper industries machinery	3554
		480500	Printing trades machinery	3555
		480600	Special industry machinery, n.e.c.	3559*
067	General industrial and other non-electrical machinery and equipment	490100	Pumps and compressors	3561, 3563
		490200	Ball and roller bearings	3562
		490300	Blowers and fans	3564*
		490400	Industrial patterns	3565
		490500	Power transmission equipment	3566*, 3568*
		490600	Industrial furnaces and ovens	3567
		490700	General industrial machinery, n.e.c.	3569
		500001	Carburetors, pistons, rings, valves	3592
		500002	Machinery, except electrical, n.e.c.	3599
068	Office and computing equipment	510101	Electronic computing equipment	3573
		510102	Calculating and accounting machines	3574

machines ---------- 3574

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing, cont'd			
068	Office and computing equipment	510200	Typewriters ----------	3572
		510300	Scales and balances ---	3576
		510400	Office machines, n.e.c.	3579
069	Service industry machinery and equipment	520100	Automatic merchandising machines ----------	3581
		520200	Commercial laundry equipment ----------	3582
		520300	Refrigeration and heating equipment -------	3585
		520400	Measuring and dispensing pumps -------	3586
		520500	Service industry machines, n.e.c. ----	3589*
070	Electric transmission and electrical industrial equipment	530100	Instruments to measure electricity -	3825
		530200	Transformers ----------	3612
		530300	Switchgear and switchboard apparatus -----	3613
		530400	Motors and generators -	3621
		530500	Industrial controls ---	3622
		530600	Welding apparatus, electric ----------	3623
		530700	Carbon and graphite products ----------	3624
		530800	Electrical industrial apparatus, n.e.c. ---	3629
071	Household appliances	540100	Household cooking equipment ----------	3631*
		540200	Household refrigerators and freezers ---	3632
		540300	Household laundry equipment ----------	3633

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing, Cont'd			
071	Household appliances	540400	Electric housewares and fans	3634*
		540500	Household vacuum cleaners	3635
		540600	Sewing machines	3636
		540700	Household appliances, n.e.c.	3639
072	Electric lighting and wiring equipment	550100	Electric lamps	3641
		550200	Lighting fixtures and equipment	3645-8
		550300	Wiring devices	3643-4
073	Receiving sets, records and tapes	560100	Radio and TV receiving sets	3651
		560200	Phonograph records and tapes	3652
074	Communications equipment	560300	Telephone and telegraph apparatus	3661
		560400	Radio and TV communication equipment	3662
075	Electronic components	570100	Electron tubes	3671-3
		570200	Semiconductors and related devices	3674
		570300	Electronic components, n.e.c.	3675-9
076	Other electrical equipment	580100	Storage batteries	3691
		580200	Primary batteries, dry and wet	3692
		580300	X-ray apparatus and tubes	3693
		500400	Engine electrical equipment	3694
		580500	Electrical equipment and supplies, n.e.c.	3699*

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing, Cont'd			
077	Motor vehicles and parts	590100	Truck and bus bodies	3713*
		590200	Truck trailers	3715
		590301	Motor vehicles and car bodies	3711
		590302	Motor vehicle parts and accessories	3714
078	Aircraft and parts			3721, 3728
079	Missiles, spacecraft and parts			3761, 3769
080	Aircraft, missile and spacecraft propulsion units			3724, 3764
081	Other transportation equipment	610100	Ship building and repairing	3731
		610200	Boat building and repairing	3732
		610300	Railroad equipment	374
		610500	Motorcycles, bicycles, and parts	375
		610601	Travel trailers and campers	3792*
		610603	Motor homes (made from purchased materials)	3716
		610700	Transportation equipment, n.e.c.	3799
082	Scientific and photographic equipment, watches and clocks	620100	Engineering and scientific instruments	3811
		620200	Mechanical measuring devices	3823-4, 3829

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing, Cont'd			
082	Scientific and photographic equipment, watches and clocks	620300	Environmental controls	3822
		620700	Watches, clocks, and parts	387
		630300	Photographic equipment and supplies	386
083	Medical, Dental and Optical equipment	620400	Surgical and medical instruments	3841
		620500	Surgical appliances and supplies	3842
		620600	Dental equipment and supplies	3843
		630100	Optical instruments and lenses	383
		630200	Ophthalmic goods	385
084	Other manufactured products	640101	Jewelry, precious metal	3911
		640102	Jewelers' materials and lapidary work	3915
		640104	Silverware and plated ware	3914
		640105	Costume jewelry	3961
		640200	Musical instruments	393
		640301	Games, toys, and children's vehicles	3944
		640302	Dolls	3942
		640400	Sporting and athletic goods, n.e.c.	3949
		640501	Pens and mechanical pencils	3951
		640502	Lead pencils and art goods	3952
		640503	Marking devices	3953
		640504	Carbon paper and inked ribbons	3955

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Manufacturing, Cont'd			
084	Other manufactured products	640600	Artificial trees and flowers	3962
		640701	Buttons	3963
		640702	Needles, pins, and fasteners	3964
		640800	Brooms and brushes	3991
		640900	Hard surface floor coverings	3996
		641000	Burial caskets and vaults	3995
		641100	Signs and advertising displays	3993
		641200	Manufacturing industries, n.e.c.	3999 (excl. 39996)
	Transportation			
085	Railroads	650100	Railroads and related services	40*, 474, pt. 4789
086	Local passenger transportation and inter-city bus	650200	Local and suburban transit and interurban highways passenger transportation	41
		790100	Local government passenger transit	pt. 41
087	Motor freight	650300	Motor freight transportation and warehousing	42*, pt. 4789
088	Water transportation	650400	Water transportation	44
089	Air transportation	650500	Air transportation	45
090	Pipelines, except natural gas	650600	Pipe lines, except natural gas	46
091	Transportation services	650701	Freight forwarders and other transportation services	471, 4723, pt. 478
		650702	Arrangement of passenger transportation	4722

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Communications			
092	Communications, except radio and TV	660000	Communications, except radio and TV	48 (excl. 483)
093	Radio and TV broadcasting	670000	Radio and TV broadcasting	483
	Electric, gas, and sanitary services			
094	Electric utilities (private and public)	680100	Electric services (utilities)	pt. 491, pt. 493
		780200	Federal electric utilities	pt. 491
		790200	State and local electric utilities	pt. 491
095	Gas transmission and distribution (private and public)	680200	Gas production and distribution (utilities)	492*, pt. 493
		(Includes pt. 790300 Other state and local government enterprises)		
096	Water and sanitary services (private and public)	680301	Water supply and sewerage systems	494, 4952
		680302	Sanitary services, steam supply, and irrigation systems	495 (excl. 4952), 496-7, pt. 493
		(Includes pt. 790300 Other state and local government enterprises)		
	Trade and services			
097	Wholesale trade	690100	Wholesale trade	50*, 51* (excl. manufactures' sales offices)

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	I-O Code	Sector Name	1977 SIC
	Trade and services, cont'd			
098	Eating and drinking places	740000	Eating and drinking places	58, pt. 70
099	General merchandise and apparel stores			53, 56
100	Food, drug and liquor stores (includes state and local government liquor stores)	690200	Retail trade (MRIO code 100 also includes liquor stores, pt. BEA code 790300, Other state and local government enterprises)	54, 591, 592
101	Automotive dealers and gasoline service stations			55
102	Other retail stores			52, 57, 593-599, 7396
103	Banking, credit agencies and investment brokers	700100	Banking	60
		700200	Credit agencies	61* (excl. pt. 613), 67*
		700300	Security and commodity brokers	62

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Trade and services, cont'd			
104	Insurance	700400	Insurance carriers	63*
		700500	Insurance agents, brokers, and services	64*
105	Real estate and rental	710100	Owner-occupied dwellings	not applicable
		710200	Real estate	65-6*, pt. 1531
106	Hotels and lodging place	720100	Hotels and lodging places	70* (excl. dining)
107	Personal and repair services, except auto	720201	Laundry, cleaning, garment services and shoe repair	721, 725
		720202	Funeral service and crematories	726
		720203	Portrait, photographic studios, and miscellaneous personal services	722, 72*-*
		720204	Electrical repair shops	762
		720205	Watch, clock, jewelry and furniture repair	763-4
		720300	Beauty and barber shops	723-4*
108	Misc. services and advertising	730101	Miscellaneous repair shops	769
		730102	Services to dwellings and other buildings	734

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Trade and services, cont'd			
108	Misc. services and advertising	730103	Personnel supply services	736
		730104	Computer and data processing services	737
		730105	Management and consulting services, testing and research labs	7391-2, 7397
		730106	Protective services	7393
		730107	Equipment rental and leasing	7394
		730108	Photofinishing labs, photocopy, and commercial photography	7332-3, 7395
		730109	Other business services	732, 7331, 7339, 735, 7399*
		730200	Advertising	731
109	Misc. professional services	730301	Legal services	811
		730302	Engineering, architectural, and surveying services	8911
		730303	Accounting, auditing and bookkeeping, and miscellaneous services, n.e.c.	893*, 899
110	Auto rental, repair and maintenance	750001	Automotive rental and leasing, without drivers	751
		750002	Automotive repair shops and services	753, 7549
		750003	Automobile parking and car washes	752, 7542

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Trade and Services cont'd			
111	Amusements	760100	Motion pictures	78
		760201	Theatrical producers (except motion pictures), bands, and entertainers	792
		760202	Bowling alleys, billiard and pool establishments	793
		760203	Commercial sports except racing	7941
		760204	Racing (including track operation)	7948*
		760205	Membership sports and recreation clubs	7997
		760206	Other amusement and recreation services	791, 799* (excl. 7997)
112	Doctors and dentists, inc. outpatient care facilities			801-3,808, 8041
113	Hospitals and nursing	770200	Hospitals	806
		770301	Nursing and personal care facilities	805
114	Other medical and health services			074, 804 except 8041, 807, 809
115	Educational services	770401	Elementary and secondary schools	821
		770402	Colleges, universities, and professional schools	822
		770403	Libraries, correspondence and vocational schools, and educational services, n.e.c.	823-9

