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RELATIVE INCOME DETERMINATION IN THE UNITED STATES: A SOCIAL ACCOUNTING PERSPECTIVE

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The disaggregated nature of a Social Accounting Matrix makes it a suitable tool for studying the income generation process and its distributional effects. Using the linear structure of a SAM, a model for distributional analysis is developed. The proposed approach emphasizes the functional determinants of relative incomes and the underlying structural features of income distribution and redistribution.

1. INTRODUCTION

Social accounting methods provide a comprehensive framework for studying the composition of national income. The institutional structure of the social accounts represent, via the social accounting matrix (SAM), a detailed itemization of the sources and destinations of income flows throughout the economy. The SAM framework also reconciles the two main sources of economy-wide income information, national income and product accounts, which reflect macroeconomic aggregates, and input-output accounts, which reflect the composition of production. Such an accounting perspective, at once disaggregated and closed-form, gives a more detailed and complete model of income determination than has been obtained by traditional macroeconomic or input-output methods.

The disaggregated nature of the SAM framework makes it attractive for distributional studies. Its tableau format emphasizes economic linkages, revealing the complex underlying structure of income determination. The growing literature on SAM-based multiplier models is promoting a more structural analysis of the determinants of nominal income, but modeling of relative incomes has received less attention. It is shown in this paper that the SAM can be articulated into a detailed model of relative income determination. Using the simple linear structure of the SAM, a distribution analysis is developed with particular emphasis on the

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functional determinants of relative incomes, the underlying structural features of income distribution and redistribution.

The paper begins with a formal model of relative income determination, followed by an empirical application to the United States. Section 2 sets out a general model of income distribution and restates it in a linear framework. A brief description of the main traits of the 1989 Social Accounting Matrix of the United States is presented in Section 3. In Section 4 distribution analysis is applied to the 1989 SAM to study the effects of exogenous inflows on sectoral, factor, and household incomes. These results indicate significant institutional asymmetries in the process by which the economic structure transmits income effects. Such asymmetries can have an important influence on the ultimate distributional outcomes of economic policy decisions.

2. Modeling Relative Income Effects

To state the problem of income determination in a general way, consider an economic model of the form

$$Y = F(x), \tag{1}$$

where Y is a vector of nominal incomes for endogenous institutions and x is a vector of exogenous variables affecting incomes via a continuously differentiable equilibrium relationship F. This yields a differential model,

$$dY = D_x F(x)\, dx \tag{2}$$

measuring nominal income changes resulting from exogenous shocks, which underlies most comparative static and multiplier based analyses. The present discussion focuses on income distribution, and for this expressions (1) and (2) must be normalized to yield

$$y = f(x) = F(x)[e'F(x)]^{-1} \tag{3}$$

with e' being a unitary row vector, and

$$\begin{aligned} dy &= D_x f(x)\, dx \\ &= \{D_x F(x) - F(x)(e'D_x F(x))[e'F(x)]^{-1}\}[e'F(x)]^{-1}\, dx \\ &= [e'F(x)]^{-1}\{I - [e'F(x)]^{-1}F(x)e'\}D_x F(x)\, dx \\ &= R(x)\, dx, \end{aligned} \tag{4}$$

where $D_x F(x)$ denotes the Jacobian matrix for F. The matrix $R(x)$ is termed the redistribution matrix. It determines the ultimate distribution of relative incomes resulting from exogenous shocks or inflows dx. It is apparent from the third line of expression (4) above, that $R(x)$ is a combination of multiplier effects [a multiplier matrix $D_x F(x)$], an indempotent projection operator (onto the simplex $e'z = e'Y$), and a normalization to the unit simplex. This composite operation is illustrated in Figure 1 below for two endogenous institutions.

