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4 Data on Intermediate Production and Value Added

4.1 Introduction

In both this and the following chapter we describe our 1973 benchmark data set. We describe in some detail the raw data and the many adjustments in order to assist anyone who wishes to reconstruct or modify any part of the data set. In this chapter we deal with data on the use of factors by industry, taxes by industry, input-output transactions, and government enterprises. Chapter 5 is concerned with data on household incomes and expenditures, general government expenditures, and foreign trade.

Value added consists of net payments to the factors of production plus factor taxes. We use the National Income and Product Accounts (NIPA) to obtain figures for capital income, labor income, and tax by industry in 1973. We listed the nineteen industries used for our production data in table 3.1. These nineteen industries are a direct aggregation of the fifty-nine industries given in detailed tables of the *Survey of Current Business* (*SCB*) or of the eighty industries given in Bureau of Economic Analysis (BEA) input-output tables. These, in turn, are based on the Standard Industrial Classification (SIC). Appendix A of this chapter shows how we aggregate the eighty BEA industries.[1] This disaggregation provides us with richer detail than many of the tables published in the *SCB*, which only report information for twelve industries. For this reason much of our data comes from unpublished worksheets of the Commerce Department's National Income Division (NID).[2] Even with this greater degree of disaggregation of the production sector of the economy, we are

1. The relationship between our classification and the SIC can be seen in a table in U.S. Department of Commerce, BEA 1975, p. 10.

2. The staff at NID were extremely helpful in providing us with detailed worksheets. We also received excellent suggestions for additional sources and alternative adjustments procedures.

left with fairly aggregated groups. We have tried to maintain separate classifications for industries that are quantitatively important and taxed differently.

While chapter 6 describes overall adjustments to the data that are necessary to meet general equilibrium consistency requirements, this chapter describes many adjustments that were made to the raw data for definitional consistency. However, two discrepancies cannot be corrected here. First of all, the National Income Division collects some data on an establishment basis and other data on a company basis. For our purposes, the best measure is income generated in the production of each good, but data are not available on this basis.[3] The second problem is that the accounts use a "national" definition of economic activity, where we would prefer a "domestic" definition.[4]

4.2 Labor Income and Labor Taxes by Industry

The gross-of-factor-tax return to labor is the sum of employee compensation and the estimated return to the labor of self-employed individuals. The NIPA definition of employee compensation includes wages and salaries and supplements to wages and salaries.[5] These supplements include employer contributions for social insurance (ECSI) and other labor income (OLI). Employer contributions include those for Old Age, Survivors, Disability, and Hospital Insurance (OASDHI or Social Security), unemployment insurance, public workmen's compensation, and railroad retirement. Other labor income includes private workmen's compensation, pensions, group health and life insurance, and supplemental unemployment benefits.

The return to the labor of self-employed persons is an unknown fraction of the total return to the entrepreneur who invests his time and capital jointly. NID provides us with data for the total return to unincorporated enterprises by industry. However, we must still estimate the portion of this return that accrues to labor. In order to estimate this return, we assume that partners or proprietors in an industry earn the

3. "The establishment basis is used for the industrial classifications of wages and salaries, supplements to wages and salaries, income of unincorporated enterprises and inventory valuation adjustment, and interest paid by noncorporate enterprises. However, the company basis is used for corporate profits, the corporate inventory valuation adjustment, and interest paid and received by corporations" U.S. Department of Commerce, OBE 1954, p. 67.

4. The national definition measures "the income and product attributable to factors of production supplied by residents of the country rather than the income and product of factors physically located in the country" ibid., p. 32.

5. Wages and salaries include all monetary remuneration of employees, including the compensation of corporate officers, commissions, tips, bonuses, and receipts in kind that represent income to the recipients. These are on an accrual, not disbursement basis. Definitions of this kind can be found in U.S. Department of Commerce, BEA 1976a, pp. 34–38.

same return as other workers in that industry. We derive the average compensation of employees in each industry from two tables in the July 1976 *SCB* (U.S. Department of Commerce, BEA 1976b). Next we divide employee compensation by the full-time equivalent number of employees (providing average annual labor income for each industry). Then, using NID data on the numbers of proprietors and partners, with a correction for hours worked, we estimate the imputed return to the labor of self-employed individuals.[6]

For several industries—construction, utilities, real estate, and manufacturing—the estimated labor component exceeds the total unincorporated income. This problem is less serious in manufacturing, because unincorporated enterprises only produce a small proportion of manufactured goods. However, large segments of construction, utilities, and real estate are unincorporated. These three industries are land intensive and probably have a high rate of accrued capital gains. These gains would not show up in the figures for unincorporated income. Rather than assign a large return to labor and a negative return to capital in these industries, we simply assign the total unincorporated return to labor.

The sum of the imputed return to labor in the unincorporated sector, and wages and salaries in the corporate sector, yields gross-of-tax labor income for our nineteen industries. These appear in column (1) of table 4.1.

We define taxes on labor income to include employer contributions for social insurance (ECSI), employee contributions for OASDHI, plus contributions for OASDHI by self-employed individuals. We include all taxes on labor income that discriminate among industries. OASDHI has a fixed rate up to a maximum per employee, so that high-income employees pay a smaller tax per dollar of labor income than employees whose incomes fall below the maximum. Thus industries with higher-than-average compensation of employees tend to pay a lower effective rate on OASDHI. Unemployment insurance also discriminates by industry, since the tax is greater for those firms with a higher incidence of unemployment.

We treat contributions for public workmen's compensation (part of ECSI) as a tax, although we treat contributions for private workmen's compensation (part of OLI) as ordinary income. This distinction is somewhat arbitrary, since both are mandatory insurance payments. We make the distinction because the contributions for workmen's compensation go

6. If this imputed return to labor is subtracted from total unincorporated income, the residual is an estimate of the return to capital. Alternatively, using an asset basis, if we can measure the capital stock of both the corporate and noncorporate sectors in each industry, we can attribute to noncorporate capital the same net-of-tax rate of return as that of corporate capital. Subtracting this estimate of return to capital from the total unincorporated income yields a residual return to labor estimate. In practice, the latter (asset basis) method is more difficult, with capital stock by industry and by sector generally unavailable.

to government. NID supplies us with breakdowns of ECSI items by industry. Since the Social Security program involves matching contributions, we use the employer share to estimate the employee share.[7] The total for contributions by self-employed individuals is given in the July 1976 *SCB*. However, NID does not divide this total by industry. We allocate the total among industries by the proportion of self-employed labor income in each industry.

The total tax on labor for each industry is shown in column (2) of table 4.1. We subtract this from gross-of-tax labor income to get labor income net-of-tax, which is column (3).

Using columns (2) and (3) of table 4.1, we calculate the effective tax rates on labor by industry, which are shown in column (4). The rates differ by industry, but they are close to the overall weighted average of 10.1 percent. This dispersion is not great for two reasons. First, our procedure for estimating self-employed contributions to OASDHI by industry actually assumes the same rate of tax in all industries. However, these contributions represent only $2.5 billion out of $63 billion of labor taxes. Second, when we combine detailed industries into less-detailed ones, we tend to reduce the dispersion of tax rates. The rate of .0702 for agriculture, for example, reflects the fact that many agricultural workers are not covered by insurance programs. The rate of .0903 on services is due to a low level of coverage and some high salaries above the ceiling for OASDHI.

4.3 Capital Income and Capital Taxes by Industry

The return to capital, net-of-factor taxes, includes corporate profits after tax, the return to unincorporated capital, net interest paid, and net rents paid. We would like to include real accrued capital gains in our measure of capital income in each industry, but the data are not available. (Moreover, constancy of relative prices is consistent with our parameterization of an equilibrium economy with no excess profits.)[8] Now we will discuss the various components of capital income.

4.3.1 Corporate Profits after Tax

The July 1976 *SCB* gives corporate profits after deducting property taxes and indirect business taxes. *SCB* table 6.21 shows corporate profits *after* the corporate income tax. This corresponds to a net-of-tax definition. This series includes profits after the capital consumption allowance

7. This step is justified empirically, since 1973 employer contributions to OASDHI total $30,549 million, while employee contributions total $30,388 million. (See U.S. Department of Commerce, BEA 1976b, table 3.11.)

8. Since we include corporate profits after tax, we account for any capital gains on shares that might result from real retained earnings.

Table 4.1 **Labor Income, Tax, and Effective Rates by Industry in the U.S. for 1973**

	Labor Income Gross of Tax (1)	Tax on Labor (2)	Labor Income Net of Tax (3)	Effective Tax Rate (2) ÷ (3) (4)
All industries	708,037	64,997	643,040	.1011
Agriculture, forestry, fisheries	17,398	1,141	16,257	.0702
Mining	5,182	464	4,718	.0983
Crude petroleum and gas	3,723	308	3,415	.0902
Contract construction	56,216	5,308	50,908	.1043
Food and tobacco	18,823	1,859	16,964	.1096
Textiles, apparel, and leather	19,715	2,268	17,447	.1300
Paper and printing	20,944	1,948	18,996	.1025
Petroleum refining	3,073	239	2,834	.0843
Chemicals, rubber, and plastics	21,344	1,957	19,387	.1009
Lumber, furniture, stone, clay, glass	19,349	1,930	17,419	.1108
Metals, machinery, instruments, and miscellaneous manufacturing	97,163	9,167	87.996	.1042
Transport equipment and ordnance	15,131	1,393	13,738	.1014
Motor vehicles	16,422	1,358	15,064	.0901
Transportation, communications, utilities	65,274	6,188	59,086	.1047
Trade	143,984	13,745	130,239	.1055
Finance and insurance	36,000	3,161	32,839	.0963
Real estate	8,609	827	7,782	.1063
Services	122,964	10,179	112,785	.0903
Government enterprises	16,723	1,557	15,166	.1027

Note: All figures are in millions of dollars. Component detail is available upon request.

