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Constructing Data for Use in Applied General Equilibrium Models from the U.S. National Income and Product Accounts

An ERS Data Base

Arthur M. Wiese

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Abstract

[This report describes and illustrates a method by which a set of total accounts can be constructed from the U.S. National Income and Product Accounts (NIPA). These total accounts can be used in applied general equilibrium models. An appealing feature of the accounting system is that it allows a precise mapping of various components of the NIPA into the relevant markets with which they are associated. To the extent that this results in a more accurate representation of the initial state of the economy, the more reliable will be the results stemming from the imposition of economic models on the data.]

Keywords: National Income and Product Accounts, total accounts, net expenditure and tax tables, Keller model, applied general equilibrium models

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Constructing Data for Use in Applied General Equilibrium Models from the U.S. National Income and Product Accounts

An ERS Data Base

Arthur M. Wiese

Introduction

This report gives an overview of the structure of a U.S. specification of the Keller Applied General Equilibrium Model (KELUS) and documents a process of data base construction using the U.S. National Income and Product (NIPA) and Input-Output (I/O) Accounts. The data base can be used in the KELUS model as well as in other applied general equilibrium models (AGE). This modeling framework is particularly suited to analysis involving tax incidence, that is, the analysis of the distribution of the burden of taxation across agents in the economy. The report concludes with a brief description of the KELUS computer program.

Model Structure and Data Construction

An Overview of the Keller Applied General Equilibrium (KELUS) Model

The Keller model is well established in the economics literature. For a mathematical description of the model, see Keller (1980, pp. 283-289). A pictorial representation is given in figure 1 at the end of this report. In its most basic form, firms are assumed to maximize profits subject to their production technologies, and households are assumed to maximize utility subject to their budget constraints. Households supply factors to the market and demand goods while firms supply goods and demand factors.¹ Perfect competition is assumed in all markets. The fisc may intervene in any transaction between buyers and sellers by levying a tax or providing a subsidy.² The transaction taxes imposed on goods generate tax revenue. This tax revenue is returned as transfers to households using various rules of allocation. Supply and demand will react to the imposition of the tax(es) and the new equilibrium can be characterized as a vector of prices (and associated quantities) such that utilities and profits are maximized subject to their respective constraints, and all markets clear.

¹The terms firm and industry are used synonymously throughout this report.

²The fisc is defined as an autonomous government sector with the authority to impose various types of taxes and subsidies. Both transaction and lump-sum taxes can be modeled in this framework.

Various assumptions described above can be relaxed, for example, price rigidities, disequilibrium, and rationing can be introduced into the Keller model (Cornielje, 1990). Other appealing features of this model include its aggregation properties allowing for inspection of individual agent and aggregate elasticities. Hence, results are readily traceable to parametric assumptions at the industry and household levels.

Buyers and sellers can be classified into various groups, for example, industries, households, and government sectors. Industries can be further divided into sectors, like the industries of the input-output table. There is a fictitious capital goods sector in the model which buys the investment goods produced and imported by industries and transforms these into an aggregate capital good. This capital good is used by industries to replace depreciated capital, and also serves as the vehicle by which households save. Private household disaggregation is also possible, for example, by income class. The government sector is partitioned to reflect various functional roles which it plays in the economy. The fisc imposes taxes and makes transfers to other sectors, and two levels of government, Federal and State/local, which produce public goods.

Data Requirements and Construction

To calculate the effects of exogenous shocks, e.g. tax changes, the following information is needed: information describing the initial situation, i.e., expenditures on all goods both inclusive and exclusive of taxes for each sector; and information describing agents' marginal behavior. As discussed above, this report concerns itself with generating information characterizing the initial situation.

Information Describing the Initial Situation

The data requirements for many applied general equilibrium (AGE) models can be extensive. What is offered here is a method for the construction of a set of accounts (called net expenditure and tax tables³), first developed by Zeelenberg et al. (1989) and applied here to the U.S. National Income and Product Accounts (NIPA). Some general characteristics of the accounting system include the following: i) accounts of expenditures and receipts are constructed in an identical way for each sector of the economy; ii) all sector transactions are valued at sector prices; iii) to as great an extent as possible, taxes are associated with the market transactions to which they are related; iv) consistency with the NIPA Accounts is maintained; v) the results are easily incorporated into AGE models.

While from a modeling point of view, all the characteristics listed above are desirable, the third is critical since discriminant taxation changes relative prices and hence the production and consumption decisions made by agents in the economy. Unfortunately, the structure of the NIPA does not readily lend

³These two tables have also been referred to as the Total Accounts (Keller, 1980, p. 277).

itself to the attainment of this property.⁴ In the NIPA certain receipts from taxation are classified by paying entity: personal tax receipts, corporate profit tax, contributions for social insurance. In these cases, it is relatively easy to determine with which markets and agents these tax revenues are associated. For example, corporate profit taxes can be treated as a tax on capital services and the contributions for social insurance as a tax on labor services. Exceptions include indirect business taxes (IBT) and some employer contributions to privately administered programs, like health insurance. IBT's are a conglomeration of various types of taxes. Various excise taxes can be considered a tax on industry output, various property taxes as a tax on capital services, and various sales taxes as taxes actually levied on the demand side of commodity transactions. The accounting system presented here facilitates the process of mapping these types of taxes into the markets with which they are most appropriately associated. To the extent that this mapping results in a more accurate characterization of the initial state of the economy, the more reliable will be the results stemming from the imposition of economic models on the data.⁵