In the diagram, $Y \rightarrow Y'$ indicates the multiplier effect, $Y' \rightarrow Y''$ the projection, and $Y'' \rightarrow y'$ the normalization. The SAM can be articulated into a linear economic

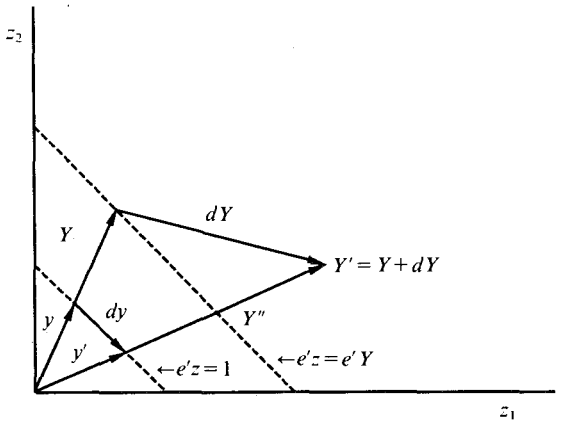

Figure 1. Decomposition of Income Redistribution

model using its accounting (row and column sum) identities. Consider a SAM which tabulates income and expenditure flows for $n = m + k$ institutions, m of which are designated as endogenous, k exogenous. Denoting vectors of total income by z_m and z_k, respectively, this yields the accounting identities

$$\begin{pmatrix} z_m \\ z_k \end{pmatrix} = \begin{pmatrix} A_{mm} & A_{mk} \\ A_{km} & A_{kk} \end{pmatrix} \begin{pmatrix} z_m \\ z_k \end{pmatrix} \tag{5}$$

where A_{ij} denote submatrices of column normalized or expenditure share coefficients. The first subgroup of these identities corresponds to a linear model of endogenous income determination of the form

$$\begin{aligned} Y = z_m &= A_{mm} z_m + A_{mk} z_k \\ &= (I - A_{mm})^{-1} A_{mk} z_k = Mx = F(x), \end{aligned} \tag{6}$$

where $x = A_{mk} z_k$ is a vector of exogenous injections and M is a matrix of multipliers. This corresponds to a redistribution model of the form

$$\begin{aligned} dy &= [e'Mx]^{-1}\{I - [e'Mx]^{-1}(Mx)e'\}M\,dx \\ &= \frac{1}{e'Y}\left[I - \frac{Y}{e'Y}e'\right]M\,dx = R(x)\,dx. \end{aligned} \tag{7}$$

To examine redistributional effects more closely, consider the form of an individual element R_{ij}, i.e.

$$R_{ij} = \frac{1}{e'Y}\left[M_{ij} - \frac{Y_i}{e'Y}e'M_{\cdot j}\right], \tag{8}$$

where $M_{\cdot j}$ stands for the j-th column of M. The sign of a given R_{ij} depends on the terms in brackets, i.e.

$$R_{ij} \gtrless 0 \quad \text{as} \quad \frac{M_{ij}}{e'M_{\cdot j}} \gtrless \frac{Y_i}{e'Y}. \tag{9}$$

In words, these inequalities mean that an injection to institution j will be beneficial

to institution i if i's share of the multiplier gains exceeds its initial share of nominal income.[1] Otherwise, agent i will gain less nominal income on average, losing ground in the income distribution, and the bilateral linkage will be detrimental when j receives an exogenous inflow. For exogenous government expenditure, these beneficial and detrimental links are analogous to progressive and regressive fiscal effects.

3. Data Base for the United States

Social accounting methodology has been applied in over fifty countries.[2] Its compatibility with the United Nations System of Accounts makes it appealing for comparative work and studies of countries with limited domestic data resources.[3] The international standards for social accounts may actually have hindered assimilation of SAM methods into U.S. policy work, where the NIPA and input-output accounting conventions are well-established. SAM methodology is not incompatible with these, however, and indeed it generalizes and largely reconciles the two.

The SAM used in this study displays the structure of the U.S. economy in 1989 and was designed to reveal the rich structural information which can be obtained with the accounting device. The choice of institutions was made with reference to the three major components of income: production, factor payments, and demand.[4] The three main closure components of economy-wide models are also represented here in the form of government expenditure and finance, savings-investment flows, and international trade accounts. The production structure of the economy is represented by ten SIC industry accounts that were chosen to match the standard ten sector classification used by the U.S. Department of Commerce, so the SAM is reconciled with published National Income and Product Accounts.[5] Factors of production consist of six occupational labor categories, productive capital, and other productive property. Occupational categories are the same as those used by the U.S. Bureau of Labor Statistics.[6] Four household types and three enterprise institutions are the final income recipients and their consumption behavior closes the real side of the endogenous economy.