(tax depreciation) but before the capital consumption adjustment (correction to economic depreciation) or the inventory valuation adustment (IVA). The capital consumption adjustment will be treated separately later. We obtained the IVA from NID of Commerce.[9] Column (1) of table 4.2 shows profits after correction for the IVA.[10] The total is $45,633 million.[11]

9. The negative $301 million IVA for mining and crude petroleum is divided between the two by their proportions of value added in 1973. The negative $178 million for "other" corporate industries is allocated entirely to services, since this is the largest component, with a majority of inventories.

10. The relationship between these NIPA corporate profits and the IRS definition can be seen in U.S. Department of Commerce, BEA 1976b, table 8.5. The NIPA starts with IRS numbers and adds depletion, bad-debt adjustment, and other dividends, and the cost of issuing securities, in order to reach a measure related to current production.

11. Federal Reserve Board (FRB) earnings are included in corporate income figures, and FRB payments to the Treasury are counted as part of the corporate income tax. This

Table 4.2 **Capital Income Components by Industry in the U.S. for 1973 (millions of dollars)**

	Corporate Profits after Tax with IVA (1)	Capital Consumption Adjustment (2)	Return to Noncorporate Capital (3)	Net Rents Paid (4)	Net Interest Paid (5)	Total Capital Income (6)
All industries	45,633	8,221	33,541	21,237	65,530	181,973
Agriculture, forestry, fisheries	523	—[d]	22,865	4,067	3,323	30,778
Mining	840[b]	—	37	80	179	1,136
Crude petroleum and gas	2,446[b]	—	561	304	59	3,370
Contract construction	500	—	0	75	448	1,023
Food and tobacco	335	572	0	64	846	1,817
Textiles, apparel, and leather	428[a]	138	0	49	471	1,086
Paper and printing	2,376	−96	0	242	199	2,721
Petroleum refining	3,583	3,578	0	640	481	8,282
Chemicals, rubber, and plastics	3,172	132	0	71	535	3,910
Lumber, furniture, stone, clay, glass	3,115[b]	512	0	181	421	4,229
Metals, machinery, instruments, and miscellaneous manufacturing	5,527	2,144	0	427	2,303	10,401
Transport equipment and ordnance	−91[a]	61	0	22	176	168
Motor vehicles	2,785	1,180	0	30	852	4,847
Transportation, communications, utilities	4,292	—	0	357	8,606	13,255
Trade	7,198	—	367	898	1,258	9,721
Finance and insurance	6,843[c]	—	809	188	0	7,840
Real estate	88[a]	—[d]	0	13,013	43,731	56,832
Services	1,673	—	8,902	529	1,642	12,746
Government enterprises	—	—	—	—	—	7,811[e]

[a]Averaged over 1971–73. [c]Includes FRB earnings. [e]Imputed.
[b]Includes depletion. [d]CCA already included.

4.3.2 Capital Consumption Adjustment

Neither published nor unpublished sources at the Commerce Department give sufficiently disaggregated industry data on the capital consumption adjustment or on "economic" depreciation. In the aggregate, the Commerce Department uses straight-line depreciation for consistent accounting and a replacement cost basis to measure economic depreciation. Then they subtract from the capital consumption allowance (as measured by the Internal Revenue Service) to get the capital consumption adjustment. We took capital consumption adjustment figures for manufacturing industries from Coen (1980) and aggregated them to our industrial classification. These figures are shown in column (2) of table 4.2, along with nonmanufacturing data taken from the Commerce Department.

4.3.3 Return to Unincorporated Capital

The procedure used to calculate these numbers has been described in the earlier section on labor income. We impute a return to the labor of proprietors and partners, and subtract this from the total to yield a residual capital return. If the imputed labor share is too large, we assign capital a share of zero. The results are shown in column (3) of table 4.2.

4.3.4 Net Rents Paid

Rents paid by an industry are payments for "borrowed" capital, property, buildings, and machinery. The Internal Revenue Service (IRS) and the NIPA treat these payments as a cost deduction for the renting firm and as income for the owners of the rented property. Since we seek to measure all payments to capital used in each industry, we treat rents paid as capital income in the paying industry. For each industry we would like to add to capital income all payments for rental property and subtract rental earnings. This would be equivalent to adding net rents paid. The NIPA has no industry distribution for rents paid, and the IRS *Statistics of Income* (*SOI*) show only gross rents paid by industry. However, the NID does provide the total of net rental income, which is equal to the total net rents paid. This total and its components are shown in table 4.3.

We treat net rents from farm realty as a return to capital used in industry 1 (agriculture, forestry, and fisheries). The NIPA measure of imputed net rent from owner-occupied and other dwellings sum to $12,917 million. This figure is added to the capital income of our real estate industry.

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operation is not covered by the corporate income tax system and should be excluded from calculations on that tax. FRB earnings do make up part of capital income in our finance and insurance industry, however, and their payments to the Treasury can best be modeled as part of a tax on capital income in that industry, but not part of the corporate tax.

Table 4.3 Net Rental Income Components, 1973

Source		Amount
1. Net rents from farm realty		3,879
2. Imputed net rent from owner-occupied dwellings		10,334
3. Net rents from other dwellings[a]		2,583
4. Royalty earnings		1,498
5. Net rents from business and government[b]		3,124
5a. Nonfarm business	2,884	
5b. Nonprofit organizations	59	
5c. U.S. government	160	
5d. Foreign governments	21	
6. Total net rental income from the private sector[c]		21,237

Note: All figures are in millions of dollars. Items 1 through 5 were obtained from NID and include the capital consumption adjustment for an economic measure of depreciation.

[a]The sum of items 2 and 3 is net rents from housing, equal to $12,917 million, found in table 1.20 of the July 1976 *SCB*. These include farm housing.

[b]Items 5a through 5d are an approximate breakdown of item 5. See text for procedure.

[c]The sum of items 1 through 4, 5a and 5b.

Similarly, copyrights, patents, and royalties paid for natural resources should be counted as capital income in the industry where these capital assets are used and paid for. This item 4 in table 4.3 totals $1,498 million, but we are not supplied with industry division. The *SOI* show only royalties received. We therefore resort to a procedure used by Rosenberg (1969, p. 152), and allocate 12.5 percent to printing and publishing, 12.5 percent to electrical machinery (phonograph records), and 75 percent to natural resources. We approximate the use of natural resources by industry from the depletion deductions taken for tax purposes in 1973 (U.S. Department of the Treasury, IRS 1977a and 1977b). We assign deductions proportionally by depletion to six industries: petroleum and natural gas, other mining, petroleum refining, lumber, primary metals, and utilities.[12]

Finally, NID supplies us with net rents from business and government. These total $3,124 million, as shown in table 4.3. Net rents paid by each group are unavailable, so we use the proportion of gross rent paid to divide the total net rent paid.[13]

Nonprofit organizations are part of the services industry. We attribute the estimated net rents of these institutions directly to the services industry. The $2,884 million estimated net rental payments of business were

12. Rosenberg (1969) distributes 75 percent among three oil- and gas-using industries, despite the existence of "royalty" payments for lumber and other mining.

13. Gross nonresidential rent paid by business and government was $45,235 million. The portions paid by nonfarm business, nonprofit organizations, the U.S. government, and foreign governments were also provided by NID. We used these data to calculate items 5a to 5d in table 4.3.

allocated among industries by the proportion of gross rent paid by industry, furnished in the corporate and business *SOI*. This procedure generally follows Rosenberg (1969), and the results are shown in column (4) of table 4.2.

The NIPA imply that all of these rents originate in the real estate industry. The NIPA real estate industry includes housing services, other real property, and intermediation services. We redistribute the second component, but are still left with a somewhat curious definition of the real estate industry: housing services and intermediation in real property.

4.3.5 Net Interest Paid

The amount of an industry's capital return that is paid to bondholders will be reflected in that industry's net interest payments. We have used detailed worksheets by industry, provided by the NID. The worksheets show interest flows for 1973.

The dollar payments of interest by each industry are referred to as net monetary interest paid. Since all kinds of producers issue bonds to raise capital, these payments are positive for all industries except one. Finance and insurance (F&I) has a large negative value for net monetary interest paid, due to the peculiar structure of that industry. The F&I industry engages in financial intermediation, thus its interest receipts exceed the interest it pays on deposits. These net interest receipts are the form in which the F&I industry receives payment for services rendered. We argue above that net interest paid should be added to capital earned in each industry. If we add the (negative) net interest paid to the profits of the F&I industry, total capital is measured by a negative number. In 1973, net monetary interest paid by F&I was negative $61,181 million.