The information contained in net expenditure and tax tables describes an economy at a given point in time. Some general characteristics of the tables are described below. Table 1, found at the end of this report, contains the 1982 aggregated net expenditures for the U.S. economy. The columns of the table correspond to the sectors of the economy and the rows to the goods. There are seven sectors, excluding the fisc: the firm sector, the rest-of-the-world account (ROW), the capital goods sector, two public goods sectors (Federal and State/local governments), the foreign sector, and the private domestic household sector. There are six markets for the six goods in the economy corresponding to the rows: products of firms, capital goods, imported goods, labor services, proprietor services, and capital services. The accounts of the sectors are therefore represented by the columns of the table and are recorded in agents' prices. According to micro-economic convention, demand (expenditure) is recorded with a positive sign and supply (income) with a negative sign. There are two restrictions on the table. For each sector, outlay plus savings is equal to income.⁶ The sum of the columns is therefore zero. Also, sales of a good (including factors) are recorded exclusive of taxes and purchases inclusive of taxes. The difference between sales and purchases of a good therefore yields the total amount of transaction tax or subsidy levied on the good.

As an illustration, the firm account and product market are explained. Beginning with the firm account, firms have produced a total of \$2944.3

⁴For a discussion of the historical roots of the NIPA, see Carson (1975).

⁵For example, it is widely accepted that an accurate characterization of the economy is crucial for reliable AGE results (Keller, 1980, p. 294).

⁶Agents save by purchasing capital goods.

billion worth of output or product (net of intermediate output).⁷ In order to produce this output, firms have purchased the following goods; \$383.2 billion of capital goods; \$298.4 billion of imports; \$1579.3 billion of labor services; \$175.5 billion of proprietor services; and \$508.1 billion of capital services. From table 2, the tax table, the fisc has levied the following taxes on these transactions: \$72.2 billion on the production of products, \$8.6 billion of import duties, \$196.5 billion on labor services, and \$146.2 billion on capital services.

The sum of the elements in a column of table 1 represents expenditures above non-transfer income (denoted there as "Net expenditures on goods"). For firms, given the construction of the NIPA, this should equal zero, that is, output (net of intermediate demand) equals value added. "Transfer" (table 1) designates the amount of transfer necessary to cover net expenditures.

Turning to the product market, it shows that firms have received \$2,944 billion and the ROW \$91 billion from the sale of products. The capital goods sector has purchased \$497 billion of firm products (investment goods), the Federal Government \$159 billion, State and local governments \$154 billion, the foreign sector \$355 billion, and private domestic households \$1,890 billion. The tax table shows that the fisc has levied about \$21 billion on these transactions involving products, the net of a \$72 billion firm output tax and a \$51 billion subsidy on products to households.

A description of the remaining columns and rows is provided in the next section, which demonstrates how the NIPA and I/O accounts can be used to compute the expenditure and tax tables that have been partially explained above.

Construction of the Total Accounts from the NIPA and I/O Accounts

As discussed above, there are six goods in this aggregated system of accounts. For each of these goods a row must be computed for the net expenditure and tax table. This process is illustrated in tables 3 and 4 also found at the end of this report.

Products Block

This subsection explains and documents all nonzero entries in this block proceeding in a column-by-column fashion. Recall that the entries in the net expenditure table are expressed in prices faced by the sellers and buyers. Therefore all transaction taxes related to products must be included in the calculation of this row. Take the products of firms as an illustration. What determines the revenue of firms (net of intermediate sales) from sales of its products? As can be seen from table 3, the Federal and State/local governments and the rest-of-the-world sector (ROW) purchase \$314 billion of products,

⁷Documentation of the source of these numbers is provided in the next section.

private domestic households and ROW purchase \$2,050 billion, gross fixed capital formation of firms involves the purchase of \$520 billion, inventory change is -\$23 billion, and the foreign sector purchases \$355 billion of products.⁸

The indirect business tax (IBT) is the largest tax item associated with the production of products. In the NIPA it is treated as a tax liability chargeable to business expense in the calculation of profit-type income. Here, excise and sales taxes are associated with the product market and comprise the IBT category in tables 3 and 4, while property taxes are treated as taxes on capital services. Hence, also associated with the production and exchange of these products is a fraction (total IBT less customs duties less property taxes) of indirect business taxes of magnitude \$161 billion (table 3.5-- Indirect Business Tax and Nontax Accruals, *Survey of Current Business* (SCB), July 1986). Other taxes associated with the product market are an \$8.7 billion subsidy, "subsidy less current surplus of government enterprises" (table 3.1-- Government Receipts and Expenditure, SCB, July, 1986) and a \$14.3 billion tax, "business transfer payments" (table A--Summary National Income and Product Accounts, *The National Income and Product Accounts of the United States, 1929-82*).

The sum of all entries in the firm column of the product block in table 3 yields \$2,944 billion. It is net of the above-mentioned taxes and subsidies. According to the signing convention used here, the figure is preceded by a negative sign, supply (income) being so denoted. Note that this figure is also found in the (1,1) position of table 1.

The rest-of-the-world account (ROW) is explicitly designated here so as to leave the other accounts on a GDP basis. For example, in table 3, one finds in this column the value \$14.2 billion. This figure is negative as found in the PCE account of the 1982 Use Table (I/O accounts), since embedded in this account are expenditures by foreigners residing in the United States. Summing all elements of the PCE account in the Use Table thus gives domestic household expenditures of \$2,036 billion (as also found in table 3 of this report). Specification in this way allows the PCE account total to reflect only domestic demands. In an analogous way, an element in the export account of the 1982 Use Table has magnitude \$106 billion. This reflects income from U.S. factors located abroad. It is not associated with production or output of domestic firms. Therefore, it falls under the ROW column in table 3. In this way, firm output is specified on a GDP basis. The sum of the elements in the

⁸Taking the absolute value of the sum of the items through exports in the firm column of the product block of table 3 (\$3110.6 billion) and adding to this the sum of Federal and State/local governments use of labor services (\$337.4 billion) minus the imports of goods (\$289.7 billion) yields \$3158 billion as an estimate of Gross Domestic Product in 1982. This corresponds to the value obtained in column GNP of table 2 in the July 1991 *Survey of Current Business*. There GDP (\$3,158.5 billion) can be derived as value added (\$3,207.597 billion) less income associated with the rest-of-the-world (\$49.088 billion).