The government institution accounts for revenue, expenditure, and public borrowing. Revenue sources include indirect taxes, income taxes, and contributions to social insurance. Expenditures include sectoral commodity purchases, transfers, and financial activity. The capital or flow-of-funds account details the disposition of annual savings and investment in the economy. Commodity and capital flows between the United States and the Rest of the World are detailed in the last accounting group. The resulting SAM is balanced (equal row and

[1] In the Keynesian multiplier model, marginal effects are always positive, so the above ratios are well-defined and the inequality between marginal and average shares depends only on absolute values.

[2] For a Survey of SAM applications, see Pyatt and Round, 1985.

[3] Both the SNA (United Nations, 1968) and SAMs received their principal impetus from Sir Richard Stone. See R. F. Stone, 1981.

[4] The labels used in the table are defined in the Appendix.

[5] See, e.g. U.S.D.O.C., 1983.

[6] See, e.g. U.S.B.L.S., 1983.

column, income and expenditure, totals for every institution) and is based on 1989 data from the National Income and Product Accounts, Department of Interior Input-output Tables, and Federal Reserve Flow-of-Funds Accounts.[7]

4. Income Distribution and Redistribution in the United States

The redistribution mechanism can be studied in the SAM-based linear framework by direct computation of the matrix $R(x)$. The set of institutions in the reference 1989 SAM is exhaustive, in the sense that all of national product is represented. The institutions are not mutually exclusive, however, so there is multiple accounting for economic activity and the grand total exceeds national income. These two properties are common in SAM applications. The former is essential for consistency, the latter inconsequential but often unavoidable. Choice of institutional categories is largely at the discretion of the practitioner, subject to accounting for all of national income and availability of data by institution type. In the present case, a variety of alternative endogenous groups were chosen to emphasize the flexibility of the SAM approach and to indicate how distributional results depend upon the classification of income categories. In particular, three types of endogenous groups are used to give different perspectives on income distribution: the composition of the value of output, of the rewards to factors of production, and of household and enterprise incomes. Each of these perspectives are taken in turn for comparison and contrast.

4.1. *Redistribution and the Composition of National Product*

The first perspective on income distribution considers the composition of the value of national product, or the value of sales or income accruing to domestic productive sectors. Redistribution in this context means shifting rewards to different sectoral activities in the economy. How investment, government, and export demand affect the relative incomes of different productive sectors has important implications for industrial policy.[8] Table 1 presents the results on sectoral relative income effects of exogenous commodity demand. To calculate the redistribution structure for industries, as it arises from commodity demand, we begin with the submatrix of SAM multipliers corresponding to the ten industry classification. These multipliers are accompanied by summary measures of transmission effects. The column label "Ave" indicates the average sensitivity of each industry's income to exogenous inflows at the ten industries. This gives a general indication of the effect on the industry of a uniformly distributed unit flow. The next three columns are computed as averages of multipliers in each row, weighted by the composition of 1989 investment, government, and international inflows to the ten endogenous industries. These correspond to the total multiplier effect on a given industry of a one unit rise in exogenous inflows from each source,

[7]U.S.D.O.C. and U.S.B.L.S., op. cit., U.S. Dept. of Forestry, 1980, and Federal Reserve B.O.G., 1983. A more detailed discussion and documentation of data and procedures used to construct this SAM, as well as the SAM itself, are available upon request.

[8]This type of analysis is similar in nominal terms to input-output analysis, but here relative effects are emphasized and the SAM framework captures more extensive income-expenditure linkages.