A consistent solution to this problem exists if we assume that F&I companies do not issue bonds to raise funds. That is, we assume that no interest payments are made for the capital used in the provision of intermediation services.[14] In fact, we can raise the F&I net-interest-paid figure to zero by *imputing* additional interest payments to other industry and to persons. Thus, we have two separate kinds of interest payments: monetary payments and imputed payments. This view of the world

14. Savings and loan associations in 1973 paid $12 billion in interest on deposits and $1 billion on borrowed money. Most of the latter went to the Federal Home Loan Bank Board, which means that the savings and loan associations paid for borrowed reserves at certain times. It is not obvious how to classify this kind of borrowing: it is borrowed capital used to provide financial services, but it is not for building plant or equipment as a factor of production. Commercial banks paid $20 billion interest on deposits, $4 billion on federal funds (borrowed reserves), $.5 billion on other borrowing, and $.25 billion interest on capital notes and bonds. Only the last category is clearly analogous to interest paid by other industries, but it is such a small portion of F&I net interest paid that it can be safely ignored. These two types of institutions had the only substantial payments on borrowed money.

attributes all property income of F&I straight through to the depositors who also make (imputed) service charge payments to F&I.[15]

The Commerce Department NID has made some of these imputations, but they only total $41,702 million. This falls $19,479 million short of the total for net monetary interest paid by F&I. There are several reasons for the difference. For instance NID does not make an imputation for finance companies and small-business investment companies. We have chosen to force the net interest paid by F&I (including both monetary and imputed interest) to be zero. To do this we impute an additional $19,479 million of interest paid by F&I.

These interest payment imputations should be allocated to other industries according to their use of financial services. As a proxy for the use of financial services, NID distributes the imputed interest receipts in proportion to cash held (including demand deposits) by each industry. These data come from the *SOI*. We use the same proportions to allocate all $61 million of imputed interest, including the $19 billion that are not imputed by NID. Based on these proportions, we allocate 79 percent of the total to persons and government. Out of the amount that we allocate to persons and government, some $15,388 million (or 79 percent of the $19,479 of extra imputed interest) is not counted by NID. The result is a GNP increase of $15,388 million. No one is better off, but our accounting shows larger consumer interest income, offset by larger (imputed) service charge payments to the finance and insurance industry. Net interest paid, both monetary and imputed, is shown in column (5) of table 4.2.

4.3.6 Special Treatment of Depletion Deductions

To obtain profits for tax purposes, natural resource firms in 1973 could deduct a percentage of revenues to reflect the depletion of their reserves. The combination of these depletion deductions and expensing of exploration costs is a case of double counting, because in competitive equilibrium, exploration costs are matched by the value of expected discoveries. We can avoid this double counting by adding depletion deductions to IRS income figures. Data in the *Statistics of Income* indicate that these deductions totaled $9,301 million for corporations and $429 million for unincorporated enterprises in 1973. The Commerce Department adds the noncorporate figure to its income statistics, but adds only $5,828 million of the corporate figure. The difference ($3,473 million, which equals 37 percent of corporate depletion deductions) is allocated as follows: We take corporate deductions for mining and lumber times .37 and add the result to incomes in those industries. We take the total of crude petroleum and petroleum-refining deductions times .37 and add this to

15. This treatment is consistent with competition and the absence of abnormal profits. If an F&I company is superior at discovering investments for its clients, it can make larger service charges.

income in crude petroleum alone. We do this because the income statistics for petroleum-refining corporations are on a company basis, so their deductions are for crude petroleum operations. These adjustments are reflected in column (1) of table 4.2.

4.3.7 Tax on Capital Income

In our model, the tax on capital income at the industry level has three components—the corporation income tax levied by the federal government, corporation franchise taxes levied by the state governments, and property taxes levied at the state and local levels. We use capital income as the tax base for all three taxes, even though the legal tax bases for the latter two taxes are capital stock and capital assets, respectively.

Information on the corporation income tax comes from table 6.20 of the July 1976 *SCB*. We list this information in column (1) of table 4.4. Information on corporate franchise taxes, from an unpublished worksheet from NID, is displayed in column (2) of table 4.4.

There are no good national statistics for the property tax by industry. The best data for 1973 are contained in a worksheet from NID. The NID data are collected from a wide variety of sources. For some industries data are gathered on yearly property tax payments from publications like *Agriculture Statistics*, *Life Insurance Fact Book*, and *Statistics of Common Carriers*. Property taxes in the manufacturing industries are estimated from a property tax survey in the 1958 *Census of Manufacturing*. In some cases NID took the estimated property tax rate for one of these industries and applied it to an *SOI* estimate of the assets of another industry for which no direct information on property taxes was available. In the remaining industries NID built up an estimate of property taxes for the entire nation by taking a weighted average of the property tax rates of the states.

We must make one adjustment to the NID property tax figures. In adjusting our figures on net rents paid, we move some income from the real estate industry to other industries where industrial real properties were used. The property tax figures from NID still include tax on those properties in the real estate industry, so we redistribute a part of the real estate industry's tax to other industries. Rather than assume the real estate industry tax rate on the income reassigned, we assume the rate of the industry where the property is used. First, we calculate a subtotal for capital income without net rents paid. Then, we calculate effective property tax rates in each industry and apply these rates to the net rent reassigned from NID's real estate industry. The property tax figures with this adjustment are given in column (3) of table 4.4.

Column (4) of table 4.4 shows the sum of the three capital taxes. Total net-of-tax capital income is shown in column (5) of table 4.4. The effective tax rates (column 4 divided by column 5) are shown in column (6),

Table 4.4 **Capital Taxes by Industry in the U.S. for 1973 (millions of dollars)**

	Corporate Income Tax (1)	Corporate Franchise Tax (2)	Adjusted Property Tax (3)	Total Tax on Capital (4)	Capital Income Net of Tax (5)	Effective Tax Rate (4 ÷ (5) (6)
All industries	48,702	1,161	46,033	95,896	181,973	.5270
Agriculture, forestry, fisheries	309	10	2,420	2,739	30,778	.0890
Mining	237	8	273	518	1,136	.4560
Crude petroleum and gas	194	4	804	1,002	3,370	.2973
Contract construction	1,012	18	334	1,364	1,023	1.3333
Food and tobacco	2,585	45	617	3,247	1,817	1.7870
Textiles, apparel, and leather	1,221	23	264	1,508	1,086	1.3886
Paper and printing	2,125	31	479	2,635	2,721	.9684
Petroleum refining	1,282	92	256	1,630	8,282	.1968
Chemicals, rubber, and plastics	3,573	44	574	4,191	3,910	1.0719
Lumber, furniture, stone, clay, glass	1,647	28	422	2.097	4,229	.4959
Metals, machinery, instruments, and miscellaneous manufacturing	8,094	138	1,979	10,211	10,401	.9817
Transport equipment and ordnance	536	7	542	1,085	168	6.4583
Motor vehicles	2,974	19	276	3,269	4,847	.6744
Transportation, communi-cations, utilities	4,007	319	5,313	9,639	13,255	.7272
Trade	7,513	125	3,252	10.890	9,721	1.1203
Finance and insurance	9,457[a]	178	968	10,603	7,840	1.3524
Real estate	700	47	25,354	26,101	56,832	.4593
Services	1,236	25	1,906	3,167	12,746	.2485
Government enterprises	0	0	0	0	7,811	.0000

[a]Includes 4,341 for FRB payments to the Treasury.

where .5270 is the average rate for all industries. Agriculture has the lowest effective tax rate and transportation equipment has the highest.[16]

We use capital income net of all taxes to reflect the use of capital in each industry, but we should note that measuring the industrial use of capital services by capital income is not the only method available. Several studies, including those by Kendrick (1976) and Jorgenson and Sullivan (1981) have collected data on capital *stock* by industry. In a perfect risk-free equilibrium with perfect measurement, both data sets would show the same distribution among industries. Capital would be allocated so that the ratio of net capital income to value of capital stock is the same in every industry. Without a perfect equilibrium measurement, however, we could still ignore the capital income figures derived here, use capital stocks, and attribute the same rate of return to all industries. Such alternatives have been investigated, but they do not make a major difference to the results of simulating alternative tax structures in the general equilibrium model.

4.4 Personal Factor Taxes

In section 3.3 we described the construct we use to model the features of the personal income tax (PIT) which discriminate by industry. Equation (3.31) shows how personal taxes are collected at an average personal marginal rate τ on a fraction f_i of the i^{th} industry's payments for capital (CAP_i). This weighted average personal marginal tax rate is 27.8 percent. The personal factor tax (PFT), is thus equal to $CAP_i f_i \tau$. Corrections at the personal level ensure that individual groups pay their own marginal rate, τ_j, ($j = 1, \ldots, 12$) on an average fraction, $\bar{f}$, of capital income from industry.

To calculate the f_i, we use data on the various types of capital income by industry. These include corporate profits (dividends and retained earnings), net interest payments (monetary and imputed), net rent payments (including the imputed net rent from owner-occupied homes), and the return to capital used in noncorporate business. These types of capital income are treated differently by the personal income tax. In our model we calculate the proportion, g, of each type of capital income that is fully taxable by the personal income tax. An industry's f_i is the weighted average of these g proportions. The weights are the amounts of these capital income types in each industry. The formula for f_i is given as

$$(4.1)\quad f_i = \frac{DIV_i g_D + RE_i g_{RE} + INT_i g_I + MRENT_i g_{MR} + IRENT_i g_{IR} + NCI_i g_{NC} - (NCITC_i/\tau) + \pi K_i g_{CG}/\gamma}{DIV_i + RE_i + INT_i + MRENT_i + IRENT_i + NCI_i}$$

where the variables are defined in table 4.5 and discussed further below.