ROW column for products equals -\$91 billion and represents the "output" of this fictitious sector.

The two nonzero entries in the capital goods column of the product block are the column sums of the investment and inventory change vectors from the 1982 Use Table. As for the government accounts, the Federal Government purchases \$159 billion of products and State/local government \$154 billion of products. These figures are the sums of the corresponding final demand vectors also found in the 1982 Use Table. The foreign sector purchases \$355 billion of products, also obtained by summing the export column from the 1982 Use Table.

Turning attention to the private domestic household account, the consumption of products of magnitude \$2,036 billion has been explained above in the discussion of the ROW account. It is subject to various taxes and subsidies. As can be seen in table 4, a part of the \$161 billion of IBT associated with products (\$94 billion) falls on the demand side of the transaction in the form of various sales taxes. This partition was facilitated by table 3.5--Indirect Business Tax and Nontax Accruals (SCB, July 1986) which categorizes the IBT by type of tax. Also seen in table 4 in the private household account is a consumption subsidy of magnitude \$152 billion. The largest items comprising this subsidy are group health insurance of the amount \$87.8 billion, and \$15.6 billion of workers' compensation. The revenue for these components of the subsidy originates from items in the labor service's block (health insurance and workers' compensation) of table 4. These items are components of "Other Labor Income" (SCB, July 1986, table 6.13). The fisc uses the revenue from the contribution of firms to subsidize health insurance for private domestic households.

The utility of the accounting system with respect to the discussion in the previous paragraph is demonstrated with various components of the NIPA. For example, Other Labor Income (OLI) is a part of Compensation of Employees in the NIPA. A large part of OLI consists of employer contributions for employee health insurance (ECEHI). On the income side, this type of employee compensation is treated as part of the employee's wages in the NIPA. In other words, this nonmonetary compensation for labor services is treated as if it were a monetary compensation. On the expenditure side in the NIPA, this ECEHI is added to household purchases of health insurance and medical services. From a neoclassical modeling framework, such as utility maximization subject to a budget constraint, this treatment is problematic since it assumes that had the employee in reality been given the monetary equivalent of ECEHI, he/she would have purchased the equivalent amount of health insurance and medical services as found in the Personal Consumption Expenditures Account of the NIPA. This assumption is tenuous at best. For modeling purposes, the accounting system presented here provides a framework to treat this component, and others like it in the NIPA, in a more realistic way. In the case of the above example, it is argued that it is more appropriate to interpret employer-provided health insurance as a contribution from industry, the revenue of which is used to subsidize the purchase of health insurance and medical services by households. In this way, the nonmonetary compensation is not treated as if it were monetary compensation in the optimization problem of the household.

The smaller items that comprise this subsidy on products to private households, found in table 3.11--Government Transfer Payments to Persons (*SCB*, July 1986), are: \$31.7 billion for medical care, \$9.9 billion for food stamps, \$1.6 billion for energy assistance, and \$5 billion for education and job training and the "other" subcategory under public assistance. The sum of these components equals the total amount of subsidy on products which private domestic households face. Finally, the \$5.9 billion consumption tax is taken from two components in table 3.4 --Personal Tax and Nontax Receipts (*SCB*, July 1986): \$4.6 billion for motor vehicle licenses and \$1.3 billion for "other" taxes. An appealing feature here is that, in a disaggregate set of accounts, the items comprising this consumption subsidy can be associated with their appropriate markets and agents, for example, the market for foodstuffs and food stamps received by low-income households. In an AGE framework this allows for policy analysis involving very specific programs, for example, analyzing the household welfare effects of reducing or adding to the food stamp program.

Summing all items in the private domestic household column of the product block in table 4 shows them receiving a net subsidy of \$51 billion for consumption of products. The sum of the items in the private domestic household account in table 3 yields \$1,890 billion for the net expenditures on products by private households. These values correspond to those found in position (1,7) of tables 2 and 1, respectively.

The first row of table 1 has been computed via construction of the product block in table 3. Compare the first rows in tables 1 and 3. Summing across these rows shows the fisc receiving \$21 billion in transaction taxes associated with these products. In the same way, the first row of table 2 is computed by summing the elements of the product block in table 4. The second row of table 1 will now be derived via construction of the capital goods block.

Capital Goods Block

From table 3 it is seen that there are two rows comprising this block, depreciation and net savings. Firms demand \$383 billion of capital goods to replace worn out plant and equipment (table 1.10--Relation of GNP, Net National Product, and National Income in Constant Dollars, *SCB*, July 1986). The Federal Government borrows \$149 billion to cover its deficit (table 3.2--Federal Government Receipts and Expenditures, *SCB*, July 1986), State/local governments save \$28 billion (table 3.3--State and Local Government Receipts and Expenditures, *SCB*, July, 1986) and private domestic households save \$231 billion. Included in this latter figure are: \$153.9 billion of personal savings (table 2.1--Personal Income and Its Disposition, *SCB*, July, 1986); \$57.4 billion in pension premiums (table 6.13--Other Labor Income by Industry and Type, *SCB*, July, 1986); and \$20 billion in undistributed corporate profits (table 5.1--Gross Savings and Investment, *SCB*, July, 1986). From table 3, this savings by firms and all households allows capital formation of magnitude \$493 billion. The second row of table 1 has now also been derived.