TABLE 1

REDISTRIBUTION AND THE COMPOSITION OF NATIONAL OUTPUT

Multiplier Submatrix

		1	2	3	4	5	6	7	8	9	10	Ave	Gov	Inv	ROW
1	Agric	1.25	0.03	0.06	0.15	0.05	0.04	0.05	0.04	0.06	0.05	0.18	0.07	0.05	0.14
2	Mining	0.04	1.10	0.05	0.13	0.04	0.08	0.04	0.03	0.04	0.04	0.16	0.05	0.05	0.08
3	Construc	0.04	0.06	1.05	0.05	0.05	0.08	0.05	0.07	0.05	0.06	0.16	0.17	0.53	0.05
4	NDurmfg	0.47	0.20	0.43	1.67	0.37	0.34	0.34	0.29	0.45	0.39	0.50	0.46	0.41	0.65
5	Durmfg	0.20	0.17	0.55	0.25	1.58	0.23	0.21	0.20	0.27	0.26	0.39	0.45	0.91	0.85
6	TrComm	0.17	0.12	0.23	0.23	0.20	1.28	0.22	0.17	0.23	0.23	0.31	0.27	0.23	0.33
7	Commerce	0.25	0.16	0.43	0.28	0.27	0.24	1.25	0.22	0.29	0.29	0.37	0.31	0.42	0.27
8	Finance	0.34	0.25	0.39	0.33	0.31	0.34	0.40	1.49	0.42	0.43	0.47	0.42	0.38	0.37
9	Services	0.41	0.31	0.64	0.48	0.46	0.47	0.61	0.48	1.65	0.58	0.61	0.65	0.56	0.59
10	Pub Admin	0.03	0.02	0.05	0.05	0.04	0.04	0.05	0.05	0.05	1.04	0.14	0.59	0.05	0.05
	Total	3.23	2.42	3.85	3.61	3.37	3.15	3.23	3.04	3.50	3.38				

Redistributed Income (Billions)

		1	2	3	4	5	6	7	8	9	10	Ave	Gov	Inv	ROW
1	Agric	1.18	−0.03	−0.03	0.07	−0.03	−0.03	−0.02	−0.02	−0.02	−0.02	0.10	−0.01	0.02	−0.01
2	Mining	−0.01	1.07	−0.01	0.07	−0.01	0.03	−0.02	−0.02	−0.01	−0.01	0.11	−0.01	0.04	0.01
3	Construc	−0.17	−0.09	0.79	−0.18	−0.17	−0.13	−0.16	−0.13	−0.18	−0.16	−0.06	−0.05	−0.16	−0.08
4	NDurmfg	0.01	−0.14	−0.13	1.15	−0.12	−0.11	−0.12	−0.15	−0.05	−0.10	0.02	−0.03	0.49	−0.09
5	Durmfg	−0.38	−0.27	−0.15	−0.40	0.97	−0.34	−0.37	−0.36	−0.37	−0.35	−0.20	−0.17	−0.36	−0.33
6	TrComm	−0.08	−0.08	−0.08	−0.06	−0.06	1.03	−0.03	−0.07	−0.05	−0.04	0.05	0.00	0.37	0.19
7	Commerce	−0.08	−0.09	0.03	−0.10	−0.08	−0.08	0.92	−0.09	−0.08	−0.06	0.03	−0.04	−0.07	0.39
8	Finance	−0.08	−0.07	−0.11	−0.14	−0.12	−0.07	−0.01	1.10	−0.03	−0.01	0.05	−0.02	−0.01	0.10
9	Services	−0.20	−0.16	−0.10	−0.21	−0.18	−0.13	0.00	−0.10	0.98	−0.06	−0.01	0.00	−0.14	−0.05
10	Pub Admin	−0.19	−0.15	−0.22	−0.20	−0.19	−0.18	−0.17	−0.16	−0.20	0.81	−0.09	0.35	−0.19	−0.13
	Total Effect	1.19	1.07	0.83	1.29	0.97	1.06	0.92	1.10	0.98	0.81	1.02	1.00	1.00	1.01

Redistribution Shares (Percent)