16. The next section describes how we add the personal taxation of capital income by industry to the effective tax rates of table 4.4.

The last term in the numerator of equation (4.1) is $\pi K_i g_{CG}/\gamma$. If π is the rate of inflation with no relative price changes, then nominal appreciation in the i^{th} industry is equal to π times the capital assets used there.[17] We use 7 percent inflation for 1973, from the *Economic Report of the President* (Council of Economic Advisers 1973). In our model, K_i are measured in terms of capital service units, each of which earns a dollar per period in the benchmark. A real after-tax rate of return, $\gamma = .04$, is used to convert between capital stocks and capital service units, as described in section 3.4. Then K_i/γ is measured in capital assets, and $\pi K_i g_{CG}/\gamma$ is the taxable portion of nominal capital gains.

The denominator of (4.1) is equal to CAP_i, defined in section 3.3 as capital income net of corporate and property taxes. Our capital usage by industry, K_i, is net of personal factor taxes:

$$K_i = CAP_i(1 - f_i\tau). \tag{4.2}$$

Thus the final term in the numerator, which involves K_i, implicitly includes a term in f_i. To solve for f_i by itself, define

$$\begin{aligned}\Lambda_i \equiv\ & DIV_i g_D + RE_i g_{RE} + INT_i g_I + MRENT_i g_{MR} \\ & + IRENT_i g_{IR} + NCI_i g_{NC} - (NCITC_i/\tau);\end{aligned} \tag{4.3}$$

then equation (4.1) can be rewritten as

$$f_i = \frac{\Lambda_i + \pi CAP_i(1 - f_i\tau)g_{CG}/\gamma}{CAP_i}. \tag{4.4}$$

Solving for f_i, one obtains

$$f_i = \frac{\Lambda_i}{CAP_i} + \frac{\pi g_{CG}}{\gamma}/(1 + \tau\pi_{CG}/\gamma). \tag{4.5}$$

Table 4.5 summarizes the parameter values we have chosen to implement these equations. In the case of dividends, the federal government lost an estimated $285 million of revenue due to the $100 dividend exclusion from the PIT in 1976 (U.S. Congress 1977). We divide this by τ to get an estimate of nontaxable dividends, equal to $1,024 million. Since total dividends paid were $24,631 million in that year, the proportion taxable was .9584. This figure is used for g_D.

We assume that retained earnings are reflected in appreciated values of

17. Relative price changes in 1973 might have provided real capital gains as a major component of capital income in land-intensive industries. However, the return to land is largely included in our return to capital already. Our capital income includes imputed returns to owner-occupied housing, and actual rents paid in all industries, and the profits of corporations that own the land they use. Only real appreciation of idle and vacant land would be excluded from our capital income figures.

corporate stock. Thus retained earnings are subject to some personal taxation through the capital gains tax. We use g_{RE} to denote the effective fraction of retained earnings that is fully taxed by the PIT. Martin Bailey (1969) has provided evidence that an average dollar of retained earnings leads to one dollar of capital gains, in present value terms over the long

Table 4.5 **Variables in Equation (4.1) Used to Define f_i, the Proportions of Capital Income Taxable at the Personal Level**

Symbol	Definition	Value or Source
DIV_i	Dividends paid by the i^{th} industry	From table 6.22 of the July 1976 *SCB*
g_D	Portion of dividends taxable by personal income tax (PIT)	.9584, as discussed in text
RE_i	Retained earnings of the i^{th} industry	Defined as corporate profits (corrected by the IVA, depletion, and capital consumption adjustments of section 4.3) minus DIV_i
g_{RE}	Portion of retained earnings taxable by PIT	.25, as discussed in text
INT_i	Net monetary and imputed interest paid by the i^{th} industry	Column (5) of table 4.2, as discussed in section 4.3
g_I	Portion of interest taxable by PIT	1.0, since interest is fully taxable
$MRENT_i$	Net monetary rent paid by i^{th} industry	Column (4) of table 4.2 (except real estate), as discussed in section 4.3
g_{MR}	Portion of monetary rent taxable by PIT	1.0, since net rents are fully taxable
$IRENT_i$	Imputed rent earned in the i^{th} industry	Zero for all but real estate, equal to $10,334 million as shown in table 4.3
g_{IR}	Portion of imputed rent taxable by PIT	0.0, since no PIT on owner-occupied housing
NCI_i	Noncorporate capital income in the i^{th} industry	Column (3) of table 4.2, as discussed in section 4.3
g_{NC}	Portion of noncorporate capital income taxable by PIT	1.0, since NCI is fully taxable
$NCITC_i$	Noncorporate investment tax credit in the i^{th} industry	Described in text and shown in table 4.6
τ	Capital weighted average of personal marginal tax rates	.278, derivation in equation (3.31)
π	Inflation rate	.07, for 1973 from the *Economic Report of the President*
K_i	Use of capital service units in the i^{th} industry	From 1973 capital income net of all tax
γ	Conversion from capital service units to capital assets units	.04, from the real after-tax rate of return as described in the text
g_{CG}	Portion of nominal capital gains taxable by PIT	Differs by industry, as described in text

run.[18] There are, however, tax rate and deferral advantages to this form of capital income. In 1973, gains deferred until death were not taxed at all. Bailey has shown that close to one-half of long-term capital gains is realized in a relatively short period, while the remainder is held for varying durations averaging perhaps thirty-five years or more. Weighing the advantages of deferral and these observations regarding holding periods leads us to the conclusion that a tax on $.25 of regular income would yield approximately the same personal income tax revenue as a tax on one dollar of retained earnings. Therefore, the g_{RE} for retained earnings is set at .25.

A value of 1.0 is assigned to the g parameters for interest, monetary rents, and noncorporate income, since these types of capital income are fully taxable by the personal income tax. Imputed net rents, which appear only in real estate, get a g_{IR} of zero because these are untaxed.

Since the noncorporate investment tax credit reduces the personal income tax (PIT) liability, we include in the numerator of equation (4.1) the amount of income that would result in the reduced tax liability. It is the amount $NCI - (NCITC/\tau)$ that, when multiplied by τ, yields tax collections of $NCI \cdot \tau - NCITC$. The statutory rate of investment tax credit for equipment was 7 percent in 1973. Estimates of the noncorporate investment tax credit (NCITC) here are intended to approximate the amounts that would have accrued by sector in 1973 if a 10 percent credit had been in effect and if there had been no limitations on the use of the credits. The Treasury Department's Office of Tax Analysis provided us with these estimates, and their procedures can be summarized as follows. The total 1973 NCITC estimate of $1,078 million is scaled up by 10/7. To allocate this total among the industries, it is assumed that the ratio of ITC to depreciation is the same for the corporate and noncorporate portions of each industry. Total noncorporate depreciation is taken from the IRS noncorporate *Statistics of Income*. Each industry's corporate depreciation is shown in the July 1976 *SCB*. Using the Treasury Department's corporate ITC estimates for each sector, the ratio of ITC to depreciation is applied to the total noncorporate depreciation. This gives an estimate of each industry's NCITC. This vector is scaled up slightly to the proper total of $1,540 million, shown in table 4.6, column (1).

The final parameter to discuss is g_{CG}. Because nominal capital gains receive the same deferral advantages as real capital gains, we set g_{CG} to .25 for all industries except housing and agriculture. For housing we note that, in value terms, 73 percent of residential structures are owner occupied.[19] We assume that owner-occupants effectively avoid the capital

18. For an alternative theoretical view, see Auerbach 1979b, Bradford 1980, and King 1977.

19. Unpublished national balance sheet from the Federal Reserve Board.

Table 4.6 **1973 Noncorporate Investment Tax Credit (in millions of 1973 dollars) and f_i Parameters for Each Industry**

Industry	Noncorporate ITC (1)	f_i Parameters (2)
Agriculture, forestry, fisheries	523.08	1.053
Mining	8.64	0.910
Crude petroleum and gas	18.52	1.281
Contract construction	78.94	0.891
Food and tobacco	4.36	1.353
Textiles, apparel, and leather	2.45	1.164
Paper and printing	15.90	0.899
Petroleum refining	0.00	0.655
Chemicals, rubber, and plastics	6.74	0.996
Lumber, furniture, stone, clay, glass	26.75	0.782
Metals, machinery, instruments, and miscellaneous manufacturing	13.28	0.971
Transport equipment and ordnance	0.73	2.500
Motor vehicles	0.00	0.963
Transportation, communications, utilities	443.76	1.296
Trade	133.54	0.921
Finance and insurance	13.91	0.768
Real estate	77.23	0.376
Services	172.26	1.182
Government enterprises	0.00	0.750
All industries	1,540.00	0.816

gains tax on their housing, whereas landlords pay taxes on 25 percent of their gains. The rate of inclusion on all of housing is thus only (.27)(.25) = .0675. In the agricultural sector most farms are privately held and are seldom exchanged in a taxable manner. We have set g_{CG} in the agricultural sector to .10.