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name	1977 SIC
	Trade and Services cont'd			
116	Nonprofit organizations	770501	Business associations and professional membership organizations	861-2
		770502	Labor organizations and civic, social, and fraternal associations	863-4
		770503	Religious organizations	866
		770504	Other membership organizations	84, 865, 869, 8922
117	Other social services	770600	Job training and related services	8331
		770700	Child day care services	8351
		770800	Residential care	8361
		770900	Social services, n.e.c.	8321*, 8399
	Government enterprises			
118	Federal government enterprises, except utilities and local transit	780100	U.S. Postal Service	4311
		780300	Commodity Credit Corporation	pt. 613
		780400	Other Federal Government enterprises	several
119	State and local government enterprises, except utilities and local transit	790300	Other State and local government enterprises	several
	Special industries			
120	Directly allocated imports	800000	Noncomparable imports	
121	Scrap	810001	Scrap	

(cont'd)

Concordance of MRIO, BEA I-O and SIC Codes

MRIO Code	Sector Name	1977 BEA I-O Code	Sector Name
	Special industries cont'd		
122	Government industry	820000	Government industry ---
123	Household industry	840000	Household industry ----
Added 124	Rest of World		
	Final Demand		
150	Personal consumption expenditures		
151	Gross private fixed capital formation		
152	Net inventory change		
153	Gross exports		
154	Federal gov't capital expenditures, (except defense)		
155	State and local gov't capital expenditures		
156	Federal defense expenditures (current and capital)		
157	Federal gov't current expenditures (except defense)		
158	State and local gov't current expenditures		
159	Foreign imports		

*Indicates those industries in which there was a change in composition between the 1972 and 1977 SIC's.

APPENDIX B

MRIO CODES CORRESPONDING TO FSC CODES

APPENDIX B

Presented below are tables showing for each code of the original contract award values used in Chapter 6 the MRIO code or codes to which the values were assigned. There were two files of contract award data: one for 1977 (Source 04204) and one for FY79 (Source 17303). Both files used Federal Supply Catalog (FSC) codes for commodity values, but they had different codes for services, including research and development. Three exhibits, presented below, cover separately the FSC codes and each of the two sets of service codes.

As indicated in Chapter 6, some of the service codes of the sources correspond to commodity codes of the Standard Industrial Classification (SIC) system. Moreover, it was believed that many of the values in such cases, particularly values given research and development codes in the original sources, were included in service groupings of the Department of Commerce estimates of Federal purchases of goods and services. Therefore, some of the original service codes to which commodity MRIO codes were assigned had those commodity codes augmented by 0.1 or 0.2, corresponding to commodity MRIO codes believed to be research and development (0.1) or other service (0.2) in national income and product coding.

In the cases of FY79 service codes, the assignment was in a few cases in two MRIO codes. The exhibit for FY79 coding gives the percentage distribution for coding those cases.

The three exhibits follow.

EXHIBIT B-1

MRIO CODES CORRESPONDING TO FSC CODES

FSC CODE	MRIO CODE
1005	20
1010	20
1015	20
1020	20
1025	20
1030	20
1035	20
1040	20
1045	20
1055	20
1070	64
1075	82
1080	34
1090	20
1095	20
1105	20
1110	20
1115	20
1120	20
1125	20
1127	20
1130	20
1135	20
1140	20
1145	20
1190	82
1195	20
1210	74
1220	74
1230	74
1240	74
1250	74
1260	74
1265	74
1270	74
1280	74
1285	74
1287	74
1290	74
1305	20
1310	20
1315	20
1320	20
1325	20
1330	20
1334	20
1337	80
1338	80
1340	20
1345	20
1350	20
1351	20
1355	20
1356	20
1360	20
1361	20
1365	45
1370	45
1375	45
1376	45
1377	20
1380	45
1385	20
1386	20
1390	20
1395	20
1398	64
1410	79
1420	79
1425	79
1427	79
1428	74
1440	89
1450	64
1510	80
1520	80
1530	78
1540	80
1550	80
1560	80
1610	78
1615	80
1620	80
1630	80
1650	80
1660	80
1670	34
1680	80
1710	64
1720	64
1730	82
1740	77
1810	79
1820	79
1830	74
1840	47
1850	69
1860	79
1900	81
1901	81
1902	81
1903	81
1904	81
1905	81
1906	81
1907	81
1908	81
1909	81
1910	81
1911	81
1915	81
1920	81
1921	81
1922	81
1923	81
1924	81
1925	81
1926	81
1927	81
1928	81
1929	81
1930	81
1935	81
1940	81
1945	81
1950	81
1955	81
1990	81
2010	47
2020	64
2030	64
2040	98
2050	64
2060	31
2090	74
2210	81
2220	81
2230	63
2240	84
2250	55
2305	77
2310	77
2320	77
2330	77
2340	81
2350	20
2410	63
2420	63
2430	63
2510	77
2520	77
2530	77
2540	77
2590	77
2610	81
2620	81
2630	81
2640	41
2805	77
2810	78
2815	41
2820	41
2825	41
2830	41
2835	41
2840	80
2845	80
2850	41
2895	41
2910	77
2915	80
2920	76
2925	76
2930	77
2935	80
2940	77
2945	78
2950	80
2990	77
2995	78
3010	47
3020	47
3030	47
3040	47
3110	47
3120	47
3130	47
3135	45
3210	64
3220	64
3230	64
3405	45
3408	65
3410	63
3411	63
3412	63
3413	63
3414	63
3415	63
3416	63
3417	63
3418	63
3419	63
3422	63
3424	63
3426	63
3431	63
3432	63
3433	63
3434	63
3438	63
3439	63
3441	63
3442	63
3443	63
3444	63
3445	63
3446	63
3447	63
3448	63
3449	63
3450	63
3455	63
3456	63
3460	63
3461	63
3465	63
3470	63
3510	69
3520	69
3530	69
3540	69
3550	69
3590	69
3605	66
3610	66
3611	66
3615	66
3620	66
3625	66
3630	66
3633	66
3640	66
3645	66
3650	66
3655	66
3660	66
3670	66
3680	66
3685	66
3690	66
3693	66
3694	66
3695	66
3710	62
3720	62
3730	62
3740	62
3750	62
3760	62
3770	82
3805	63
3810	63
3815	63
3820	63
3825	63
3830	63
3835	63
3895	63
3910	64
3915	64
3920	64
3930	64
3940	64
3950	64
3960	64
3990	64
4010	55
4020	30
4030	57
4110	69
4120	69
4130	69
4140	69
4210	77
4220	51
4230	67
4240	63
4310	67
4320	67
4330	67
4410	59
4420	59
4430	67
4440	67
4460	67
4470	59
4510	59
4520	69
4530	59
4540	59
4610	67
4620	67
4630	69
4710	58
4720	67
4730	58
4810	67
4820	67
4910	77
4920	78
4921	67
4923	67
4925	20
4927	20
4930	69
4931	82
4933	20
4935	79
4940	67
4960	79
5110	58
5120	58
5130	65
5133	65
5136	65
5140	58
5180	58
5210	65
5220	65
5280	65
5305	60
5306	60
5307	60
5310	60
5315	60
5320	60
5325	60
5330	84
5335	58
5340	58
5345	84
5350	84
5355	51
5360	58
5365	58
5410	59
5411	59
5420	59
5430	59

EXHIBIT B-1 (cont.)

MRIO CODES CORRESPONDING TO FSC CODES

FSC CODE	MRIO CODE
3440	59
3445	59
3450	59
3510	34
3520	34
3530	34
3610	12
3620	34
3630	34
3640	34
3650	30
3660	55
3670	59
3680	59
3805	74
3810	74
3811	74
3815	74
3820	74
3821	74
3825	74
3826	74
3830	74
3831	74
3835	74
3840	74
3841	74
3845	74
3850	74
3855	74
3860	74
3865	74
3870	74
3905	75
3910	75
3915	75
3920	70
3925	70
3930	75
3935	72
3940	72
3945	75
3950	70
3955	75
3960	75
3961	75
3962	75
3963	75
3965	74
3970	72
3975	60
3977	72
3985	74
3990	75
3995	57
3999	72
6010	83
6015	83
6020	83
6030	83
6060	83
6070	83
6080	83
6105	70
6110	70
6115	70
6116	70
6120	70
6125	70
6130	70
6135	74
6140	74
6145	57
6150	70
6210	72
6220	72
6230	72
6240	72
6250	72
6260	72
6310	74
6320	74
6330	74
6340	74
6350	74
6505	47
6506	114
6507	114
6508	48
6510	83
6515	83
6520	83
6525	76
6530	39
6532	33
6540	83
6545	83
6605	82
6610	82
6615	82
6620	82
6625	82
6630	82
6635	82
6636	82
6640	82
6645	82
6650	83
6655	74
6660	82
6665	82
6670	68
6675	82
6680	82
6685	82
6695	82
6710	82
6720	82
6730	82
6740	82
6750	82
6760	82
6770	82
6780	82
6810	43
6820	43
6830	43
6840	44
6850	43
6880	82
6910	82
6920	82
6930	111
6940	111
7010	68
7020	68
7021	68
7022	68
7025	68
7030	106
7035	68
7040	68
7042	68
7045	68
7050	68
7105	38
7110	39
7125	39
7195	39
7210	39
7220	31
7230	30
7240	38
7290	71
7310	44
7320	71
7330	68
7340	84
7350	40
7360	84
7420	68
7430	68
7435	68
7450	68
7460	68
7490	68
7510	42
7520	84
7530	42
7540	42
7610	42
7630	42
7640	42
7650	42
7660	42
7670	42
7690	42
7710	84
7720	84
7730	73
7740	73
7810	84
7820	84
7830	84
7910	69
7920	84
7930	48
8010	49
8020	84
8030	49
8040	48
8105	48
8110	58
8115	41
8120	43
8125	53
8130	58
8135	40
8140	58
8145	58
8305	30
8310	30
8315	84
8320	51
8325	84
8330	52
8335	52
8340	34
8345	34
8405	32
8410	33
8415	33
8420	33
8425	33
8430	51
8435	52
8440	32
8445	33
8450	34
8455	84
8460	52
8465	34
8470	33
8475	33
8510	48
8520	48
8530	58
8540	40
8710	24
8720	44
8730	4
8810	2
8820	2
8900	21
8905	21
8910	22
8915	23
8920	24
8925	26
8930	23
8935	23
8940	28
8945	28
8950	28
8955	28
8960	27
8965	27
8970	23
8975	27
8999	28
9110	9
9130	50
9135	45
9140	50
9150	50
9160	50
9310	40
9320	51
9330	44
9340	53
9350	84
9390	84
9410	3
9420	31
9430	21
9440	3
9450	21
9505	58
9510	35
9515	58
9520	58
9525	57
9530	27
9535	57
9540	57
9545	57
9610	8
9620	12
9630	55
9640	55
9650	57
9660	57
9670	55
9680	21
9905	84
9910	84
9915	84
9920	84
9925	84
9930	57
9998	84
9999	84