Imports Block

From table 3, firms purchase \$289.7 billion (the sum of the import column of

the 1982 Use Table) of goods from the foreign sector to be used in their production processes. Import duties of \$8.6 billion, found on the wholesale commodity row of the import column of the 1982 Use Table, are levied on these transactions. The rest-of-the-world entry in the import account of the 1982 Use Table is -\$42 billion. This figure represents factor income generated by foreign-owned assets located within U.S. borders. Here it is found in the ROW account in table 3. In this way, imports of firms do not include this amount. See the discussion above relating to GDP vs GNP accounting. Total income flowing to the foreign sector is therefore \$332 billion.

The expenditures and receipts of the foreign sector as documented in table 3 imply that the foreign sector had a balance of payments with the United States of \$4 billion, that is, total payments to foreigners exceeded total payments from foreigners by this amount. This deficit in the current account is regarded as dissavings in the form of capital goods (see the import block of the capital good account in table 3). The capital goods are exported by the capital goods sector. The effect of this is to retard the availability of capital goods for use in the domestic economy.

Labor Services Block

Industry, inclusive of government enterprises, employed \$1,579 billion of labor services, found by summing the labor services row of the 1982 Use Table. Also from the 1982 Use Table, total government employment (Federal and State/local) of labor services totaled \$337 billion. These numbers are reported in table 3. Included in these aggregate amounts of employee compensation are items classified as other labor income (OLI) in the NIPA: \$57 billion for pension premiums, \$88 billion for health insurance, and \$16 billion for workers' compensation insurance. These components of OLI are partitioned by industry type (industry inclusive of government enterprises, and government) using table 6.13, SCB, July 1986. Contributions to social insurance are considered forced payments associated with labor use, and hence as a transaction tax on firms' and governments' labor use. Total employer contributions are \$157 billion (table 3.6, SCB, July, 1986). This is partitioned among industry (inclusive of government enterprises) and government using table 6.12, SCB, July 1986. Private households, receiving the income from labor services employed by industry, are subject to contributions for social service of magnitude \$105 billion (\$112.3 billion total personal contributions less \$6.8 billion for self-employed) (table 3.6, SCB, July 1986). The \$6.8 billion paid by the self-employed, is found in the Proprietor Services Block. Private households also pay personal income taxes (Federal and State/local) of magnitude \$348 billion (table 3.4, SCB, July, 1986). This is partitioned using shares of total factor income into: \$261 billion associated with labor services, \$29 billion with proprietor services, and \$58 billion with capital services. This completes the documentation of the labor service block.

Proprietor Services Block

Proprietor services income equals \$175 billion as reported in table 1.14, SCB, July 1986, and as shown in table 3. The income tax component and the contributions for social insurance were explained in the labor services block.

Capital Services Block

Capital services income is composed of net interest, rental income, and corporate profits.⁹ From table 6.17B--Net Interest by Industry, SCB, July 1986, net interest paid by domestic industries is \$249 billion, net interest paid by the rest-of-the-world is \$23 billion. Net interest paid by the Federal Government is \$85 billion (table 3.2--Federal Government Receipts and Expenditures, SCB, July 1986), net interest paid by State/local governments is -\$24 billion (table 3.3--State and Local Government Receipts and Expenditures, SCB, July 1986), and net interest paid by foreign governments is -\$12 billion (table 3.2--Federal Government Receipts and Expenditures, SCB, July 1986). Rental income is \$14 billion (table 1.14--National Income by Type of Income, SCB, July 1986), corporate dividends of domestic industry \$54 billion and of rest-of-the-world industries \$12 billion (table 6.22B--Net Corporate Dividend Payments by Industry, SCB, July 1986), and corporate dividends of \$3 billion accruing to State/local government (table 3.3--State and Local Government Receipts and Expenditures, SCB, July 1986). Undistributed corporate profits (net of the inventory valuation adjustment and capital consumption adjustment) are \$20 billion (table 1.14--National Income by Type of Income, SCB, July 1986). As explained in the capital goods block, these undistributed corporate profits are treated as a part of domestic household savings. Corporate profit taxes of magnitude \$63 billion (table 6.20B--Federal, State, and Local Corporate Profits Tax Liability by Industry, SCB, July 1986) and property taxes facing industry of magnitude \$83 billion (table 3.5--Indirect Business Tax and Nontax Accruals, SCB, July 1986) are considered taxes on the employment of capital services. As can be seen from table 3, private domestic households receive the income from net interest, rental income corporate dividends, and undistributed corporate profits (which they save), and are subject to personal income taxes and property and estate taxes of magnitude \$12 billion (table 3.4--Personal Tax and Nontax Receipts, SCB, July 1986). Derivation of the \$58 billion household income tax associated with capital services was covered in the labor services block.

Transfers

Summing the fisc column of table 3 yields total transaction tax revenue of \$908 billion. Summing each agent's account gives outlays over factor incomes, in other words, transfers. For example, transfers to private domestic households are seen to equal \$307 billion. The sum of these transfers exhausts the transaction tax revenue of the fisc. Of course, the sum of the fisc column of table 4 also yields \$908 billion as does the total tax revenue shown in tables 1 and 2.