The resulting values for all benchmark f_i are shown in column (2) of table 4.6. Note that the f_i parameter is less than one for most industries. This reflects the low personal taxation of retained earnings and the noncorporate investment tax credit. The f_i for real estate is .376, reflecting the nontaxation of imputed net rents from owner-occupied homes. Some f_i are greater than one, however, because of the taxation of purely nominal capital gains.

The use of capital by government enterprises (industry 19) is assigned an f_i of .75. This reflects roughly the portion of interest payments that is taxable by the personal income tax. Approximately one-fourth of government's interest payments are on nontaxable state and local bonds.[20]

20. We assign an f_i of 1.0 to the use of private capital by general government. This simplification aids in our computations, but does not affect general government's capital tax rate, equal to the average industry tax rate (see section 3.5).

Finally, in table 4.7, we use the f_i parameters to derive the amount of personal factor tax in each industry, shown in column (3). When all capital taxes are subtracted from capital income, we have net income of column (4). The last column shows the effective tax rates that we use in the model—the ratios of all taxes to net capital income in each industry. Since the tax rate is defined as taxes relative to net income rather than to the more common use of gross income, the rates can exceed unity.

4.5 Input-Output Transactions Data

Our model requires data on interindustry transactions, that is, each industry's purchases from each other industry. We construct an interindustry transactions table from two separate tables of *The Detailed Input-Output Structure of the U.S. Economy, 1972*, published by the Bureau of Economic Analysis (U.S. Department of Commerce, BEA 1979). The first table is the "make" table, which gives the dollar values of the production of each commodity by each industry. The second is the "use" table, which gives the dollar values of the use of commodities by industries. Our goal is to transform these tables into a single table showing each industry's use of the outputs of the various industries.

To illustrate the procedure, let us consider the case with nineteen industries and eighty-five commodities. The make matrix, M, is thus 19×85 and the use matrix, U, is 85×19. The first step in arriving at a transactions table is to define a 19×85 matrix, $\bar{M}$, which is equal to M with the column sums normalized to unity. The (i, j) element of $\bar{M}$ is the proportion of the total production of commodity j that is produced by industry i. The transactions table, T, (19×19), is given as

$$T_{i,j} = \sum_{k=1}^{19} \bar{M}_{ik} U_{kj} \quad \text{for} \quad \begin{matrix} i = 1, \ldots, 19 \\ j = 1, \ldots, 19 \end{matrix} \tag{4.6}$$

Figure 4.1 gives an example of the procedure for a hypothetical case of two industries and three commodities.

The resulting 1972 interindustry transactions table reports these transactions in millions of dollars at producer prices. The valuation at producer prices excludes distribution costs. The trade margin and transportation costs appear as inputs to each industry from the trade and transportation industries. It is important to note that only the trade margin is included as an input from the trade industry. The input-output tables do not trace the actual flows of commodities to and from the trade sector. If trade were shown as buying and reselling commodities, other industries would be shown as buying most of their inputs from the trade industry. Instead, commodities are shown as moving directly to the users, bypassing the trade sector.

Table 4.7 **Capital Income and Taxes by Industry (in millions of 1973 dollars)**

	Gross Income to Capital (1)[a]	Corporate and Property Taxes (2)[b]	Personal Factor Taxes (3)[c]	Net Income to Capital (4)[d]	Personal Factor Tax Rate (5)[e]	Total Effective Tax Rate (6)[f]
All industries	277,869	95,896	40,932	141,041	0.2902	0.9701
Agriculture, forestry, fisheries	33,517	2,739	9,016	21,762	0.4143	0.5402
Mining	1,654	518	288	848	0.3396	0.9505
Crude petroleum and gas	4,372	1,002	1,201	2,169	0.5522	1.0129
Contract construction	2,387	1,364	254	769	0.3303	2.1040
Food and tobacco	5,064	3,247	684	1,133	0.6037	3.4696
Textiles, apparel, and leather	2,594	1,508	352	734	0.4796	2.5341
Paper and printing	5,356	2,635	681	2,040	0.3338	1.6255
Petroleum refining	9,912	1,630	1,509	6,773	0.2228	0.4635
Chemicals, rubber, and plastics	8,101	4,191	1,084	2,826	0.3836	1.8666
Lumber, furniture, stone, clay, glass	6,326	2,097	921	3,308	0.2784	0.9123
Metals, machinery, instruments, and miscellaneous manufacturing	20,612	10,211	2,812	7,589	0.3705	1.7160
Transport equipment and ordnance	1,253	1,085	117	51	2.2941	23.5686
Motor vehicles	8,116	3,269	1,299	3,548	0.3661	1.2875
Transportation, communications, utilities	22,894	9,639	4,781	8,474	0.5642	1.7017
Trade	20,611	10,890	2,491	7,230	0.3445	1.8508
Finance and insurance	18,443	10,603	1,676	6,164	0.2719	1.9921
Real estate	82,933	26,101	5,945	50,887	0.1168	0.6298
Services	15,913	3,167	4,192	8,554	0.4901	0.8603
Government enterprises	7,811	0	1,630	6,181	0.2637	0.2637

[a]Sum of columns (4) and (5) from table 4.4.
[b]Column (4) of table 4.4.
[c]$\tau f_i \cdot [(1)-(2)]$.
[d](1) − (2) − (3).
[e](3)/(4).
[f]((2) + (3)/(4)).

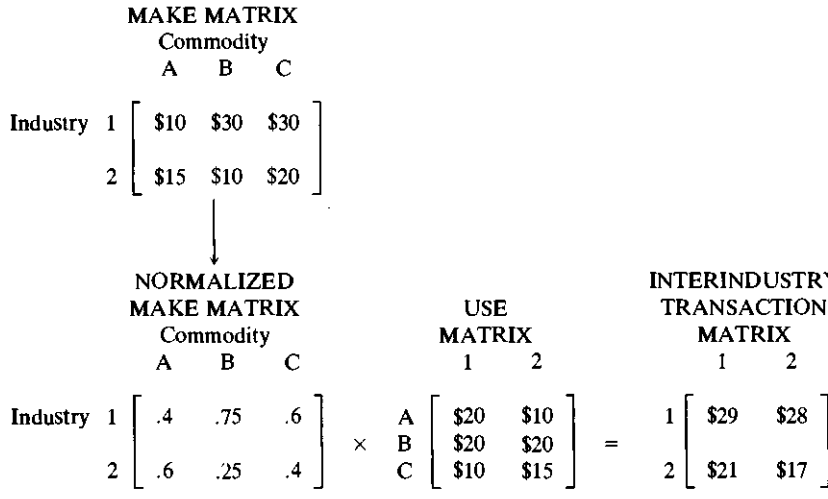

Figure 4.1 Example of construction of interindustry transactions table from make table and use table.

Table 4.8 **United States Interindustry Transactions, 1972 (in millions of dollars at producers' prices)**

	1	2	3	4	5	6	7	8	9
1.	26436.7	.5	.2	329.0	37436.9	1298.6	44.1	5.2	133.6
2.	166.1	1054.0	2.2	1394.1	55.5	27.9	203.5	129.1	945.5
3.	35.5	8.1	597.4	86.6	12.5	6.7	11.5	15007.6	93.9
4.	583.0	123.0	735.0	47.0	238.0	85.0	300.0	543.0	493.0
5.	5297.3	2.1	5.4	53.2	22976.1	517.4	192.2	48.7	611.3
6.	239.6	25.5	3.1	788.4	109.6	25829.1	387.9	13.3	1094.7
7.	281.4	93.8	63.0	1819.1	2378.6	483.8	10922.5	201.6	1613.2
8.	1341.3	222.6	70.8	3109.0	309.0	204.3	345.0	2308.3	1239.8
9.	3368.5	325.9	111.4	3629.9	1943.5	5663.5	1932.0	925.1	16671.7
10.	302.4	108.6	8.8	20545.1	4276.7	814.6	2160.5	205.9	1614.7
11.	929.8	1153.6	667.6	29355.0	4361.2	1194.9	1094.1	485.5	3193.9
12.	81.8	21.6	9.2	134.1	10.3	10.5	21.6	1.5	23.8
13.	62.6	62.7	6.3	192.7	32.8	14.4	34.5	3.0	46.9
14.	2138.6	572.0	378.1	5324.5	4429.3	1849.9	3046.1	2399.7	4873.7
15.	3036.0	358.9	91.2	12688.4	5083.5	2510.5	1666.7	295.5	2066.3
16.	1150.3	133.7	116.2	1072.5	600.5	348.1	382.6	205.7	538.0
17.	4730.8	666.7	2706.8	1013.0	575.9	644.8	1549.0	290.4	1487.1
18.	1436.0	390.8	462.8	7940.9	3869.2	1592.6	2629.9	643.5	5318.0
19.	172.0	93.0	53.7	319.2	389.9	258.7	636.7	175.5	485.8

The aggregated 19 × 19 matrix for 1972 appears in table 4.8.[21] The elements, (i, j), of this matrix are the amounts of the output of industry i that are used by industry j. Thus, if we look down the fifth column, we see that the food industry buys more from agriculture, forestry, and fisheries ($37,437 million) than from any other industry. Columns (8), (13), and (17) also provide intuitive stories: petroleum refining uses much crude petroleum, the motor vehicles industry is a heavy user of primary and fabricated metal and machinery, and real estate purchases a large amount from the construction industry. At this level of aggregation the elements along the diagonal of the matrix are quite large. If we were to use a more disaggregated industry classification, these diagonal elements would be relatively smaller.