EXHIBIT B-2

MRIO CODES CORRESPONDING TO FY77 SERVICE CODES

FSC CODE	MRIO CODE	FSC CODE	MRIO CODE	FSC CODE	MRIO CODE	FSC CODE	MRIO CODE	FSC CODE	MRIO CODE
A8A4	100.1	A8M4	78.1	A2C2	74.1	A2E4	78.1	A3A3	79.1
A8B3	78.1	A8M5	74.1	A2C4	80.1	A2E5	78.1	A3A3	79.1
A8B4	78.1	A8N3	100.1	A2D2	82.1	A2F3	78.1	A3A3	79.1
A8B5	78.1	A8N4	74.1	A2D3	78.1	A2F4	78.1	A3A3	79.1
A8C4	78.1	A8P3	74.1	A2E4	82.1	A3A2	79.1	A4D5	79.1
A8C5	78.1	A8R3	74.1	A2L5	78.1	A3A3	79.1	A4C3	79.1
A8F3	78.1	A8R3	74.1	A2E2	78.1	A3A5	79.1	A4C5	74.1
A8G3	78.1	A8R4	74.1	A2E3	82.1	A3A4	100.1	A4D3	74.1
A8I3	78.1	A8R5	74.1	A2E4	82.1	A3B2	80.1	A4D5	74.1
A8K3	78.1	A8S3	100.1	A2E5	82.1	A3B3	80.1	A4F8	79.1
A8L3	78.1	A8S4	100.1	A2F3	82.1	A3B5	80.1	A4H4	79.1
A8M3	78.1	A8U3	100.1	A2F4	82.1	A3B4	100.1	A4I3	79.1
A8N3	78.1	A8V3	100.1	A2F5	82.1	A3C2	79.1	A4J8	80.1
A8O2	74.1	A3Z3	100.1	A2B2	80.1	A3C3	79.1	A4K5	74.1
A8P3	78.1	A8Z3	100.1	A2B3	82.1	A3D2	79.1	A4L5	74.1
A8B3	74.1	A8S5	100.1	A2B4	78.1	A3B3	79.1	A4M5	79.1
A8C3	74.1	A8B5	100.1	A2B5	78.1	A3B4	79.1	A4R3	79.1
A8D3	74.1	A8Y5	100.1	A2M3	78.1	A3E2	79.1	A4U3	79.1
A8E3	74.1	A8Z5	100.1	A2M4	78.1	A3E3	79.1	A4X3	79.1
A8M3	74.1	A8B5	100.1	A2M5	78.1	A3E5	79.1	A4Z3	74.1
A8A3	74.1	A8P5	78.1	A2I2	78.1	A3F2	79.1	A4A3	74.1
A8A4	74.1	A8D3	74.1	A2I3	78.1	A3F3	79.1	A5B4	74.1
A8A5	74.1	A8M5	74.1	A2I4	82.1	A3F4	79.1	A5C3	89.1
A8B4	74.1	A8I5	74.1	A2J2	78.1	A3G3	79.1	A5D4	74.1
A8B5	74.1	A8B5	74.1	A2J5	100.1	A3B4	79.1	A5D5	74.1
A8C4	74.1	A8S5	79.1	A2J4	78.1	A3M3	79.1	A5E2	74.1
A8D4	81.1	A8X5	74.1	A2J5	78.1	A3M4	79.1	A5E3	74.1
A8D5	81.1	A8Y5	100.1	A2K3	78.1	A3M5	79.1	A5E4	74.1
A8C4	81.1	A8Z5	100.1	A2K5	79.1	A3I3	79.1	A5F3	74.1
A8C5	81.1	A8I5	74.1	A2L3	78.1	A3I4	79.1	A5G4	74.1
A8F4	81.1	A8D5	100.1	A2L4	79.1	A3I5	79.1	A5M4	74.1
A8F5	81.1	A1A1	100.1	A2M4	78.1	A3J4	79.1	A5I2	89.1
A1Z3	81.1	A1A2	100.1	A2M3	78.1	A3K3	79.1	A5J2	81.1
A8M3	81.1	A1A3	100.1	A2M4	78.1	A3L3	79.1	A5J5	74.1
A8M3	81.1	A1A4	100.1	A2O3	78.1	A3L4	79.1	A5K3	74.1
A8N3	81.1	A1B1	100.1	A2P3	80.1	A3L5	79.1	A5L3	74.1
A8O3	81.1	A1B2	100.1	A2Q3	78.1	A3M3	79.1	A5M3	74.1
A8P3	81.1	A1B3	100.1	A2R4	78.1	A3N3	79.1	A5N4	74.1
A8R3	81.1	A1B4	100.1	A2R4	78.1	A3M4	79.1	A5O3	74.1
A8U3	81.1	A1C1	100.1	A2S4	78.1	A3M5	79.1	A5O5	74.1
A8V3	74.1	A1C2	100.1	A2T3	80.1	A3O3	79.1	A5B3	80.1
A8W3	74.1	A1C3	100.1	A2T4	44.1	A3O4	79.1	A5R3	74.1
A8Y3	81.1	A1B1	100.1	A2U3	82.1	A3O5	74.1	A5R4	74.1
A8Z3	81.1	A1B4	100.1	A2V3	74.1	A3P3	82.1	A5T3	80.1
A8I3	81.1	A1E1	100.1	A2V4	78.1	A3P4	79.1	A5U4	74.1
A8Z3	81.1	A1E2	100.1	A2W4	78.1	A3Q3	79.1	A5V3	74.1
A8A2	100.1	A1F1	100.1	A2X3	78.1	A3R3	79.1	A5V3	81.1
A8A3	100.1	A1F2	100.1	A2Y3	78.1	A3R4	79.1	A5W3	74.1
A8A5	74.1	A1G1	100.1	A2Y4	78.1	A3S3	79.1	A5W5	74.1
A3B2	100.1	A1H1	100.1	A2Y5	74.1	A3S4	79.1	A8X3	74.1
A3B4	100.1	A1H2	100.1	A2Z3	74.1	A3S5	79.1	A8X4	74.1
A8C2	100.1	A1I1	100.1	A3Z4	74.1	A3T3	79.1	A8Y3	74.1
A8C3	100.1	A1J1	100.1	A2O3	78.1	A3T5	74.1	A8Z3	74.1
A8D2	100.1	A1K1	100.1	A2I3	78.1	A3U4	79.1	A8Z5	48.1
A8E3	100.1	A1L1	100.1	A2I4	78.1	A3U5	79.1	A8O3	74.1
A8E2	100.1	A1L2	100.1	A2I5	78.1	A3V3	79.1	A8I3	74.1
A8E3	100.1	A1M1	100.1	A2J4	78.1	A3V4	79.1	A8I4	74.1
A8E4	100.1	A1M2	100.1	A2J5	78.1	A3V5	79.1	A8I5	74.1
A8B7	100.1	A1N1	100.1	A2J3	78.1	A3W4	79.1	A8J3	80.1
A8B3	100.1	A1O1	100.1	A2J4	78.1	A3W5	79.1	A8J4	74.1
A8B4	100.1	A1O2	100.1	A2J5	78.1	A3X4	79.1	A8J5	74.1
A8M3	100.1	A1P1	100.1	A2K4	78.1	A3X5	79.1	A8J4	78.1
A8I3	100.1	A1Q2	100.1	A2K5	78.1	A3Y3	79.1	A8J5	74.1
A8I4	78.1	A2A2	100.1	A2L3	78.1	A3Y4	79.1	A8K3	61.1
A8J3	100.1	A2A3	100.1	A2L4	78.1	A3Z4	79.1	A8K4	81.1
A8J4	74.1	A2A4	78.1	A2L5	78.1	A3B4	79.1	A8J4	81.1
A8K3	74.1	A2B2	100.1	A2M4	74.1	A3I3	79.1	A8K3	81.1
A8K4	74.1	A2B3	78.1	A2M5	72.1	A3I4	79.1	A8K4	74.1
A8L3	74.1	A2B4	78.1	A2T4	78.1	A3J3	79.1	A8M3	74.1
A8M3	74.1	A2C2	80.1	A2T5	78.1	A3J5	79.1	A8Y3	78.1

EXHIBIT B-2 (Cont.)