The numerical values presented here in the net expenditure and tax tables depend on the interpretation of various items in the national accounts. While one may disagree with various interpretations given here, the objective was to demonstrate the method used to transform the national accounts into a set of accounts suitable for modeling purposes. This allows researchers to construct

⁹Corporate profits can be decomposed into corporate dividends and undistributed corporate profits.

accounts reflecting their own assumptions. Given the same interpretation of items within the national accounts, however, base data sets across researchers should be identical. Where they are different, differences should be readily traceable to differences in treatment of items there. Consistency with the national accounts is preserved and the method provides a set of accounts that can be readily incorporated into AGE models, i.e., firm and household cost and income shares are readily calculated from table 1 as are tax rates from tables 1 and 2.

Disaggregating the Expenditure and Tax Tables

It is often the case that a more disaggregate set of accounts is needed relative to those presented above. The current level of disaggregation, as shown in table 5 at the end of the report, allows for 33 production sectors (with detail given in the agricultural sectors), private domestic households delineated by 4 income classes, and Federal and State/local government sectors. Not shown there but worth noting is that labor services have been disaggregated by labor type: skilled and unskilled services labor; skilled and unskilled manual labor. Obvious examples include physicians and lawyers (skilled services labor), clerical (unskilled services labor), highly skilled production technicians (skilled manual), and laborers (unskilled manual labor). Documentation for the construction of the expanded tables, as well as the expanded data base, is available from Gerald Schluter (202) 219-0780 upon request.

Software

A U.S. version of the Keller AGE Model (KELUS) is programmed in two forms in the Gauss programming language. The first, a Gauss run-time module, makes it possible to execute a compiled Gauss program without having access to the Gauss software. There are benefits and costs of using this compiled program. On the one hand, one does not need the Gauss software (it can be executed directly from the operating system), and it may serve as an appropriate way to become familiar with KELUS. It may also be useful for teaching purposes since Gauss is not required, and the module is flexible enough to illustrate many principles of AGE modeling. On the other hand, modification of the code is not possible, nor is keyboard access to many intermediate variables calculated in reaching the final solution. The second type of software available is a normal Gauss program allowing for code modification and access to intermediate variables. Both forms are available from Gerald Schluter (202) 219-0780 upon request.

Conclusions

An accounting system was illustrated in this report that is capable of integrating the various components of the NIPA into a set of accounts for all sectors in the economy, called the Total Account. These Total Accounts are suitable for economic modeling, particularly in an applied general equilibrium framework. Appealing features of the accounting system include the explicit manner in which transaction taxes are associated with their appropriate markets and agents. In a set of disaggregated accounts, this facilitates the

analysis of changes in very specific government programs. As well, the accounting system is well suited to handle the nonmonetary transactions that exist in the NIPA accounts in an appropriate way, for example, employer-provided health insurance to employees.

References

- Ballard, C., D. Fullerton, J. Shoven, and J. Whalley, 1985. *A General Equilibrium Model for Tax Policy Evaluation*. University of Chicago Press.
- Carson, C., 1975. "The History of the United States National Income and Product Accounts: The Development of an Analytical Tool," *Review of Income and Wealth* 21:2 pp 153-181.
- Cornielje, O.J.C., 1990. "Rationing and Capital Mobility in Applied General Equilibrium Models," Ph.D. Dissertation, Vrije University of Amsterdam, VU University Press, Amsterdam.
- Eisner, R., 1985. "The Total Incomes System of Accounts," *Survey of Current Business* 65:1 pp 24-48.
- Hanson, K., and S. Robinson, 1991. "Data, Linkages, and Models: U.S. National Income and Product Accounts in the Framework of a Social Accounting Matrix," *Economic Systems Research* 3:3 pp 215-232.
- Hertel, T., E. Ball, K. Huang, and M. Tsigas, 1991. *Computing Farm Level General Equilibrium Demand Elasticities for Agricultural Commodities*, Research Bulletin 998 of the Agricultural Experiment Station, Purdue University.
- Keller, W. J., 1980. *Tax Incidence, A General Equilibrium Approach*. North Holland Publishing Co.
- King, B., 1988. "What is a SAM? A Layman's Guide to Social Accounting Matrices," in *Social Accounting Matrices: A Basis for Planning*, The World Bank, Washington, DC.
- Pyatt, G., 1985. "Commodity Balances and National Accounts: A SAM Perspective," *Review of Income and Wealth* 31:1 pp 155-169.
- Pyatt, G., and J. Round, 1988. *Social Accounting Matrices: A Basis for Planning*, The World Bank, Washington, DC.
- Rose, A., B. Eduardo, and P. Li, 1993. "Disaggregated Household Accounts for the ERS/USDA Social Accounting Matrix Database," unpublished manuscript, Department of Mineral Economics, Penn State University.
- Ruggles, R., and N. Ruggles, 1986. "The Integration of Macro and Micro Data for the Household Sector," *Review of Income and Wealth* 32:3 pp 245-276.
- Shoven, J., and J. Whalley, 1984. "Applied General Equilibrium Models of Taxation and International Trade," *Journal of Economic Literature* 22:3 pp 1007-1051.
- Stone, R., 1986. "Nobel Memorial Lecture 1984: The Accounts of Society," *Journal of Applied Econometrics* 1:1 pp. 5-28.

Stone, R., 1986. "Social Accounting: The State of Play," *Scandinavian Journal of Economics* 88:3 pp. 453-472.

U.S. Department of Commerce, Bureau of Economic Analysis, Interindustry Economics Division, 1982. *The Input-Output Tables of the U.S. Economy*.

U.S. Department of Commerce, Bureau of the Census, 1986. *Current Population Survey*.