Finally, this (19 × 19) transactions table is updated to 1973. Each column is multiplied by the ratio of 1973 value added to 1972 value added for that industry. These ratios are based on unpublished data from the Commerce Department's National Income Division. Since value added data are not available for the government enterprises industry, we use the weighted average ratio for the eighteen private industries. Table 4.9 contains all nineteen ratios. The only ratio far from the average is

21. The correspondence between the classification of the original matrix and our nineteen industries is in Appendix A of this chapter.

10	11	12	13	14	15	16	17	18	19
1809.0	93.6	13.3	5.3	202.2	127.4	9.8	730.7	2204.2	198.8
1165.3	4660.9	11.3	30.7	2316.7	2.3	.3	3.2	40.0	315.8
19.8	44.5	4.7	4.5	3879.5	58.9	7.7	16.8	56.9	16.9
306.0	1066.0	110.0	108.0	5013.0	863.0	298.0	10786.0	2631.0	2672.0
60.5	198.6	41.4	13.5	187.1	139.8	73.8	17.2	16450.7	56.2
888.3	921.2	292.2	1312.8	165.2	162.4	53.7	5.5	1487.8	69.5
3739.2	2447.6	262.4	290.8	1137.0	3320.6	2444.9	454.8	4388.3	251.4
575.9	1124.7	124.1	113.4	3879.7	1494.6	152.3	436.4	1375.3	304.9
2323.9	7060.0	524.2	2174.6	733.9	574.1	51.2	284.5	4430.0	321.4
11343.3	4853.0	1208.0	1394.8	92.5	477.3	9.2	3.8	1233.8	16.1
3352.6	81818.7	8636.5	16678.5	2175.6	590.1	237.2	114.4	7892.8	204.0
22.0	400.5	4092.2	125.7	1135.7	16.1	13.3	6.7	236.9	36.5
72.8	992.3	384.7	14461.5	341.8	73.3	8.6	4.9	5683.7	55.3
4276.3	10522.6	1058.0	1544.3	21578.3	9298.7	3075.8	1478.7	10611.3	2916.6
2249.7	8367.4	1043.1	3341.4	2309.2	2985.4	388.7	505.7	7259.9	182.4
500.2	1823.2	207.2	234.2	2636.6	3021.6	15580.9	3359.7	3446.3	268.0
707.6	2833.5	228.6	102.8	2655.9	8925.7	2468.2	11684.4	13999.9	450.1
1850.5	8948.8	1907.3	1672.1	8113.0	16240.7	7294.8	2856.3	22367.1	880.6
334.0	1095.8	134.8	169.1	2527.9	1750.6	1603.6	724.4	2317.3	323.5

Table 4.9 The Ratio of 1973 to 1972 Value Added in Each Industry

Industry	Ratio
1. Agriculture, forestry, fisheries	1.60012
2. Mining	1.27529
3. Crude petroleum and gas	1.09324
4. Contract construction	1.11718
5. Food and tobacco	1.01805
6. Textiles, apparel, and leather	1.06051
7. Paper and printing	1.12247
8. Petroleum refining	1.27558
9. Chemicals, rubber, and plastics	1.11344
10. Lumber, furniture, stone, clay, glass	1.15656
11. Metals, machinery, instruments, and miscellaneous manufacturing	1.14957
12. Transport equipment and ordnance	1.04596
13. Motor vehicles	1.13872
14. Transportation, communications, utilities	1.10443
15. Trade	1.11694
16. Finance and insurance	1.06860
17. Real estate	1.10290
18. Services	1.11783
19. Government enterprises	1.12368

agriculture, forestry, and fisheries. The large increase in value added in this industry is due largely to the sharp increase in grain prices that occurred at that time.

4.6 The Matrix of Transition between Producer Goods and Consumer Goods

The nineteen goods produced by our industry divisions do not correspond to the commodities purchased by consumers. For example, consumers make very few direct purchases of the outputs of the mining and crude petroleum industries. The same is true of the primary metals and machinery industries. Trade services and commodity transportation services are only purchased indirectly by consumers. The aggregate consumption vector for final demands of households, derived from table 2.6 of the July 1976 *SCB*, contains fifteen commodities rather than the nineteen industry outputs. The total is adjusted to exclude expenditures in the United States by foreigners. We also adjust the total to include the $15,388 million imputed service charge payments from consumers to the finance and insurance industry, which was discussed in section 4.3 above. After these adjustments, the total of $827,525 million in consumption expenditures on fifteen consumer goods corresponds directly to the $827,525 million consumption demand for nineteen producer goods. The

latter vector represents the industry outputs that are used to form the fifteen consumer goods.

To accommodate these different classifications, we treat these producer goods as being converted into consumer goods by a fixed-coefficient Z matrix, estimated from table B in the February 1974 *SCB*. This table used 1967 input-output data and can easily be transcribed to an 86 $\times$ 84 matrix where the (i, m) element is the total amount of producer goods i used in consumer good m. The eighty-six industries used by the Bureau of Economic Analysis aggregate directly to our definition of nineteen industries. Their eighty-four consumption categories aggregate to our fifteen consumer goods according to information in Appendix B of this chapter.

We calculate the amounts of producer goods used by the saving commodity (commodity 16) by using data on business investment from the 1972 input-output table, scaled up to 1973 levels. We impose the requirement that the total saving of consumers should exactly equal the net investment of the business sector. After we add these amounts of producer goods used by the saving commodity, we have a 19 $\times$ 16 matrix. This matrix gives the amount of each industry's output used in producing each of the consumer goods. We divide each element of this matrix by its column total in order to obtain the Z matrix coefficients. These coefficients are presented in table 4.10. This table is fairly straightforward. The reader will not be surprised to see that most of food is produced by the food industry, most of housing by real estate, etc.

Each consumer good price is a weighted average of the producer good prices, where the weights are the elements of the appropriate column from the Z matrix. Demands for consumer goods are calculated using the sixteen prices and the consumer demand functions. When we feed the vector of total demands for consumer goods through the Z matrix, we get the consumption demands for the nineteen producer goods, as shown in figure 4.2.

4.7 Government Enterprises

Some publicly supplied goods and services are subject to a price, or user charge. In our model these goods and services are produced by the government enterprises industry (industry 19). We separate this industry from the other functions of government. In this section we present data for the government enterprises industry. The data cover labor use and taxes, capital use and taxes, and subsidies received.

Data on employee compensation for federal, state, and local government enterprises are available in unpublished, disaggregated tables that correspond to table 6.1 of the July 1976 *SCB*. We present these data in

Table 4.10 **1973 *Z* Matrix Linking Producer and Consumer Good Classifications after Consistency Adjustments**

Producer Good Classification	*Consumer Good Classification*							
	Food (1)	Alcoholic Beverages (2)	Tobacco (3)	Utilities (4)	Housing (5)	Furnish-ings (6)	Appli-ances (7)	Clothing and Jewelry (8)
1. Agriculture	0.054937	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2. Mining	0.000021	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3. Crude petroleum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4. Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5. Food and tobacco	0.571470	0.509381	0.591006	0.0	0.0	0.0	0.0	0.0
6. Textiles and apparel	0.0	0.0	0.0	0.0	0.0	0.184731	0.0	0.491791
7. Paper and printing	0.0	0.0	0.0	0.0	0.0	0.004101	0.0	0.001528
8. Petroleum refining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9. Chemicals	0.000241	0.0	0.0	0.0	0.0	0.005086	0.018693	0.010041
10. Lumber and furniture	0.0	0.0	0.0	0.0	0.0	0.236246	0.024396	0.0
11. Metal and machinery	0.0	0.0	0.0	0.0	0.0	0.080389	0.552817	0.038513
12. Transport equipment	0.0	0.0	0.0	0.0	0.0	0.000602	0.0	0.0
13. Motor vehicles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14. Transportation, communications	0.023043	0.013253	0.003813	0.984237	0.0	0.015258	0.016919	0.007251
15. Trade	0.350172	0.477365	0.405181	0.0	0.0	0.473477	0.387048	0.432833
16. Finance and insurance	0.000115	0.0	0.0	0.0	0.0	0.000109	0.000127	0.000146
17. Real estate	0.0	0.0	0.0	0.0	0.963323	0.0	0.0	0.0
18. Services	0.0	0.0	0.0	0.0	0.036677	0.0	0.0	0.017898
19. Government enterprises	0.0	0.0	0.0	0.015763	0.0	0.0	0.0	0.0