MRIO CODES CORRESPONDING TO FY77 SERVICE CODES

FSC CODE	MRIO CODE	FSC CODE	MRIO CODE	FSC CODE	MRIO CODE	FSC CODE	MRIO CODE	FSC CODE	MRIO CODE
A3P4	81.1	A7A4	78.1	A7T4	78.1	A9A1	78.1	P621	108.0
A5Y5	74.1	A7A5	78.1	A7U2	78.1	A9A2	78.1	P622	88.0
A4A2	20.1	A7B2	74.1	A7U3	78.1	A9B1	78.1	P623	108.0
A4A3	20.1	A7B3	80.1	A7U4	78.1	A9B2	78.1	P629	108.0
A4A4	20.1	A7B4	80.1	A7V2	78.1	A9C1	78.1	S632	112.0
A4B2	20.1	A7C3	80.1	A7V3	78.1	A9C2	78.1	S639	113.0
A4B4	20.1	A7C4	74.1	A7V4	78.1	A9D1	78.1	R441	108.0
A4C2	20.1	A7C6	78.1	A7W2	78.1	A9D2	78.1	R442	108.0
A4C3	20.1	A7B2	74.1	A7W3	78.1	A9E2	78.1	R444	107.0
A4C4	20.1	A7B3	74.1	A7W4	78.1	A9M2	78.1	R445	108.0
A4C5	20.1	A7B4	74.1	A7X2	78.1	A9I2	78.1	R446	108.0
A4D2	20.1	A7B5	74.1	A7Y2	78.1	A9J2	78.1	R447	108.0
A4B4	20.1	A7B6	78.1	A7Y3	78.1	A9K2	78.1	R448	108.0
A4E2	20.1	A7E2	78.1	A7Y4	78.1	A9L2	78.1	R449	108.0
A4E3	78.1	A7E3	78.1	A7Z2	78.1	A9M2	78.1	R450	108.0
A4E4	78.1	A7E4	78.1	A7Z3	78.1	A9N2	78.1	R451	108.0
A4F2	78.1	A7E5	78.1	A712	78.1	A971	78.1	R452	108.0
A4F3	78.1	A7F2	78.1	A713	78.1	A972	78.1	R453	108.0
A4F4	78.1	A7F3	78.1	A714	78.1	A973	78.1	R454	108.0
A4G3	78.1	A7F4	78.1	A715	78.1	A981	78.1	R455	108.0
A4B4	82.1	A782	78.1	A722	78.1	A982	78.1	R457	108.0
A4H3	20.1	A783	78.1	A723	78.1	A983	78.1	R458	108.0
A4H5	20.1	A784	78.1	A724	78.1	A984	78.1	R440	107.0
A4I3	20.1	A786	78.1	A725	78.1	A985	78.1	R441	107.0
A4I5	20.1	A7M2	78.1	A732	78.1	A986	78.1	R499	108.0
A4J2	20.1	A7M3	78.1	A733	78.1	A991	78.1	S701	98.0
A4J3	20.1	A7M5	78.1	A734	78.1	A992	20.1	S702	98.0
A4J4	20.1	A7M6	78.1	A735	78.1	A993	20.1	S703	92.0
A4J5	20.1	A712	78.1	A742	78.1	A994	20.1	S704	94.0
A4K2	20.1	A713	78.1	A743	78.1	A995	20.1	S705	94.0
A4K3	20.1	A714	78.1	A744	78.1	A996	78.1	S706	84.0
A4K4	74.1	A715	78.1	A745	78.1	J501	78.2	S707	116.0
A4L4	20.1	A7J2	78.1	A752	78.1	J502	80.2	S708	107.0
A4M2	78.1	A7J3	78.1	A753	78.1	J503	77.2	S709	108.0
A4M3	78.1	A7J4	78.1	A754	78.1	J504	81.2	S710	108.0
A4M4	78.1	A7J5	78.1	A762	78.1	J505	80.2	S711	108.0
A4N2	20.1	A7K2	78.1	A763	78.1	J506	77.2	S712	96.0
A4N3	20.1	A7K4	78.1	A765	78.1	J507	74.2	S713	98.0
A4N4	20.1	A7K6	78.1	A766	78.1	J508	87.2	S714	108.0
A4O2	20.1	A7L2	78.1	A772	78.1	J509	68.2	S715	108.0
A4O5	20.1	A7L4	78.1	A773	78.1	J510	81.2	S720	108.0
A4P2	20.1	A7L5	78.1	A775	78.1	J511	81.2	S722	108.0
A4P3	20.1	A7M2	78.1	A782	78.1	J512	68.2	S723	107.0
A4P4	20.1	A7M3	78.1	A783	78.1	J519	67.2	S724	108.0
A4P5	20.1	A7M4	78.1	A784	78.1	K331	78.0	S799	107.0
A4Q2	20.1	A7M5	78.1	A792	78.1	K332	80.0	T801	108.0
A4Q3	20.1	A7M6	78.1	A793	78.1	K333	77.0	T802	108.0
A4Q5	20.1	A7N2	78.1	A794	78.1	K334	81.0	T803	108.0
A4R2	20.1	A7N3	78.1	A8A4	78.1	K335	20.0	T804	108.0
A4R3	20.1	A7N4	78.1	A8B4	78.1	K336	77.0	T805	108.0
A4R5	20.1	A7N5	78.1	A8C6	78.1	K337	74.0	T806	108.0
A4S2	20.1	A7O2	78.1	A8D4	78.1	K338	81.0	T807	47.2
A4S3	20.1	A7O5	78.1	A8E6	78.1	K339	67.0	T808	108.0
A4S4	20.1	A7P2	78.1	A8F4	78.1	L541	78.2	T819	108.0
A4T3	20.1	A7P3	78.1	A8G4	78.1	L542	80.2	U821	115.0
A4T4	20.1	A7P4	78.1	A8H4	78.1	L543	77.2	U822	115.0
A4T5	20.1	A7P5	78.1	A8I4	78.1	L544	81.2	U823	115.0
A4U3	20.1	A7R2	78.1	A8J4	78.1	L545	20.2	U824	115.0
A4U4	20.1	A7R3	78.1	A8K4	18.1	L546	77.2	U825	115.0
A4V3	77.1	A7R4	78.1	A8M4	78.2	L547	74.2	U826	104.0
A4V4	77.1	A7R5	78.1	A8N4	78.1	L548	81.2	U827	115.0
A4W3	77.1	A7R3	78.1	A8P4	78.1	L549	67.2	U829	115.0
A4W4	20.1	A7R4	78.1	A8Q4	78.1	M401	108.0	V841	87.0
A4X4	20.1	A7R5	78.1	A8R4	78.1	M402	108.0	V842	89.0
A4Y4	20.1	A782	78.1	A8S4	78.1	M403	108.0	V843	88.0
A4Y5	20.1	A783	78.1	A8T4	78.1	M404	108.0	V844	88.0
A413	20.1	A784	78.1	A8U4	78.1	M405	108.0	V845	88.0
A415	20.1	A785	78.1	A8V4	78.1	M406	108.0	V846	88.0
A7A2	78.1	A7T2	78.1	A8W4	78.1	M409	108.0	V847	88.0
A7A3	78.1	A7T3	78.1	A8X4	78.1	M411	19.0	V848	88.0

EXHIBIT B-2 (Cont.)

MRIO CODES CORRESPONDING TO FY77 SERVICE CODES

FSC CODE	MRIO CODE
V849	86.0
V850	110.0
V859	91.0
X871	108.0
X872	104.0
X873	89.0
X879	108.0
Y701	18.0
Y702	18.0
Y703	18.0
Y704	18.0
Y705	18.0
Y706	18.0
Y707	18.0
Y711	15.0
Y712	15.0
Y721	15.0
Y722	15.0
Y731	15.0
Y732	15.0
Y733	15.0
Y734	15.0
Y735	18.0
Y741	15.0
Y743	15.0
Y744	15.0
Y745	15.0
Y751	15.0
Y752	15.0
Y753	15.0
Y761	14.0
Y762	14.0
Y763	15.0
Y764	15.0
Y765	15.0
Y771	14.0
Y772	14.0
Y773	14.0
Y774	14.0
Y775	17.0
Y776	18.0
Y777	18.0
Y778	18.0
Y779	18.0
Y781	18.0
Y784	18.0
Y787	18.0
Z971	17.0
Z972	17.0
Z973	17.0
Z974	17.0
Z975	17.0
Z979	17.0