		1	2	3	4	5	6	7	8	9	10
1	Agric	99	−3	−4	5	−3	−3	−3	−2	−2	−3
2	Mining	−1	100	−2	5	−1	3	−2	−2	−1	−2
3	Construc	−14	−9	96	−14	−18	−12	−18	−11	−18	−19
4	NDurmfg	1	−14	−15	89	−12	−10	−13	−13	−5	−12
5	Durmfg	−32	−25	−18	−31	100	−32	−40	−32	−38	−43
6	TrComm	−7	−7	−9	−4	−7	97	−4	−7	−5	−5
7	Commerce	−7	−9	4	−7	−8	−8	100	−9	−8	−7
8	Finance	−6	−6	−13	−11	−13	−6	−2	100	−3	−1
9	Services	−17	−15	−12	−16	−18	−12	0	−9	100	−8
10	Pub Admin	−16	−14	−27	−16	−20	−17	−19	−15	−20	100

Redistribution Elasticities—Overall

		1	2	3	4	5	6	7	8	9	10
1	Agric	0.193	−0.001	−0.066	0.051	−0.082	−0.013	−0.008	−0.005	−0.012	−0.057
2	Mining	−0.002	0.053	−0.042	0.074	−0.040	0.020	−0.007	−0.006	−0.010	−0.047
3	Construc	−0.009	−0.001	0.603	−0.047	−0.175	−0.022	−0.019	−0.009	−0.037	−0.134
4	NDurmfg	0.000	−0.001	−0.044	0.133	−0.054	−0.008	−0.006	−0.005	−0.005	−0.038
5	Durmfg	−0.008	−0.001	−0.042	−0.037	0.350	−0.021	−0.015	−0.010	−0.028	−0.108
6	TrComm	−0.004	−0.001	−0.048	−0.012	−0.053	0.142	−0.003	−0.004	−0.008	−0.027
7	Commerce	−0.003	−0.001	0.016	−0.016	−0.050	−0.009	0.067	−0.004	−0.010	−0.032
8	Finance	−0.002	0.000	−0.042	−0.018	−0.061	−0.006	−0.001	0.042	−0.003	−0.003
9	Services	−0.004	−0.001	−0.026	−0.018	−0.061	−0.007	0.000	−0.002	0.070	−0.018
10	Pub Admin	−0.010	−0.002	−0.157	−0.048	−0.182	−0.028	−0.019	−0.012	−0.039	0.648

assuming the unit inflow is distributed as total annual flows from the same source. Thus, for example, one unit spent *only* on commodities for investment would yield 0.05 for the Agricultural sector if spent in the same shares as investment in the observed 1989 SAM, while the same unit in the same composition would generate 0.53 for Construction.[9] The greatest beneficiary of added investment in its existing composition is the Durables Manufacturing industry (0.91), while Agriculture, Mining and Public Administration would benefit least (0.05). The existing composition of government commodity demand most benefits the Services sector (0.65) followed by Public Administration (0.59), and the two manufacturing industries. The existing composition of exports greatly favors the Durables Manufacturing industry in nominal terms (0.85), whereas Services (with 0.61) and the Nondurables sector (0.50) are the largest beneficiaries from aggregate exogenous inflows.

These nominal multiplier effects are of some interest in themselves, but consider now their distributional implications. The second matrix in Table 1 measures implicitly redistributed income. Its elements measure the non-normalized effects $[e'Y]R(x)$ which give an implicit dollar value of redistribution induced by a one dollar inflow, holding total income constant at the initial value. This essentially reduces the income effects of the inflow to a zero-sum outcome and identifies the purely distributional effects of the exogenous shock. The columns of this matrix sum to zero, as do those of $R(x)$, and the signs of the elements are the same as those of $R(x)$. The total effect at the bottom of each column gives an indication of the degree to which the income distribution has shifted, while the individual elements indicate the component directions of the shift.