Producer Good Classification	*Consumer Good Classification*							
	Transportation (9)	Motor Vehicles (10)	Services (11)	Financial Services (12)	Reading, etc. (13)	Non-durable Nonfood (14)	Gasoline (15)	Savings (16)
1. Agriculture	0.0	0.0	0.0	0.0	0.049808	0.0	0.0	0.031513
2. Mining	0.0	0.0	0.0	0.0	0.0	0.000196	0.005499	0.013787
3. Crude petroleum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.003978
4. Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.459195
5. Food and tobacco	0.0	0.0	0.0	0.0	0.0	0.0	0.001545	−0.010129
6. Textiles and apparel	0.0	0.001242	0.0	0.0	0.006637	0.003132	0.0	−0.005661
7. Paper and printing	0.0	0.0	0.0	0.0	0.191114	0.101444	0.0	0.001125
8. Petroleum refining	0.0	0.0	0.0	0.0	0.0	0.0	0.463279	−0.000155
9. Chemicals	0.0	0.040905	0.0	0.0	0.001975	0.380230	0.001182	0.012216
10. Lumber and furniture	0.0	0.000055	0.001134	0.0	0.0	0.002594	0.001182	0.018404
11. Metal and machinery	0.0	0.050842	0.0	0.0	0.154909	0.073403	0.000091	0.274652
12. Transport equipment	0.0	0.007866	0.0	0.0	0.063302	0.0	0.0	0.003429
13. Motor vehicles	0.0	0.436738	0.0	0.0	0.0	0.0	0.0	0.047273
14. Transportation, communications	0.889504	0.015346	0.013243	0.0	0.059078	0.014387	0.040584	0.020776
15. Trade	0.0	0.223930	0.001275	0.0	0.322216	0.424615	0.486639	0.117918
16. Finance and insurance	0.0	0.000359	0.006236	1.000000	0.000110	0.0	0.0	0.000086
17. Real estate	0.0	0.0	0.005070	0.0	0.0	0.0	0.0	0.013863
18. Services	0.0	0.222716	0.953794	0.0	0.150850	0.0	0.0	−0.002270
19. Government enterprises	0.110496	0.0	0.019258	0.0	0.0	0.0	0.0	0.0

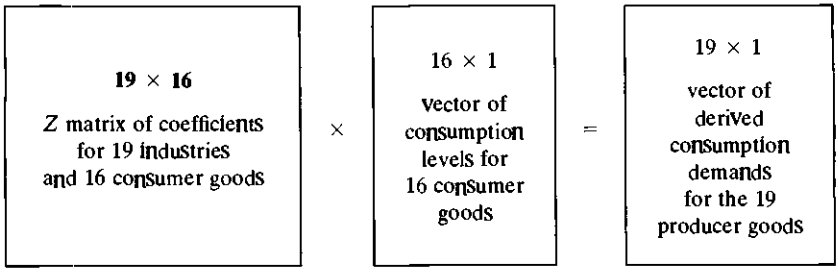

Fig. 4.2 Use of the Z matrix to create a vector of derived consumption demands for the producer goods.

table 4.11. Employer and employee contributions to retirement programs are given in table 3.11 of the July 1976 *SCB*. The total contribution for government employment is multiplied by the fraction of government labor in government enterprises, to produce an estimate of the labor tax attributable to this industry. The total tax is $1,557 million. When we subtract this figure from the gross-of-tax wage bill of $16,723 million, we get a net-of-tax labor bill of $15,166 million. The rate of tax on net-of-tax labor is .1027.

Capital estimates are considerably more difficult to produce. The *SCB* shows a profit-type return for government enterprises. This corresponds to their "surplus," which is often negative. Even if the average surplus were positive, this would not be an appropriate measure of the return to capital in government enterprises. Our procedure is to impute the amount of capital, used by the government enterprises industry, on the basis of capital/labor ratios in those private activities that are most similar to the activities of the government enterprises.

Seven components of this industry are listed in table 4.12 along with the comparable private industries. Since employee compensation data were

Table 4.11 **Government Enterprise Labor Use and Tax (in millions of 1973 dollars)**

	Federal	State and Local	Total
1. Government enterprise labor	$10,484	$6,239	$16,723
2. Total government labor	$62,407	$103,378	$165,785
3. Proportion of labor government enterprises (1 ÷ 2)	0.1680	0.0604	0.1009
4. Employer retirement contributions	$3,217	$6,828	$10,045
5. Employee retirement contributions	$2,246	$3,765	$6,011
6. Total contributions (3 + 4)	$5,463	$10,593	$16,056
7. Estimated labor tax in government enterprises (6 × 3)	$918	$639	$1,557

Table 4.12 **Government Enterprise Components and Capital Estimates**

	Intermediate Inputs (1)	Proportions of Total Inputs (2)	Corresponding Private Industry (3)	*K/L* Ratio of Private Industry (4)	Weighted *K/L* (2 × 4) (5)
Federal Total	3,075	1.00	—	—	.4020
Post office	1,233	.40	services	.14	.0560
Electric utilities	236	.08	utilities	1.07	.0856
Commodity credit corp.	863	.28	finance & insurance	.57	.1596
Other	743	.24	overall	.42	.1008
State and Local Total	4,405	1.00	—	—	.5764
Passenger transit	334	.08	transportation	.10	.0080
Electric utilities	1,221	.28	utilities	1.07	.2996
Other	2,851	.64	overall	.42	.2688

not available in this detail, and since value added includes the mismeasured surplus, we used the sum of intermediate inputs as a measure of the relative size of these activities. The inputs shown in column (1) are from the 1967 detailed input-output table. We assume that the proportions in column (2) would still be appropriate in 1973. Column (4) contains the capital/labor ratio (gross-of-tax) for the private counterparts of these activities, obtained from industry data presented earlier in this chapter. When we use gross-of-tax ratios, we impute a higher capital/labor ratio for the government enterprises industry than might seem appropriate, because the government pays no tax on the capital it uses. However, we believe this is appropriate treatment, since it also implies the same ratio of the marginal product of capital to the marginal product of labor in both the public and private portions of each industry.

We use the relative sizes of the seven components to get weighted averages of these capital/labor ratios for federal and for state and local government enterprises. Multiplying the federal ratio of .4020 by the federal government enterprises' use of labor capital of $10,484 million yields a capital estimate of $4,125 million. The state and local labor ratio is .5764. Multiplying this by labor of $6,239 million yields a $3,596 million capital estimate. Their sum of $7,811 million is the final gross-of-tax and net-of-tax capital estimate for government enterprises.

Finally, we use an estimate of the subsidy to the government enterprises industry. Capital use is valued at $7,811 million, while the 1973 surplus of government enterprises (from tables 3.2 and 3.4 of the July *SCB*) totals only $1,601 million. The difference of $6,210 million is the implied subsidy on these operations. NID worksheets list a single indirect business tax of $78 million for this industry, so the final output tax attributed to it is −$6,132 million. When we divide this figure by the total demand for the output of the government enterprises industry ($22,564 million), we have a 27 percent rate of subsidy on the output of this industry. The effect of this negative output tax is to lower the output price faced by purchasers.

Purchases by government other than those for public enterprises are considered an element of final demand and are described in the next chapter.

4.8 Other Production Taxes

The NID has provided a worksheet with their estimates of the amount of each indirect business tax paid by each industry in 1973. Each of these taxes requires a model-equivalent treatment that matches as closely as possible the legal base, rates, and rules of the tax.

State and local sales taxes are represented by various rates of tax on consumption. We will discuss these taxes in chapter 5. The motor vehicles

Table 4.13 Production Taxes

	Gross Output[a] (1)	Output Taxes (2)	Rate of Output Tax (3)	Intermediate Use of Motor Vehicles (4)	Estimated Tax on Use of Motor Vehicles (5)
All industries	2,001,452.0	15,060	—	31,162.4	1,656.00
Agriculture, forestry, fisheries	113,923.6	68	.0006	42.4	2.25
Mining	14,641.1	73	.0050	25.3	1.34
Crude petroleum and gas	15,092.0	826	.0547	0.0	.00
Contract construction	136,826.1	334	.0024	10.3	.55
Food and tobacco	134,519.6	379	.0028	11.3	.60
Textiles, apparel, and leather	70.081.8	28	.0004	7.6	.40
Paper and printing	54,179.7	38	.0007	0.0	.00
Petroleum refining	37,570.1	4,202	.1118	7.6	.40
Chemicals, rubber, and plastics	80,409.2	926	.0115	115.1	6.12
Lumber, furniture, stone, clay, glass	61,893.9	24	.0004	66.8	3.55
Metals, machinery, instruments, and miscellaneous manufacturing	252,288.7	199	.0008	3,678.7	195.49
Transport equipment, and ordnance	30,810.5	81	.0026	824.0	43.79
Motor vehicles	64,530.0	629	.0097	20,239.0	1,075.53
Transportation, communications, and utilities	163,899.9	5,919	.0361	283.8	15.08
Trade	229,707.5	3,237	.0141	275.7	14.65
Finance and insurance	96,306.9	1,155	.0120	0.0	.00
Real estate	163,230.8	2,856	.0175	660.4	35.09
Services	258,976.7	218	.0008	4,861.9	258.37
Government enterprises	22,563.9	−6,132[b]	−.2718	52.5	2.79

[a]In millions of 1973 dollars, from the *I/O* table, after RAS method.

[b]As described in section 4.7, "Government Enterprises."

tax is treated as a tax on the use of one product by other producers, i.e., as a tax on intermediate inputs. We divide the total collection of $1,656 million among producers according to their use of motor vehicles. We use the updated 1973 input-output table to determine each industry's purchase of this input. These are shown in column (4) of table 4.13. The estimated motor vehicle tax paid is shown in column (5).