EXHIBIT B-3

MRIO CODES CORRESPONDING TO FY79 SERVICE CODES

Service Code	First (or only) MRIO Code	First (or only) MRIO Percent	Second MRIO Code	Second MRIO Percent
AA90	108.1			
AA92	108.1			
AB10	108.1			
AB20	108.1			
AB30	108.1			
AB31	108.1			
AB40	108.1			
AB91	108.1			
AC10	108.1			
AC11	108.1			
AC30	108.1			
AC40	108.1			
AC90	108.1			
AD10	108.1			
AD30	25.1			
AD90	108.1			
AD93	108.1			
AE10	102.1			
AE11	108.1			
AE20	108.1			
AE25	108.1			
AE90	102.1			
AE91	108.1			
AE92	108.1			
AE96	108.1			
AF10	108.1			
AF11	108.1			
AF12	108.1			
AF16	108.1			
AG10	107.1	(36%)	108.1	(64%)
AG11	108.1			
AG12	108.1			
AG13	102.1			
AG14	108.1			
AG15	100.1			
AG20	107.1	(39%)	108.1	(61%)
AG21	108.1			
AG23	108.1			
AG24	107.1			
AG25	108.1			
AG26	108.1			
AG27	108.1			
AG30	109.1			
AG31	108.1			
AG32	111.1			
AG33	108.1			
AG34	108.1			
AG36	108.1			
AG37	108.1			
AG41	108.1			
AG42	108.1			
AG43	108.1			
AG44	107.1			
AG50	109.1			
AG51	108.1			
AG52	108.1			
AG53	108.1			
AG54	108.1			
AG55	108.1			
AG57	108.1			
AG60	108.1			
AG61	108.1			
AG62	108.1			
AG63	108.1			
AG65	108.1			
AG67	108.1			
AG70	108.1			
AG71	108.1			
AG72	108.1			
AG73	108.1			
AG74	108.1			
AG76	108.1			
AG77	108.1			
AG80	108.1			
AG81	108.1			
AG82	108.1			
AG83	100.1			
AG84	108.1			
AG86	108.1			
AG87	108.1			
AG90	108.1			
AG91	100.1			
AG92	108.1			
AG93	108.1			
AG94	15.1	(77%)	108.1	(23%)
AG95	108.1			
AG96	108.1			
AG97	74.1			
AH10	108.1			
AH11	108.1			
AH12	108.1			
AH14	108.1			
AH15	108.1			
AH20	108.1			
AH21	108.1			
AH22	102.1			
AH23	108.1			
AH25	108.1			
AH26	108.1			
AH30	108.1			
AH31	108.1			
AH40	108.1			
AH41	108.1			
AH50	108.1			
AH51	108.1			
AH55	108.1			
AH90	108.1			
AH91	108.1			
AH93	108.1			
AH96	108.1			
AJ10	108.1			
AJ11	108.1			
AJ12	108.1			
AJ13	108.1			
AJ14	108.1			
AJ15	108.1			
AJ16	108.1			
AK10	108.1			
AK11	108.1			
AK12	108.1			
AL10	108.1			
AL20	108.1			
AL90	108.1			
AL91	108.1			
AM10	108.1			
AM16	108.1			
AM11	108.1			
AM20	108.1			
AM40	108.1			
AM30	108.1			
AM60	108.1			
AM70	108.1			
AM71	108.1			
AM90	108.1			
AM91	108.1			
AP10	108.1			
AP11	108.1			
AP12	108.1			
AP20	108.1			
AP21	108.1			
AP24	108.1			
AP30	108.1			
AP31	107.1			
AP32	107.1			
AP33	107.1			
AP34	107.1			
AP35	107.1			
AP40	107.1			
AP41	107.1			
AP50	107.1			
AP51	108.1			
AP52	108.1			
AP70	108.1			
AP71	108.1			
AP72	107.1			
AP74	108.1			
AQ10	108.1			
AQ90	108.1			
AQ91	108.1			
AQ96	108.1			
AR10	78.1	(32%)	108.1	(68%)
AR20	78.1	(23%)	108.1	(77%)
AR30	77.1	(59%)	108.1	(41%)
AR40	78.1	(27%)	108.1	(73%)
AR50	108.1			
AR51	108.1			
AR90	108.1			
AS10	108.1			
AS20	108.1			
AS30	108.1			
AS31	107.1			
AS40	107.1			
AS90	107.1			
AT10	107.1			
AT20	108.1			
AT30	108.1			
AT40	108.1			
AT50	107.1			
AT60	108.1			
AT70	107.1			
AT90	108.1			
AU10	108.1			
AU90	108.1			
AV10	107.1			
AV11	108.1			
AV12	107.1	(70%)	108.1	(30%)
AV13	107.1	(36%)	108.1	(64%)
AV14	108.1			
AV15	108.1			
AV20	108.1			
AV21	107.1			
AV22	107.1			
AV23	108.1			
AV24	107.1			
AV25	108.1			
AV26	108.1			
AV30	109.1			
AV31	107.1	(87%)	108.1	(13%)
AV32	107.1	(80%)	108.1	(20%)
AV33	107.1			
AV35	103.1			
AV36	107.1			
AV40	108.1			
AV41	107.1	(50%)	108.1	(50%)
AV42	107.1	(57%)	108.1	(43%)
AV43	107.1			
AV45	107.1			
AV46	107.1			
AV50	107.1	(86%)	108.1	(14%)

EXHIBIT B-3 (Cont.)

MRIO CODES CORRESPONDING TO FY79 SERVICE CODES

Service Code	First (or only) MRIO Code	First (or only) MRIO Percent	Second MRIO Code	Second MRIO Percent
AV51	109.1			
AV52	108.1	(58%)	109.1	(42%)
AV53	107.1			
AV55	108.1			
AV60	107.1	(60%)	108.1	(40%)
AV61	109.1	(54%)	108.1	(46%)
AV62	109.1	(72%)	108.1	(28%)
AV63	108.1	(90%)	107.1	(10%)
AV64	108.1	(80%)	109.1	(20%)
AV65	108.1			
AV66	108.1	(64%)	109.1	(36%)
AV70	109.1			
AV71	109.1			
AV72	108.1			
AV73	108.1			
AV75	109.1			
AV90	109.1	(90%)	108.1	(10%)
AV91	108.1			
AV92	108.1	(60%)	109.1	(40%)
AV93	108.1			
AV94	108.1	(86%)	109.1	(14%)
AV95	109.1	(71%)	108.1	(29%)
AV96	108.1			
AZ10	110.1			
AZ11	108.1	(90%)	109.1	(10%)
AZ12	108.1	(90%)	109.1	(10%)
AZ13	108.1			
AZ14	108.1	(95%)	109.1	(5%)
AZ15	108.1	(65%)	109.1	(35%)
AZ16	108.1			
F001	4.0			
F002	5.0			
F003	5.0			
F005	5.0			
F006	5.0			
F008	5.0			
F009	5.0			
F010	5.0			
F011	4.0			
F012	109.0			
F014	5.0			
F015	10.2			
F016	108.0	(75%)	6.0	(25%)
F018	6.0			
F019	6.0			
F099	5.0			
S003	11.0			
S004	117.0			
S005	117.0			
S006	8.0			
S007	8.0			
S008	8.0			
S009	8.0			
S099	108.0			
M100	108.0			
M170	108.0			
M199	108.0			
M216	108.0			
M218	108.0			
M219	108.0			
M220	108.0			
M223	108.0			
M244	108.0			
M234	108.0			
M258	108.0			
M259	108.0			
M261	108.0			
M266	108.0			
M270	108.0			
M299	108.0			
M315	108.0			
M319	108.0			
M320	108.0			
M338	108.0			
M361	108.0			
M366	108.0			
M399	108.0			
M999	108.0			
J011	20.2			
J012	20.2			
J015	78.2			
J016	78.2			
J019	81.2			
J020	81.2			
J023	77.2			
J028	61.2			
J029	78.2			
J034	65.2			
J036	66.2			
J037	62.2			
J038	63.2			
J039	64.2			
J041	19.0			
J042	19.0			
J043	67.2			
J044	67.2			
J045	19.0			
J046	19.0			
J058	74.2			
J059	75.2			
J061	70.2			
J062	72.2			
J063	19.0			
J065	83.2			
J066	82.2			
J068	65.2			
J070	108.0			
J071	107.0			
J072	107.0			
J074	108.0			
J076	108.0			
J079	107.0			
J080	107.0			
J095	108.0			
J099	108.0			
K013	78.0			
K016	78.0			
K019	81.0			
K025	77.0			
K028	61.0			
K034	65.0			
K038	63.0			
K039	64.0			
K041	19.0			
K058	74.0			
K061	70.0			
K066	82.0			
K067	82.0			
K070	108.0			
K078	84.0			
K099	108.0			
L013	108.0			
L016	78.2			
L018	78.2			
L019	81.2			
L020	81.2			
L028	61.2			
L041	69.2			
L045	59.2			
L058	74.2			
L061	70.2			
L065	83.2			
L066	82.2			
L070	108.0			
L099	108.0			
M111	108.0			
M119	108.0			
M123	92.0			
M139	92.0			
M141	108.0			
M153	108.0			
M159	108.0			
M161	108.0			
M169	108.0			
M179	108.0			
M181	108.0			
M182	108.0			
M191	108.0			
M192	108.0			
M199	108.0			
M212	108.0			
M219	17.0			
M236	108.0			
M239	108.0			
M242	108.0			
M243	108.0			
M249	108.0			
M259	108.0			
M010	79.2			
M020	81.2			
M039	64.2			
M041	19.0			
M042	19.0			
M043	19.0			
M046	19.0			
M047	19.0			
M053	19.0			
M056	19.0			
M058	74.2			
M059	75.2			
M061	19.0			
M063	19.0			
M065	76.2			
M066	82.2			
M070	108.0			
M071	107.0			
M075	71.2			
M077	19.0			
M099	19.0	(72%)	108.0	(28%)
P100	108.0			
P400	19.0			
P999	96.0			
S201	112.0	(75%)	113.0	(25%)
S301	13.0			
S401	13.0			
S402	13.0			
S501	13.0			
S502	13.0			
S503	12.0			
S504	12.0			
S506	13.0			
S509	12.0			
S510	12.0			
S512	12.0			
S513	12.0			
S515	13.0			
S519	13.0			
S522	13.0			
S523	13.0			
S999	12.0			

EXHIBIT B-3 (Cont.)