As would be expected from the zero-sum property, the redistributed income matrix is dominated, except in the diagonal, by negative elements. The matrix is not completely negative off the diagonal, however, and there are some beneficial linkages between sectors with strong forward linkages to the initial recipient of the inflow. For example, Agriculture industry benefits (0.07) from an increase in Nondurables commodity demand, as might be expected from a processed food linkage. An inflow to Agriculture is also beneficial to Nondurables but the effect is substantially smaller (0.01). It is logical that Mining benefits from inflows to Nondurables, but when the latter receives the inflow, the former loses ground in the distribution of output. In general, however, there are symmetric tradeoffs between the relative standing of industries, and the issue becomes one of degree. It is noteworthy that, although the redistribution matrix is nearly sign symmetric, it is far from symmetric in magnitudes. Thus \$1.00 spent on agricultural commodities ultimately redistributes \$1.19 among domestic industries when the multiplier process has run its course, "taking" \$0.17 from Construction in the process. When Construction receives \$1.00, however, redistribution is less (i.e. the distribution of multiplier effects is more egalitarian in nominal terms) at \$0.83 and Agriculture implicitly loses only \$0.03. Variations in the total redistribution are largely due to differences in backward linkages. Agriculture has weak backward

[9]These multipliers could be averaged over several years, but the results of Roland-Holst, 1989, indicate that this would not yield dramatically different estimates.

links, and thus more of the total effect of the inflow is retained by them than is the case for Construction.

The average columns on the right-hand side of this matrix indicate the effects of observed investment, government consumption, and export demand on the composition of national product or the distribution of income between industries. If exogenous commodity demands were uniformly distributed, each dollar of new demand would induce a redistributed value of $1.02, and the losing industries in relative terms would be Durables (−0.20), Public Administration (−0.09), Construction (−0.06), and Services (−0.01). Export demand strongly favors intermediary sectors, such as Commerce (0.39), Transportation & Communications (0.19), and Finance (0.10), and this points up the importance of indirect linkages. None of these sectors has the most significant nominal export demand, but they are so closely tied to the group of export dependent sectors that they benefit more from diversified export demand than any single export sector. As can be seen by comparing the three individual exogenous columns, the distributional effects of investment, government, and export demand tend to work in different directions.

The matrix of Redistribution shares provides another sign-preserving transformation of $R(x)$, this time indicating how the total implied redistribution is apportioned (in percentage terms) among beneficiaries and those who lose in relative terms. Diagonal elements are again positive, and equal to 100 where the initial recipient is the only one whose relative income advances. The few positive off-diagonals result from very strong linkages. Among the negative elements, there are two principal reasons for large values. If an industry has relatively high income (value of product), it will tend to contribute more to the redistribution (e.g., Durables and Services). If it has weak forward linkages, it will tend to gain little in nominal terms from the inflow for another commodity (e.g., Public Administration). Both these tendencies lead to a large (negative) percent contribution to the total redistribution effect. Small percentages result from the opposite properties (e.g. Agriculture, on the one hand, and Transportation & Communication, on the other hand).

The matrices discussed above measure the disposition of new income among recipients and the adjustments in distribution it implies, but they do not indicate the significance of such adjustments for the individual institutions. This is elucidated in the next matrix, which contains redistribution effects in elasticity form. A given element E_{ij} gives the percent change in the income of i as this results from a one percent change in final demand inflows to institution j. Apparently similar redistribution effects hide substantially distinct individual effects. Own redistributed income in Agriculture (1.18) and Mining (1.07), for example, give rise to elasticity values of 0.193 and 0.053, respectively, showing that the own effect on Agriculture is over three times that of mining. Public Administration obtains the highest elasticity value (0.648), again an indication of its the weak forward linkages to the other sectors and its strong dependence on government spending. Exogenous demand for Nondurables is also beneficial to Agriculture (0.051), but a four percent increase in Nondurables demand is necessary to yield the same relative income appreciation as a one percent increase in direct Agricultural demand (0.193).

4.2. *Redistribution and the Rewards to Factors of Production*

We turn in this subsection to functional or factor-based income distribution. Factors of production include six occupational labor groups and two capital categories. The distributional results are presented in Table 2. The multiplier submatrix and the redistribution matrices measure the effects on factor incomes of exogenous demand for the ten commodities.

The multiplier results indicate that commodity demand benefits the Other Property factor most in most cases (especially Finance with a nominal gain of 0.69). The only exceptions are Public Administration, and existing composition of Government demand, both of them rewarding the Management labor group over all other factors. Farming employees benefit least in nominal terms, except where their own commodity is demanded directly. Investment demand generally favors blue collar occupations, while Government commodity demand favors white collar; export demand falls somewhere in between.