U.S. Department of Commerce, July 1982, 1986, 1991. *National Income and Product Accounts, Survey of Current Business*.

U.S. Department of Commerce, Bureau of Economic Analysis 1986. *The National Income and Product Accounts of the United States, 1929-82*.

Young, A., and H. Stone-Tice, 1985. "An Introduction to National Economic Accounting," *Survey of Current Business* 65:3 pp 59-76.

Zeelenberg, C., R.D. Huigen, and P. Kooiman, 1989. "Total Accounts: An Accounting System for Applied General Equilibrium Analysis," in *CBS Select*, 5, Central Bureau voor de Statistiek, Voorburg, pp 25-40.

Table 1 -- Net expenditure table for the United States, 1982

Item	Firm	ROW	Cap good	Federal	State	Foreign	Priv. HH	Fisc	Total
					\$ billion				
Products	-2944.3	-91.3	496.9	159.5	154.1	355.2	1890.5	-20.7	0.0
Capital goods	383.2	0.0	-492.8	-149.5	28.1	0.0	231.1	0.0	0.0
Imports	298.4	42.2	-4.0	0.0	0.0	-327.9	0.0	-8.6	0.0
Labor service	1579.3	0.0	0.0	116.6	220.8	0.0	-1289.8	-626.8	0.0
Proprietor service	175.5	0.0	0.0	0.0	0.0	0.0	-139.4	-36.1	0.0
Capital service	508.0	49.0	0.0	84.6	-27.3	-12.3	-385.8	-216.1	0.0
Net exp. on goods	0.0	0.0	0.0	211.1	375.6	15.0	306.6	-908.4	0.0
Transfer	0.0	0.0	0.0	-211.1	-375.6	-15.0	-306.6	908.4	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sources: NIPA, Survey of Current Business, July 1986, IO Tables, BEA 1982

Table 2 -- Tax table for the United States, 1982

Item	Firm	ROW	Cap good	Federal	State	Foreign	Priv. HH	Fisc	Total
					\$ billion				
Products	72.2	0.0	0.0	0.0	0.0	0.0	-51.5	-20.7	0.0
Capital goods	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Imports	8.6	0.0	0.0	0.0	0.0	0.0	0.0	-8.6	0.0
Labor service	196.5	0.0	0.0	22.2	42.0	0.0	366.2	-626.8	0.0
Proprietor service	0.0	0.0	0.0	0.0	0.0	0.0	36.1	-36.1	0.0
Capital service	146.2	0.0	0.0	0.0	0.0	0.0	70.0	-216.1	0.0
Transaction tax	423.5	0.0	0.0	22.2	42.0	0.0	420.8	-908.4	0.0
Transfer	0.0	0.0	0.0	-211.2	-375.6	-15.0	-306.6	908.4	0.0
Total	423.5	0.0	0.0	-189.0	333.6	-15.0	114.2	0.0	0.0

Sources: NIPA, Survey of Current Business, July 1986; IO tables, BEA, 1982

Table 3 -- Correspondence of the net expenditure table to the NIPA, 1982

Item	Firm	ROW	Cap good	Federal	State	Foreign	Priv. HH	Fisc	Total
\$ billion									
1 PRODUCTS	-2944.3	-91.3	496.9	159.5	154.1	355.2	1890.5	-20.7	0.0
Government consumption	-314.1	0.6	0.0	159.5	154.1	0.0	0.0	0.0	0.0
Household consumption	-2050.4	14.2	0.0	0.0	0.0	0.0	2036.2	0.0	0.0
Capital formation	-520.0	0.0	520.0	0.0	0.0	0.0	0.0	0.0	0.0
Inventory change	23.1	0.0	-23.1	0.0	0.0	0.0	0.0	0.0	0.0
Exports	-249.2	-106.0	0.0	0.0	0.0	355.2	0.0	0.0	0.0
Indirect business taxes	160.8	0.0	0.0	0.0	0.0	0.0	0.0	-160.8	0.0
Consumption taxes	0.0	0.0	0.0	0.0	0.0	0.0	5.9	-5.9	0.0
Consumption subsidies	0.0	0.0	0.0	0.0	0.0	0.0	-151.6	151.6	0.0
SLCSGE*	-8.7	0.0	0.0	0.0	0.0	0.0	0.0	8.7	0.0
Business transfer payment	14.3	0.0	0.0	0.0	0.0	0.0	0.0	-14.3	0.0
2 CAPITAL GOODS	383.2	0.0	-492.8	-149.5	28.1	0.0	231.1	0.0	0.0
Depreciation	383.2	0.0	-383.2	0.0	0.0	0.0	0.0	0.0	0.0
Net savings	0.0	0.0	-109.7	-149.5	28.1	0.0	231.1	0.0	0.0
3 IMPORTS	298.4	42.2	-4.0	0.0	0.0	-327.9	0.0	-8.6	0.0
Goods	289.7	42.2	0.0	0.0	0.0	-331.9	0.0	0.0	0.0
Balance of payments	0.0	0.0	-4.0	0.0	0.0	4.0	0.0	0.0	0.0
Import duties	8.6	0.0	0.0	0.0	0.0	0.0	0.0	-8.6	0.0
4 LABOR SERVICES	1579.3	0.04	0.0	116.6	220.8	0.0	-1289.8	-626.8	0.0
Firm labor wages	1330.3	0.04	0.0	0.0	0.0	0.0	-1330.3	0.0	0.0
Government labor wages	0.0	0.0	0.0	92.7	175.5	0.0	-268.2	0.0	0.0
Income taxes	0.0	0.0	0.0	0.0	0.0	0.0	260.7	-260.7	0.0
Contribution to social insur.	100.6	0.0	0.0	19.6	37.1	0.0	105.5	-262.7	0.0
Pension premiums	52.5	0.0	0.0	1.7	3.2	0.0	-57.4	0.0	0.0
Health insurance	80.2	0.0	0.0	2.6	4.9	0.0	0.0	-87.8	0.0
Workers' compensation	15.6	0.0	0.0	0.0	0.0	0.0	0.0	-15.6	0.0
5 PROPRIETOR SERVICE	175.5	0.0	0.0	0.0	0.0	0.0	-139.4	-36.1	0.0
Entrepreneur income	175.5	0.0	0.0	0.0	0.0	0.0	-175.5	0.0	0.0
Income taxes	0.0	0.0	0.0	0.0	0.0	0.0	29.3	-29.3	0.0
Contribution to social insur.	0.0	0.0	0.0	0.0	0.0	0.0	6.8	-6.8	0.0
6 CAPITAL SERVICES	507.9	49.0	0.0	84.6	-27.3	-12.3	-385.8	-216.2	0.0
Net interest	249.1	23.2	0.0	84.6	-24.4	-12.3	-320.2	0.0	0.0
Rental income	13.6	0.0	0.0	0.0	0.0	0.0	-13.6	0.0	0.0
Corporate dividends	54.3	12.5	0.0	0.0	-2.9	0.0	-64.0	0.0	0.0
Undistrib. corporate profits	20.0	0.0	0.0	0.0	0.0	0.0	-20.0	0.0	0.0
Corporate profit tax	63.1	0.0	0.0	0.0	0.0	0.0	0.0	-63.1	0.0
Income tax	0.0	0.0	0.0	0.0	0.0	0.0	58.4	-58.4	0.0
Property tax	83.1	0.0	0.0	0.0	0.0	0.0	11.6	-94.7	0.0
Residual	24.7	13.3	0.0	0.0	0.0	0.0	-38.0	0.0	0.0
TRANSFER	0.0	0.0	0.0	211.1	375.6	15.0	306.6	-908.4	0.0