We include state public utility taxes as a tax on the output of the transportation, communications, and utilities industry. We model severance taxes as a tax on the outputs of two industries: mining, and petroleum and gas. We treat occupation and business taxes, other license fees, and other taxes as ad valorem taxes on the output of various industries. The same is true for nontax payments. This last category includes inspection fees, special assessments, fines, etc.

Federal excise taxes and customs duties are the only categories that require an adjustment from NID estimates. The NID attributes manufacturers' excise taxes to the appropriate industry, but some of retailers' excises and customs payments appear under retail and wholesale trade. We reallocate a portion of these latter taxes, since they are not taxes on the output of the trade industry. We perform this reallocation using table 3 of the 1974 *Annual Report of the Commissioner of Internal Revenue* (U.S. Department of the Treasury, IRS 1974).

The result of these procedures is shown in table 4.13, column (2), where the output tax is the sum of federal excises, public utility, severance, occupation, and business taxes, license fees, and nontax payments to government. The negative output tax on government enterprises represents the subsidy discussed in the last section. Column (1) of table 4.13 shows the gross value of output.[22] If we divide column (2) by column (1), we get the output tax rates in column (3).

22. These figures reflect our consistency procedures. We describe these consistency procedures in chapter 6. They ensure that gross output can be measured by the sum of inputs and production taxes in an industry, *or* by the sum of intermediate and final uses of the product.

Appendixes

Appendix A

Table 4.A.1 **Correspondences between Our Producer Goods and Bureau of Economic Analysis (BEA) Categories**

Classification of Rows		Corresponding Elements from Original Matrix	
Row Number of Aggregated Matrix	Industry	Code Number(s) from Original Matrix	Numerical Position of Row(s) in Original Matrix
1.	Agriculture, forestry, fisheries	1,2,3,4	/1,2,3,4
2.	Mining	5,6,7,9,10	/5,6,7,9,10
3.	Crude petroleum and gas	8	/8
4.	Contract construction	11,12	/11,12
5.	Food and tobacco	14,15	/14,15
6.	Textiles, apparel, and leather	16,17,18,19,33,34	/16,17,18,19,33,34
7.	Paper and printing	24,25,26	/24,25,26
8.	Petroleum refining	31	/31
9.	Chemicals, rubber, and plastics	27,28,29,30,32	/27,28,29,30,32
10.	Lumber, furniture, stone, clay, glass	20,21,22,23,35,36	/20,21,22,23,35,36
11.	Metals, machinery, instruments, and miscellaneous manufacturing	37,38,39,40,41, 42,43,44,45,46, 47,48,49,50,51, 52,53,54,55,56, 57,58,62,63,64, 82,83	/37,38,39,40,41, 42,43,44,45,46, 47,48,49,50,51, 52,53,54,55,56, 57,58,62,63,64, 82,83
12.	Transport equipment and ordnance	13,60,61	/13,60,61
13.	Motor vehicles	59	/59
14.	Transportation, communications, and utilities	65,66,67,68	/65,66,67,68

Table 4.A.1 (continued)

Classification of Rows		Corresponding Elements from Original Matrix	
Row Number of Aggregated Matrix	Industry	Code Number(s) from Original Matrix	Numerical Position of Row(s) in Original Matrix
15.	Trade	69	/69
16.	Finance and insurance	70	/70
17.	Real estate	71	/71
18.	Services	72,73,75,76,77,81	/72,73,74,75,76,81
19.	Government enterprises	78,79	/77,78
20.	Directly allocated imports	80A	/79
21.	Transferred imports	80B	/80
22.	Total intermediate inputs	I.	/88
23.	Special industries	84,85,86,87	/84,85,86,87

Classification of Columns		Corresponding Elements from Original Matrix	
Column Number of Aggregated Matrix	Industry	Code Number(s) from Original Matrix	Numerical Position of Column(s) in Original Matrix
1.	Agriculture, forestry, fisheries	1,2,3,4	/1,2,3,4
2.	Mining	5,6,7,9,10	/5,6,7,9,10
3.	Crude petroleum and gas	8	/8
4.	Contract construction	11,12	/11,12
5.	Food and tobacco	14,15	/14,15
6.	Textiles, apparel, and leather	16,17,18,19,33,34	/16,17,18,19,33,34
7.	Paper and printing	24,25,26	/24,25,26
8.	Petroleum refining	31	/31
9.	Chemicals, rubber, and plastics	27,28,29,30,32	/27,28,29,30,32
10.	Lumber, furniture, stone, clay, glass	20,21,22,23,35,36	/20,21,22,23,35,36
11.	Metals, machinery, instruments, and miscellaneous manufacturing	37,38,39,40,41, 42,43,44,45,46, 47,48,49,50,51, 52,53,54,55,56, 57,58,62,63,64, 82,83	/37,38,39,40,41, 42,43,44,45,46, 47,48,49,50,51, 52,53,54,55,56, 57,58,62,63,64, 81,82
12.	Transport equipment and ordnance	13,60,61	/13,60,61
13.	Motor vehicles	59	/59
14.	Transportation, communications, and utilities	65,66,67,68	/65,66,67,68
15.	Trade	69	/69
16.	Finance and insurance	70	/70
17.	Real estate	71	/71
18.	Services	72,73,75,76,77,81	/72,73,74,75,76,80
19.	Government enterprises	78,79	/77,78

Table 4.A.1 (continued)

Classification of Columns		Corresponding Elements from Original Matrix	
Column Number of Aggregated Matrix	Industry	Code Number(s) from Original Matrix	Numerical Position of Column(s) in Original Matrix
20.	Imports	80	/79
21.	Special industries	84,85,86,87	/83,84,85,86
22.	Total intermediate output	88	/87
23.	Personal consumption expenditures	91	/88
24.	Gross private fixed capital formation	92	/89
25.	Net inventory change	93	/90
26.	Net exports	94	/91
27.	Federal government purchases	97	/92
28.	Federal government purchases, defense	9710	/93
29.	Federal government purchases, nondefense	9720	/94
30.	State and local government purchases	98	/95
31.	State and local government purchases, education	9860	/96
32.	State and local government purchases, other	9899	/97
33.	Total final demand	9902	/98
34.	Total output	9903	/99
35.	Transfers out	9904	/100

Appendix B

Table 4.A.2 **Correspondences between Our Consumer Goods and Bureau of Economic Analysis (BEA) Categories (February 1974 *SCB*)**

Our Categories	Bureau of Economic Analysis Categories
Food	Food purchased for off-premises consumption
	Purchased meals and beverages
	Foor furnished to government and commercial employees
	Food produced and consumed on farms
Alcoholic beverages	(Subdivision of the food categories)
Tobacco	Tobacco products
Utilities	Electricity
	Gas
	Water and other sanitary services
	Telephone and telegraph
Housing	Owner-occupied nonfarm dwellings
	Tenant-occupied nonfarm dwellings
	Farmhouses
	Other housing

Table 4.A.2 (continued)

Our Categories	Bureau of Economic Analysis Categories
Furnishings	Furniture
	Other durable house furnishings
	Semidurable house furnishings
Appliances	Kitchen and other household appliances
	China, glassware, tableware
	Radio and TV receivers, musical instruments
Clothing and jewelry	Shoes and other footwear
	Women's and children's clothing
	Men's and boy's clothing
	Clothing issued to military personnel
	Jewelry and watches
	Other clothing, accessories, and jewelry
Transportation	Bridge, tunnel, ferry, and road tolls
	Street and electric railway and local bus
	Taxicabs
	Commuter railway
	Other railway
	Intercity bus
	Airline
	Other intercity transportation
Motor vehicles, tires, and auto repair	New and used cars
	Tires, tubes, accessories, and parts
	Automobile repair, greasing, washing, parking, storage, and rental
Services	Shoe cleaning and repair
	Cleaning and repair of garments
	Laundering
	Barbershops, beauty parlors
	Domestic service
	Other household operation
	Physicians
	Dentists
	Other professional service
	Legal service
	Funeral and burial expenses
	Other personal business
	Radio and TV repair
	Admissions to motion picture theaters
	Admissions to other theaters
	Admissions to spectator sports
	Clubs and fraternal organizations
	Commercial participant amusements
	Pari-mutuel net receipts
	Private higher education
	Private elementary and secondary schools
	Other private education and research
	Religious and welfare activities

Table 4.A.2 (continued)

Our Categories	Bureau of Economic Analysis Categories
Financial services	Health insurance
	Brokerage charges and investment counseling
	Bank service charges
	Services furnished without payment by financial intermediaries except insurance companies
	Expense of handling life insurance
	Automobile insurance premiums less claims paid
Recreation, reading, and miscellaneous	Books and maps
	Magazines, newspapers, and sheet music
	Nondurable toys and sports supplies
	Wheel goods, durable toys and sports equipment, boats, pleasure aircraft
	Flowers, seeds, and potted plants
	Other recreation
	Foreign travel by U.S. residents
Nondurable, nonfood household items	Toilet articles and preparations
	Cleaning and polishing preparations, household supplies
	Stationery and writing supplies
	Drug preparations and sundries
	Ophthalmic products and orthopedic appliances
Gasoline and other fuel	Other fuel and ice
	Gasoline and oil