What these results mean for relative incomes is indicated in the next matrices. It should be noted first that the ideas of diagonality and symmetry from the previous subsection do not apply here, where there is no direct correspondence between initial and final recipients. The redistribution mechanism still leads to a predominance of negative signs, but there are some interesting cases of mutual advancement. The results indicate that income distribution strongly favors capital factors. Indeed, non-labor factors are relatively better off about 75 percent of the time (14 out of 20 cases), while labor only advances in the factor income distribution 33 percent of the time (20 out of 60 cases). As can be seen from the average column, Management workers are the biggest losers under any observed exogenous set of commodity demands, whereas both capital factors are likely to gain. In striking contrast with government demand, the existing composition of investment and exports strongly benefits Property capital, but Government demand induces the biggest shift in income distribution of all three exogenous sources of demand.

Total redistribution between factors is generally less than that occurring between sectors. This fact has nothing to do with links between the recipient groups, as with backward linkages between sectors. The redistributions are more neutral in this table because of the greater overlap between factor groups in each commodity category, i.e. most labor and capital types are represented in each commodity's value-added and share the benefits of its new demand. Scanning the rows of the redistributed income matrix reveals each factor's most and least beneficial commodity. For Managerial labor, the former is Public Administration (0.17) and the latter Agriculture (−0.14), while Precision Production benefits most from new Construction demand (0.13) and least from Finance (−0.08). Capital has its greatest relative gains in response to new Agricultural demand and loses the most to Public Administration demand.[10]

Percentages of the redistribution indicate that the largest adjustments generally accrue to and come from the high income factors, white collar workers and Other Property. An exception to this rule is Precision Production, which gets

[10]The last result may be anomalous, due to the different standards for capital accounting and profit retention in the public sector.

a lion's share (79 percent) of the relative gains from new demand for Construction, and Operators, Fabricators, and Laborers, who take 85 percent of the redistributional gains from new Durables demand. Large redistributional shares also accrue to Technical and Sales workers, who get 83 percent of the relative gains when Commerce expands, and Property capital, with a gain of 86 percent as a result of an increase in demand for Transportation and Communications. From the elasticity results in Table 2, it is apparent that the lower total redistribution effects lead to lower elasticities. Despite their large percentages in the redistribution process, however, white collar and capital factors have quite low elasticities because of their relatively high incomes.

4.3. *Redistribution of Household and Enterprise Incomes*

Our final perspective on income distribution relates to what might be termed final recipient institutions. These are the endogenous income groups who receive the ultimate rewards from the cycle of production and consumption, the households and enterprises whose income originates in the value of output, is passed on in factor payments, and finally received and retained by them for consumption, savings, and investment. The redistribution effects of exogenous commodity demands are therefore evaluated here in relation to the classical "triangle" of production-factor-consumption flows.

Table 3 shows the redistribution effects on household and enterprise income from changing investment, government, and foreign commodity demands. The nominal (multiplier) income effects on the institutions are less than those for industries (Table 1), but comparable to those for the factors from whom they receive their endogenous income (Table 2). The total redistribution effects are also comparable to those among factors, although sectoral comparisons between Tables 2 and 3 are difficult because the composition of household and (to a lesser extent) enterprise factor holdings is diverse. The results for redistributed income are strongly influenced by the distribution of nominal incomes, with White Urban households and Corporations contributing the most to nominal gains and losses. The qualitative and elasticity results are of particular interest, however.

White Rural households lose relative income in response to new demand for every single commodity, including Agricultural goods, which give twice as much relative income to Corporations as they take away from White Rural households. With less quantitative impact, similar considerations also apply to Non-white Rural households. Farm enterprises are also systematic losers when new demand for goods and services arise. Non-white Urban households lose in almost every category, except when demand rises for Non-durables manufacturing and Public Administration, where their workers are well represented and well compensated. Urban households are the only households benefiting from the existing composition of government demand, while the existing composition of investment and exports is detrimental to all households.