*Subsidy Less Current Surplus of Government Enterprise

Sources: NIPA, Survey of Current Business July 1986; IO Tables BEA, 1982

Table 4 -- Correspondence of the tax table to the NIPA, 1982

Item	Firm	ROW	Cap good	Federal	State	Foreign	Priv. HH	Fisc	Total
					\$ billions				
1 PRODUCTS	72.2	0.0	0.0	0.0	0.0	0.0	-51.5	-20.7	0.0
Indirect business taxes	66.6	0.0	0.0	0.0	0.0	0.0	94.2	-160.8	0.0
Consumption taxes	0.0	0.0	0.0	0.0	0.0	0.0	5.9	-5.9	0.0
Consumption subsidies	0.0	0.0	0.0	0.0	0.0	0.0	-151.6	151.6	0.0
SLCSGE*	-8.7	0.0	0.0	0.0	0.0	0.0	0.0	8.7	0.0
Business transfer payment	14.3	0.0	0.0	0.0	0.0	0.0	0.0	-14.3	0.0
2 CAPITAL GOODS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 IMPORTS	8.6	0.0	0.0	0.0	0.0	0.0	0.0	-8.6	0.0
Import duties	8.6	0.0	0.0	0.0	0.0	0.0	0.0	-8.6	0.0
4 LABOR SERVICE	196.5	0.0	0.0	22.2	42.0	0.0	366.2	-626.8	0.0
Income taxes	0.0	0.0	0.0	0.0	0.0	0.0	260.7	-260.7	0.0
Contrib. to social insurance	100.6	0.0	0.0	19.6	37.1	0.0	105.5	-262.7	0.0
Workers' compensation	15.6	0.0	0.0	0.0	0.0	0.0	0.0	-15.6	0.0
Health insurance	80.2	0.0	0.0	2.6	4.9	0.0	0.0	-87.8	0.0
5 PROPRIETOR SERVICE	0.0	0.0	0.0	0.0	0.0	0.0	36.1	-36.1	0.0
Income taxes	0.0	0.0	0.0	0.0	0.0	0.0	29.3	-29.3	0.0
Contrib. to social insurance	0.0	0.0	0.0	0.0	0.0	0.0	6.8	-6.8	0.0
6 CAPITAL SERVICE	146.2	0.0	0.0	0.0	0.0	0.0	70.0	-216.1	0.0
Income taxes	0.0	0.0	0.0	0.0	0.0	0.0	58.4	-58.4	0.0
Property taxes	83.1	0.0	0.0	0.0	0.0	0.0	11.6	-94.7	0.0
Corporate profits tax	63.1	0.0	0.0	0.0	0.0	0.0	0.0	-63.1	0.0
TOTAL	423.4	0.0	0.0	22.2	42.0	0.0	420.8	-908.4	0.0