MRIO CODES CORRESPONDING TO FY79 SERVICE CODES

Service Code	First (or only) MRIO Code	First (or only) MRIO Percent	Second MRIO Code	Second MRIO Percent
R111	107.0			
R112	107.0			
R113	107.0			
R114	107.0			
R115	107.0			
R116	107.0			
R118	107.0			
R119	107.0			
R121	107.0			
R122	107.0			
R123	107.0			
R124	107.0			
R129	107.0			
R199	107.0			
R211	107.0			
R212	107.0			
R213	107.0			
R214	107.0			
R215	107.0			
R219	107.0			
R301	108.0			
R302	108.0			
R303	108.0			
R304	108.0			
R399	108.0			
R401	108.0			
R402	108.0			
R403	108.0			
R404	108.0			
R405	108.0			
R406	108.0			
R407	108.0			
R408	108.0			
R409	108.0			
R410	108.0			
R411	108.0			
R412	108.0			
R413	103.0			
R414	108.0			
R415	108.0			
R416	108.0			
R498	108.0			
R499	108.0			
R501	108.0			
R502	108.0			
R503	108.0			
R504	108.0			
R505	108.0			
R506	108.0			
R507	108.0			
R508	108.0			
R509	108.0			
R510	108.0			
R511	108.0			
R512	108.0			
R513	108.0			
R514	108.0			
R515	108.0			
R516	108.0			
R517	108.0			
R518	108.0			
R519	108.0			
R520	108.0			
R521	108.0			
R522	108.0			
R523	108.0			
R524	108.0			
R525	108.0			
R526	108.0			
R527	108.0			
R528	108.0			
R529	108.0			
R530	108.0			
R531	108.0			
R532	108.0			
R533	108.0			
R534	108.0			
R535	108.0			
R536	108.0			
R547	108.0			
R599	108.0			
S111	95.0			
S112	94.0			
S113	92.0			
S114	96.0			
S119	96.0			
S201	108.0			
S202	108.0			
S203	98.0			
S204	87.0			
S205	96.0			
S206	103.0			
S207	108.0			
S208	108.0	(80%)	4.0	(20%)
S209	107.0			
S211	108.0			
S299	107.0	(85%)	108.0	(15%)
T001	108.0			
T002	108.0			
T003	108.0			
T005	108.0			
T006	108.0			
T007	108.0			
T008	108.0			
T009	108.0			
T010	108.0			
T011	42.2			
T012	108.0			
T013	108.0			
T014	108.0			
T099	108.0			
U001	115.0			
U002	115.0			
U004	115.0			
U005	115.0			
U006	115.0			
U007	15.0			
U009	15.0			
V001	108.0			
V111	89.0			
V112	87.0			
V113	88.0			
V114	87.0			
V115	88.0			
V119	91.0			
V121	89.0			
V122	87.0			
V124	88.0			
V125	88.0			
V129	87.0			
V211	89.0			
V212	87.0			
V214	88.0			
V221	89.0			
V222	87.0			
V223	85.0			
V224	85.0			
V225	89.0			
V230	104.0			
V231	104.0			
V231	108.0			
V999	91.0			
W015	18.0			
W019	88.0			
W020	108.0			
W022	108.0			
W023	110.0			
W024	108.0			
W034	102.0			
W036	103.0			
W038	108.0			
W039	108.0			
W058	108.0			
W061	108.0			
W062	108.0			
W063	108.0			
W064	108.0			
W067	82.2	(78%)	108.0	(22%)
W069	108.0			
W070	108.0	(75%)	68.2	(25%)
W071	108.0			
W072	108.0			
W074	108.0			
W075	108.0			
W076	108.0			
W083	108.0			
W084	108.0			
W099	108.0			
X111	105.0			
X119	105.0			
X127	105.0			
X131	105.0			
X139	105.0			
X142	105.0			
X152	105.0			
X154	105.0			
X159	105.0			
X161	105.0			
X162	105.0			
X163	105.0			
X169	105.0			
X174	105.0			
X179	105.0			
X182	105.0			
X192	105.0			
X199	105.0			
X222	108.0			
X224	105.0			
X244	108.0			
X291	105.0			
X299	105.0			
Y111	15.0			
Y119	15.0			
Y121	15.0			
Y123	81.2			
Y124	18.0			
Y125	18.0			
Y127	18.0			
Y129	18.0			
Y131	18.0			
Y139	18.0			
Y141	18.0			
Y142	18.0			
Y149	18.0			
Y152	18.0			
Y153	18.0			
Y154	18.0			
Y159	18.0			
Y161	14.0			
Y162	14.0			
Y163	14.0			

EXHIBIT B-3 (Cont.)

MRIO CODES CORRESPONDING TO FY79 SERVICE CODES

Service Code	First (or only) MRIO Code	First (or only) MRIO Percent	Second MRIO Code	Second MRIO Percent
Y169	14.0			
Y172	15.0			
Y173	15.0			
Y174	15.0			
Y179	15.0			
Y181	15.0			
Y182	15.0			
Y191	15.0			
Y192	15.0			
Y199	15.0			
Y211	19.0			
Y212	18.0			
Y219	18.0			
Y221	17.0			
Y222	17.0			
Y223	17.0			
Y224	17.0			
Y234	16.0			
Y235	16.0			
Y236	16.0			
Y237	16.0			
Y239	16.0			
Y241	16.0			
Y242	16.0			
Y243	16.0			
Y244	16.0			
Y245	16.0			
Y249	16.0			
Y291	18.0			
Y299	18.0			
Z111	19.0			
Z119	19.0			
Z121	19.0			
Z122	19.0			
Z123	19.0			
Z124	19.0			
Z129	19.0			
Z131	19.0			
Z139	19.0			
Z141	19.0			
Z142	19.0			
Z149	19.0			
Z152	19.0			
Z154	19.0			
Z159	19.0			
Z161	19.0			
Z162	19.0			
Z163	19.0			
Z169	19.0			
Z172	19.0			
Z173	19.0			
Z174	19.0			
Z179	19.0			
Z181	19.0			
Z182	19.0			
Z191	19.0			
Z192	19.0			
Z199	19.0			
Z211	19.0			
Z212	19.0			
Z214	19.0			
Z219	19.0			
Z222	19.0			
Z223	19.0			
Z224	19.0			
Z232	19.0			
Z234	19.0			
Z239	19.0			
Z241	19.0			
Z242	19.0			
Z243	19.0			
Z244	19.0			
Z245	19.0			
Z249	19.0			
Z291	19.0			
Z299	19.0			

APPENDIX C

MRIO Procedures: No. 3
January 11, 1982

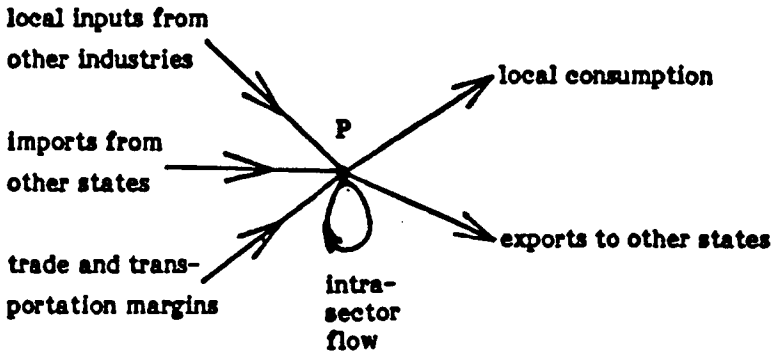
MRIO's MATHEMATICAL FORMULATION

In this paper the matrix formulation of the base year (1977) MRIO accounts is developed. Several new procedures have been introduced in the formulation of the accounts, including the use of separate activities in each state to serve as the distribution sectors for commodities consumed in the state (see MRIO Procedures No. 1), treatment of secondary products using a by-product approach (see MRIO Procedures No. 2), and the use of national and regional "clearinghouse" sectors to account for interstate service flows. Unlike previous regional models, trade flows and trade and transportation margins are incorporated explicitly into the table, an approach which will considerably simplify future updates and user applications of the model.

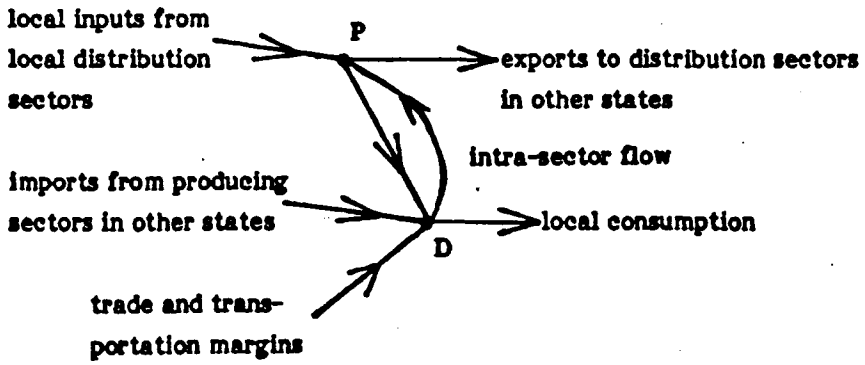
A comparison of the input/output link structure of the new margin and trade flow approach is compared to the traditional approach in Exhibit 1, with producing industries represented by a "P" and distribution activities by a "D". In the new formulation output of the producing industries (expressed in 1977 producer prices) is sold only to distributors while consumption (valued at 1977 purchaser prices) is supplied by the distributors to all users, including exports. In this paper distribution activities will be introduced for both commodity and service sectors, except for service sectors which have national clearinghouses. The distribution activities for the service industries are the only "dummy" sectors, since purchaser price is defined to equal producer price in these sectors. Hence no margins are charged and these "dummy" sectors serve only as a place holder in the matrix structure of the problem. The fundamental variables of the model are the primary product output of each industry in each state and the total consumption of each product in each state by both intermediate and final users. All other quantities of interest may be derived from the fundamental variables by a relatively simple post-solution calculation. An example of such a quantity would be the total output of a particular industry. Under the assumption of Procedures Paper No. 2, by-product production is assumed proportional to primary product production. Hence total output of the industry is a constant times primary output. If the percent change of total output is desired, this percent will be equal simply to the percent change in primary product output.

EXHIBIT 1

OLD



NEW



(output of P in producer price;
output of D in purchaser price)

The following notation will be used for the case of N industries and S states. It will be assumed that the industries are ordered such that the last n industries are service industries with associated national clearinghouses. All margin industries are assumed to have associated national or regional clearinghouse activities. For notational convenience we let n' = N-n+1 denote the index of the first industry in the ordering which has a clearinghouse. Unless otherwise noted indices extend over the full range of states and industries.

P_i^k : identifier for producing industry k in state i.

D_i^k : identifier for the distribution sector for product k (k = 1, . . ., N-n) in state i.

H^k : identifier for the national clearinghouse for service from industry k (k = n', . . ., N).

X_i^k = production (output) of primary product k by industry k in state i, in 1977 producer prices (i = H may also indicate the national clearinghouse for k = n', . . ., N).

C_i^k = consumption (both intermediate and final) of the product k (k = 1, . . ., N-n) in state i, in 1977 purchaser prices.

E_i^k = international exports of product k from state i, in freight-alongside-ship prices.

I_i^k = international imports of product k to state i, in domestic port prices.

Y_i^k = final demand for product k in state i, in purchaser prices.

$U_i^{k,l}$ = intermediate use (input) of product k (k = 1, . . ., N-n) by industry l in state i, in purchaser prices.

$B_i^{k,l}$ = by-products of type k (k = 1, . . ., N-n) produced by industry l in state i ($B_i^{k,k} = 0$), in producer prices.

$T_{i,j}^k$ = interstate (or intrastate) trade flow of product k (k = 1, . . ., N-n) moving from state i to state j, in producer prices.

$M_{i,j}^{k,l}$ = margin or interstate service flow purchased from sector k (k = n', . . ., N) in state i by the distribution sector l (l = 1, . . ., N-n) in state j, in producer prices (i may also identify the national clearinghouse).

G_i^k = allocation of national clearinghouse revenues to the producer for mode k (k = n', . . ., N) in state i, in producer prices.

It should be noted that clearinghouse and margin sectors, which have no associated local distribution sector, are treated uniquely in the above definitions. In particular, careful attention to the subscripting will show that no secondary production of a clearinghouse and margin service is defined, nor are margins paid by clearinghouse sectors. In addition, all distribution sectors purchase margins directly from the appropriate producing sector or national clearinghouse.

To aid in understanding the interrelationships of the quantities defined above, consider the particularly simple example of two industrial sectors (S = steel and F = foundries) and one transportation sector (R = railroads) in a two-state model. Exhibit 2 displays the appropriate MRIO table for this example, which utilizes a national-level rail clearinghouse to distribute the portion of interstate transportation margins which cannot meaningfully be assigned to the originating or destinating state. In this example, the steel and foundry industry in each state are represented by a producing and a distributing sector. The rail industry has no local distribution sector but has a national clearinghouse. Hence, in the notation introduced above, S = 2, n =1 and n' =N=3. Note that since the rail industry has no local distribution sector, final demand for rail transportation is satisfied directly by the <u>producing</u> sector for the rail industry. (Although in the two (or three) state example the clearinghouse approach may appear somewhat superfluous, its usefulness in the many state problem is immediately obvious.) In Exhibit 2, the sectors are arranged by state with adjacent producing and distributing sectors for each commodity. In Exhibit 3 the ordering of sectors has been sorted within states to group all producing sectors together, revealing the block matrix structure of the table. Reading across the first row of Exhibit 3, we obtain the following equation:

$$-X_1^S - B_1^{S,F} - B_1^{S,R} + T_{1,1}^S + T_{1,2}^S = 0$$

or,

$$X_1^S = T_{1,1}^S + T_{1,2}^S - B_1^{S,F} - B_1^{S,R} \qquad (1)$$

			REGION I					REGION II					NATIONAL RAILROAD CLEARING HOUSE	FOREIGN EXPORTS & FINAL DEMAND
			STEEL		FOUNDRY		RAIL	STEEL		FOUNDRY		RAIL		
			P_1^S	D_1^S	P_1^F	D_1^F	P_1^R	P_2^S	D_2^S	P_2^F	D_2^F	P_2^R		
REGION I	STEEL	P_1^S	$-X_1^S$	$T_{1,1}^S$	$-B_1^{S,F}$		$-B_1^{S,R}$		$T_{1,2}^S$					0
		D_1^S	$U_1^{S,S}$	$-C_1^S$	$U_1^{S,F}$		$U_1^{S,R}$							$Y_1^S + E_1^S$
	FDY	P_1^F	$-B_1^{F,S}$		$-X_1^F$	$T_{1,1}^F$	$-B_1^{F,R}$				$T_{1,2}^F$			0
		D_1^F	$U_1^{F,S}$		$U_1^{F,F}$	$-C_1^F$	$U_1^{F,R}$							$Y_1^F + E_1^F$
	RL	P_1^R		$M_{1,1}^{R,S}$		$M_{1,1}^{R,F}$	$-X_1^R$		$M_{1,2}^{R,S}$		$M_{1,2}^{R,F}$		Q_1^R	$Y_1^R + E_1^R$
REGION II	STEEL	P_2^S		$T_{2,1}^S$				$-X_2^S$	$T_{2,2}^S$	$-B_2^{S,F}$		$-B_2^{S,R}$		0
		D_2^S						$U_2^{S,S}$	$-C_2^S$	$U_2^{S,F}$		$U_2^{S,R}$		$Y_2^S + E_2^S$
	FDY	P_2^F				$T_{2,1}^F$		$-B_2^{F,S}$		$-X_2^F$	$T_{2,2}^F$	$-B_2^{F,R}$		0
		D_2^F						$U_2^{F,S}$		$U_2^{F,F}$	$-C_2^F$	$U_2^{F,R}$		$Y_2^F + E_2^F$
	RL	P_2^R		$M_{2,1}^{R,S}$		$M_{2,1}^{R,F}$			$M_{2,2}^{R,S}$		$M_{2,2}^{R,F}$	$-X_2^R$	Q_2^R	$Y_2^R + E_2^R$
NAT. RAIL CLEARING-HOUSE				$M_{H,1}^{R,S}$		$M_{H,1}^{R,F}$			$M_{H,2}^{R,S}$		$M_{H,2}^{R,F}$		$-X_H^R$	0

S = STEEL
F = FOUNDRY
R = RAIL

EXHIBIT 3

			REGION I					REGION II					NATIONAL RAILROAD CLEARING-HOUSE	FOREIGN EXPORTS & FINAL DEMAND
			PRODUCERS			DISTRIBUTORS		PRODUCERS			DISTRIBUTORS			
			P_1^S	P_1^F	P_1^R	D_1^S	D_1^F	P_2^S	P_2^F	P_2^R	D_2^S	D_2^F		
REGION I	PRODUCERS	P_1^S	$-X_1^S$	$-B_1^{S,F}$	$-B_1^{S,R}$	$T_{1,1}^S$					$T_{1,2}^S$			0
		P_1^F	$-B_1^{F,S}$	$-X_1^F$	$-B_1^{F,R}$		$T_{1,1}^F$					$T_{1,2}^F$		0
		P_1^R			$-X_1^R$	$M_{1,1}^{R,S}$	$M_{1,1}^{R,F}$				$M_{1,2}^{R,S}$	$M_{1,2}^{R,F}$	G_1^R	$Y_1^R + E_1^R$
	DIST	D_1^S	$U_1^{S,S}$	$U_1^{S,F}$	$U_1^{S,R}$	$-C_1^S$								$Y_1^S + E_1^S$
		D_1^F	$U_1^{F,S}$	$U_1^{F,F}$	$U_1^{F,R}$		$-C_1^F$							$Y_1^F + E_1^F$
REGION II	PRODUCERS	P_2^S				$T_{2,1}^S$		$-X_2^S$	$-B_2^{S,F}$	$-B_2^{S,R}$	$T_{2,2}^S$			0
		P_2^F					$T_{2,1}^F$	$-B_2^{F,S}$	$-X_2^F$	$-B_2^{F,R}$		$T_{2,2}^F$		0
		P_2^R				$M_{2,1}^{R,S}$	$M_{2,1}^{R,F}$			$-X_2^R$	$M_{2,2}^{R,S}$	$M_{2,2}^{R,F}$	G_2^R	$Y_2^R + E_2^R$
	DIST	D_2^S						$U_2^{S,S}$	$U_2^{S,F}$	$U_2^{S,R}$	$-C_2^S$			$Y_2^S + E_2^S$
		D_2^F						$U_2^{F,S}$	$U_2^{F,F}$	$U_2^{F,R}$		$-C_2^F$		$Y_2^F + E_2^F$
NAT. RAIL CLEARING-HOUSE						$M_{H,1}^{R,S}$	$M_{H,1}^{R,F}$				$M_{H,2}^{R,S}$	$M_{H,2}^{R,F}$	$-X_H^R$	0
			PRODUCTION			CONSUMPTION		PRODUCTION			CONSUMPTION			

S = STEEL
F = FOUNDRY
R = RAIL

EXHIBIT 3

Equation (1) may be interpreted as stating that (in 1977 producer price) the steel industry in state 1 (P_1^S) must produce an amount of steel equal to the trade flows demanded by the steel distributors in states 1 and 2 (D_1^S and D_2^S) less the amount of steel produced as by-product by the foundry and rail producing sectors in state 1 (P_1^F and P_1^R). Similarly, the fourth row in Exhibit 3 (second row in Exhibit 2) yields

$$C_1^S = U_1^{S,S} + U_1^{S,F} + U_1^{S,R} + Y_1^S + E_1^S \qquad (2)$$

indicating that D_1^S must supply an amount of steel equal to the sum of the intermediate uses of steel by the steel, foundry and rail industries in state 1 plus the exports and final demand for steel in that state. To satisfy this demand, the fourth column of Exhibit 3 shows that D_1^S must purchase amounts $T_{1,1}^S$ and $T_{2,1}^S$ of steel plus the transportation margins $M_{1,1}^{R,S}$, $M_{2,1}^{R,S}$ and $M_{H,1}^{R,S}$ which are paid to the rail producing sectors in states 1 and 2 and to the national clearinghouse, respectively. Since the distribution sectors are assigned no value-added, a column equation

$$C_1^S = T_{1,1}^S + T_{2,1}^S + M_{1,1}^{R,S} + M_{2,1}^{R,S} + M_{H,1}^{R,S} \qquad (3)$$

may be written to show that the total output of D_1^S equals the producer value of steel consumed in state 1 plus margins. A similar column interpretation may be given to a producing sector column, except that for these sectors value-added, which is not shown in the sample table, is no longer zero. Using V_1^S to denote the value-added by the steel industry in state 1, column 1 of Exhibit 3 yields the equation

$$V_1^S + U_1^{S,S} + U_1^{F,S} = X_1^S + B_1^{F,S} \qquad (4)$$

indicating that the inputs on the left hand side of equation (4) are the amounts necessary to produce <u>both</u> the primary and secondary products of the steel industry.