*Subsidy Less Current Surplus of Government Enterprises

Sources: NIPA, Survey of Current Business, July 1986; 10 Tables, BEA, 1982

Table 5 -- Industry and household aggregations

Sector	Sector description	BEA I/O Code
1. dairy/poultry	dairy and poultry farm products	1.01 1.02
2. livestock	animals and misc. livestock	1.03
3. cotton	cotton	2.01
4. foodgrn	wheat, rice and other	2.0201
5. feedcrp	corn and other feedcrops, hay	2.0202
6. oilcrops	soybeans and other oilseed crops	2.06
7. sugar	cane and sugarbeets	2.0502
8. othcrop	tobacco, fruits, tree nut, vegetables	2.0203 2.03
	misc. crops, nursery	2.04 2.0501 2.0503 2.07
9. meatmfg	red meat, poultry, egg processing	14.01
10. dairymfg	dairy processing	14.02-14.06
11. grain/feed mfg	flour and oth. grain mill products, prepared feed	14.14 14.1501 14.1502 14.16 14.1802 14.31
12. cornmill	wet corn milling	14.17
13. sugarmfg	sugar processing	14.19
14. oilmill	oilseed mills	14.24-14.27 14.29
15. miscfood	packaged foods and beverages	14.07-14.13 14.1801 14.20-14.23 14.28 14.30 14.32
16. resourse	forestry, fisheries and mining	3 5-7 - 10
17. pet-crud	crude oil and natural gas	8
18. construction	construction and maintenance	11-12
19. pet-ref	petroleum refineries	31
20. chem-rub	chemical and rubber products	27-30 32
21. othndmfg	tobacco, textiles, paper, printing	15-19 24-26 33-34
22. othdmfg	wood, glass, stone, misc. products	20-23 35-36 64
23. metalmfg	metal products	37-42
24. machinery	machinery	13 43-50
25. oth-elec	export intensive elec. equipment	51.0101 52-53
	e.g. industrial equipment	55 56.03-56.04 57.01 57.03 62
26. cons-elec	import intensive elec. equipment	51.0102-51.0104
	e.g. for household use	54 56.01 56.02 57.02 58 63
27. trns-eqp	motor vehicles and aircraft	59-61
28. elec-gas util	electric and gas utilities	68
29. trd-trn	trade and transportation	65 69
30. finance	finance and real estate	70-71
31. services	services, govn. enterprises, hhold industries	4 66-67 72-82 84
32. row industry	fictitious industry tracking cross-border income flows	
33. capital goods industry	capital goods production	

Note: The BEA I/O code can be found in Survey of Current Business, Vol. 71, No. 7, July 1991.

Household Aggregation

Household 1) Federal Govn.	Household 2) State Govn.	Household 3) < \$20,000	Household 4) \$20,000 - \$49,999
Household 5) \$50,000 - \$75,000	Household 6) \$75,000+	Household 7) Foreign	

Figure 1

Structure of the Keller model

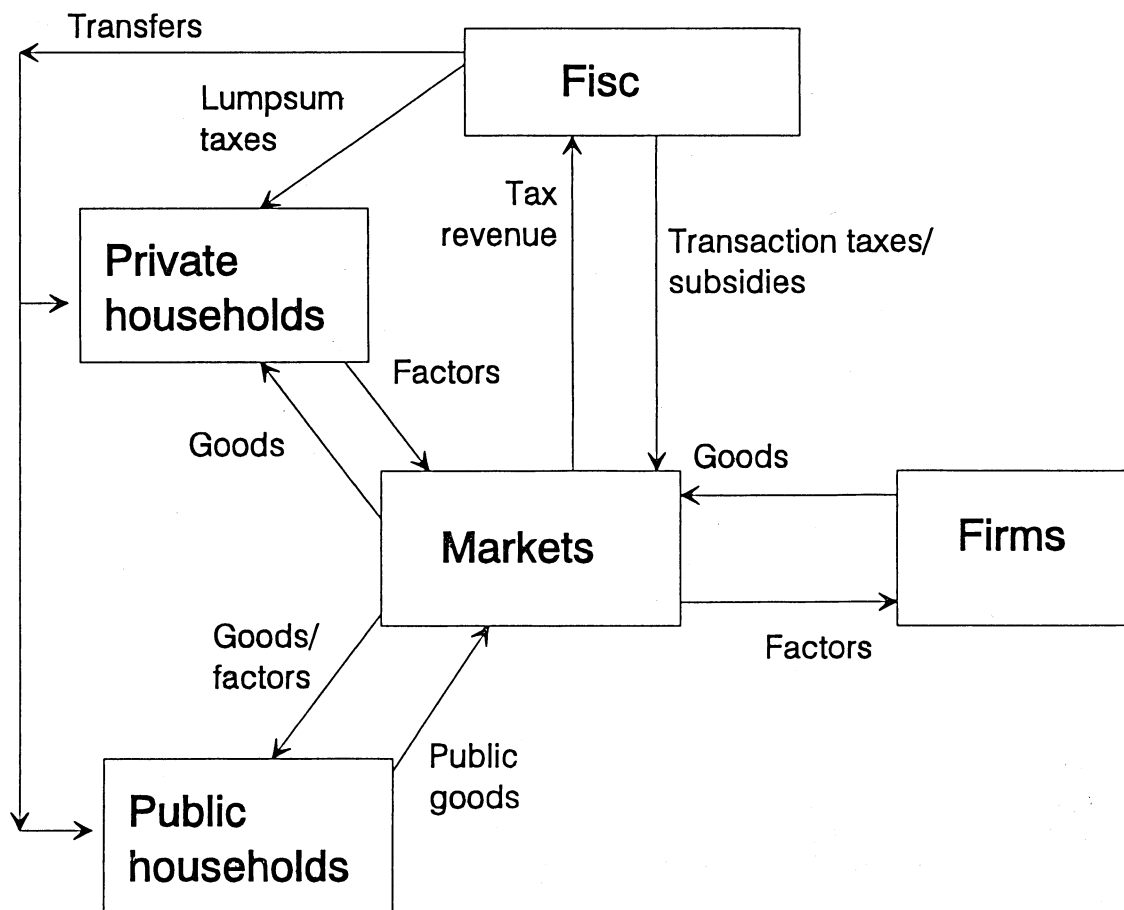


Figure 1

Structure of the Keller model