The block matrix structure evident in Exhibit 3 may be exploited to express concisely the many-state table using a block matrix representation. We will use the following notation:

$$\underline{Y}_i = \begin{pmatrix} 0 \\ \vdots \\ 0 \\ Y_i^{n'} + E_i^{n'} \\ \vdots \\ Y_i^{N} + E_i^{N} \\ Y_i^{1} + E_i^{1} \\ \vdots \\ Y_i^{N-n} + E_i^{N-n} \end{pmatrix} \qquad (i = 1, \ldots, S)$$

$$\underline{U}_i = \begin{pmatrix} U_i^{1,1} & \cdots & U_i^{1,N} \\ \vdots & & \vdots \\ U_i^{N-n,1} & \cdots & U_i^{N-n,N} \end{pmatrix} \qquad (i = 1, \ldots, S)$$

$$\underline{B}_i = \begin{pmatrix} X_i^1 & B_i^{1,2} & \cdots & B_i^{1,N} \\ B_i^{2,1} & X_i^2 & \cdots & B_i^{2,N} \\ \vdots & \vdots & & \vdots \\ B_i^{N-n,1} & B_i^{N-n,2} & \cdots & B_i^{N-n,N} \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & X_i^N \end{pmatrix} \qquad (i = 1, \ldots, S)$$

$$\underline{T}_{i,j} = \begin{bmatrix} T_{i,j}^{1} & 0 & \cdots & 0 \\ 0 & T_{i,j}^{2} & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & & T_{i,j}^{N-n} \\ M_{i,j}^{n',1} & M_{i,j}^{n',2} & \cdots & M_{i,j}^{n',N-n} \\ \vdots & \vdots & & \vdots \\ M_{i,j}^{N,1} & M_{i,j}^{N,2} & \cdots & M_{i,j}^{N,N-n} \end{bmatrix} \qquad (i, j = 1, \ldots, S)$$

$$\underline{T}_{H,i} = \begin{bmatrix} M_{H,i}^{n',1} & \cdots & M_{H,i}^{n',N-n} \\ \vdots & & \vdots \\ M_{H,i}^{N,1} & \cdots & M_{H,i}^{N,N-n} \end{bmatrix} \qquad (i = 1, \ldots, S)$$

$$\underline{C}_{i} = \begin{bmatrix} C_{i}^{1} & 0 & \cdots & 0 \\ 0 & C_{i}^{2} & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & C_{i}^{N-n} \end{bmatrix} \qquad (i = 1, \ldots, S)$$

$$\underline{G}_{i} = \begin{bmatrix} 0 & 0 & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & 0 \\ G_{i}^{n'} & 0 & \cdots & 0 \\ 0 & G_{i}^{n'+1} & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & G_{i}^{N} \end{bmatrix} \qquad (i = 1, \ldots, S)$$

$$\underline{X}_H = \begin{bmatrix} X_H^{n'} & 0 & \cdots & 0 \\ 0 & X_H^{n'+1} & \cdots & 0 \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ 0 & 0 & \cdots & X_H^{N} \end{bmatrix}$$

where $$X_H^k = \sum_{i=1}^{S} G_{i,H}^k \qquad (k = n', \ldots, N)$$

Here $\underline{Y}_i$ refers to the final demand (plus exports) vector for state i, $\underline{U}_i$ and $\underline{B}_i$ refer to the use matrix and make matrix for state i, and $\underline{T}_{i,j}$ consists of an upper part which is a diagonal matrix containing trade flows of all commodities moving from state i to state j along its diagonal, with the clearinghouse and margin payments in the lower rows. $\underline{T}_{H,i}$ contains the payments to the national clearinghouse. The diagonal matrix, $\underline{C}_i$, has the state consumption of products along the diagonal. The matrices $\underline{G}_i$ contain the allocations from each clearinghouse to the local producers, while $\underline{X}_H$ contains on its diagonal the total output of each national clearinghouse. These diagonal entries, along with the diagonals of the $\underline{B}_i$ and $\underline{C}_i$ matrices contain the fundamental variables of the model.

The above definitions allows the use of a single block-partitioned account matrix, A, to represent the many-state model as follows. We define:

$$
A = \begin{array}{c|cccccccc|l}
 & \multicolumn{2}{c}{\text{STATE 1}} & \multicolumn{2}{c}{\text{STATE 2}} & \cdots & \multicolumn{2}{c}{\text{STATE S}} & \text{NATIONAL CLEARING-HOUSES} & \\
\hline
 & -\underline{B}_1 & \underline{T}_{1,1} & \underline{0} & \underline{T}_{1,2} & \cdots & \underline{0} & \underline{T}_{1,S} & \underline{G}_1 & \text{STATE 1} \\
 & \underline{U}_1 & -\underline{C}_1 & \underline{0} & \underline{0} & \cdots & \underline{0} & \underline{0} & \underline{0} & \\
\hline
 & \underline{0} & \underline{T}_{2,1} & -\underline{B}_2 & \underline{T}_{2,2} & \cdots & \underline{0} & \underline{T}_{2,S} & \underline{G}_2 & \text{STATE 2} \\
 & \underline{0} & \underline{0} & \underline{U}_2 & -\underline{C}_2 & \cdots & \underline{0} & \underline{0} & \underline{0} & \\
\hline
 & \vdots & \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots & \\
\hline
 & \underline{0} & \underline{T}_{S,1} & \underline{0} & \underline{T}_{S,2} & \cdots & -\underline{B}_S & \underline{T}_{S,S} & \underline{G}_S & \text{STATE S} \\
 & \underline{0} & \underline{0} & \underline{0} & \underline{0} & \cdots & \underline{U}_S & -\underline{C}_S & \underline{0} & \\
\hline
 & \underline{0} & \underline{T}_{H,1} & \underline{0} & \underline{T}_{H,2} & \cdots & \underline{0} & \underline{T}_{H,S} & -\underline{X}_H & \text{NATIONAL CLEARING-HOUSES}
\end{array}
$$

$$W = \begin{pmatrix} \underline{Y}_1 \\ \underline{Y}_2 \\ \cdot \\ \cdot \\ \cdot \\ \underline{Y}_S \\ \underline{O} \end{pmatrix} \qquad Z = \begin{pmatrix} \underline{X}_1 \\ \underline{C}_1 \\ \underline{X}_2 \\ \underline{C}_2 \\ \cdot \\ \cdot \\ \cdot \\ \underline{X}_S \\ \underline{C}_S \\ \underline{X}_H \end{pmatrix}$$

Here A is a square accounts matrix of dimension $q = S(2N-n)+n$ and W is the final demand (plus exports) vector of dimension q by 1. The column vector Z is of the same dimension as W and contains as its elements the entire set of fundamental variables, including the primary product output and the total consumption of the product for each industry in each state, plus the output of each national clearinghouse activity. In forecasting applications it will be necessary to solve for Z, hence this vector will be defined as the solution vector.

To convert the base year accounts matrix to a coefficient matrix suitable for forecasting applications, each column of A must be divided by the negative of the corresponding element of the solution vector. In other words, each column of A is to be divided by the element in that column which lies along the diagonal. The resulting coefficient matrix will then contain the number 1 along its diagonal. Using "a" to represent the coefficient matrix, we have

$$a_{i,j} = \frac{A_{i,j}}{A_{i,i}} \qquad (i,j = 1, \ldots, q)$$

The MRIO model may then be represented as a set of linear equations. The solution vector for a future year may then be obtained as a linear function of the exogeneously stipulated final demand vector for that year. The base year equation is

$$a Z^{77} = W^{77} \tag{5}$$

Assuming for now the invertability of the coefficient matrix, a, we may write the solution for the forecast year, represented by an asterisk, as

$$Z^{*} = a^{-1} W^{*} \tag{6}$$

Since the coefficient matrix is quite large (q approximately 12,000), actual inversion of the matrix may not be the most efficient method of obtaining solutions. An alternative method is to expand the inverse in a series expansion. We note that since the matrix a contains ones along its diagonal the required inverse may be written formally as

$$a^{-1} = (I - L)^{-1} = I + L + L^{2} + \ldots \tag{7}$$

where the matrix L = I-a contains zeroes on the diagonal. Existence and convergence properties of the series expansion in equation (7) remain to be investigated. Determination of such properties is complicated by the fact that L contains both negative and positive values, hence convergence will not be monotonic.

APPENDIX D

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