The redistribution structure is considerably more favorable to non-agricultural enterprises, whose combined gains exceed 90 percent of the total redistribution in all private commodity categories but three (Construction, Durables, and Commerce). It is worth noting at this point that, derived from extended Keynesian

TABLE 2

FACTOR INCOMES FROM SECTORAL PRODUCTION

Multiplier Submatrix														
		1	2	3	4	5	6	7	8	9	10	Ave	Gov	Inv	ROW
11	Mgmt & Prof	0.19	0.15	0.34	0.26	0.29	0.26	0.33	0.27	0.47	0.62	0.32	0.49	0.31	0.29
12	Tech & Sales	0.15	0.11	0.24	0.19	0.21	0.24	0.33	0.26	0.24	0.44	0.24	0.34	0.24	0.21
13	Service	0.03	0.02	0.05	0.04	0.04	0.04	0.07	0.04	0.08	0.18	0.06	0.12	0.05	0.04
14	Farm Ind	0.19	0.01	0.02	0.03	0.01	0.01	0.02	0.02	0.04	0.04	0.04	0.03	0.02	0.03
15	Prec Prod	0.08	0.12	0.29	0.14	0.14	0.14	0.13	0.07	0.11	0.14	0.14	0.16	0.12	0.13
16	Op, Fab, & Lat	0.08	0.08	0.19	0.15	0.20	0.17	0.12	0.07	0.10	0.12	0.13	0.14	0.19	0.16
17	Capital	0.34	0.10	0.14	0.12	0.09	0.10	0.14	0.20	0.18	0.11	0.15	0.12	0.12	0.12
18	Other Property	0.44	0.49	0.44	0.50	0.37	0.61	0.48	0.69	0.52	0.39	0.49	0.43	0.42	0.46
	Total	1.50	1.08	1.70	1.43	1.36	1.57	1.62	1.61	1.74	2.05	1.57	1.83	1.55	1.46
Redistributed Income (Billions)															
		1	2	3	4	5	6	7	8	9	10	Ave	Gov	Inv	ROW
11	Mgmt & Prof	−0.14	−0.09	−0.04	−0.05	−0.02	−0.09	−0.03	−0.09	0.09	0.17	−0.03	0.08	−0.07	−0.04
12	Tech & Sales	−0.09	−0.07	−0.03	−0.04	−0.01	−0.02	0.07	0.00	−0.04	0.11	−0.01	0.05	−0.03	0.03
13	Service	−0.03	−0.03	−0.03	−0.02	−0.02	−0.03	0.00	−0.03	0.00	0.09	−0.01	0.04	−0.03	−0.01
14	Farm Ind	0.17	−0.01	−0.01	0.01	−0.01	−0.01	−0.01	−0.01	−0.01	0.01	0.01	0.01	0.00	−0.01
15	Prec Prod	−0.06	0.02	0.13	0.00	0.01	0.00	−0.02	−0.08	−0.05	−0.05	−0.01	−0.02	−0.01	−0.01
16	Op, Fab, & Lat	−0.06	−0.02	0.03	0.02	0.08	0.03	−0.03	−0.07	−0.05	−0.06	−0.01	−0.02	0.02	−0.02
17	Capital	0.22	0.01	0.00	0.00	−0.03	−0.03	0.00	0.07	0.04	−0.06	0.02	−0.03	−0.01	0.00
18	Other Property	0.00	0.17	−0.05	0.08	−0.02	0.16	0.01	0.22	0.02	−0.21	0.04	−0.10	0.12	0.06
	Total Effect	0.39	0.21	0.17	0.12	0.10	0.18	0.09	0.29	0.15	0.78	0.21	0.27	0.16	0.16

Redistribution Shares (Percent)

		1	2	3	4	5	6	7	8	9	10
11	Mgmt & Prof	−36	−42	−26	−45	−17	−52	−31	−32	58	44
12	Tech & Sales	−24	−32	−21	−33	−6	−8	83	−1	−26	29
13	Service	−9	−12	−15	−20	−21	−16	−2	−12	3	24
14	Farm Ind	44	−4	−4	9	−7	−6	−11	−3	−4	3
15	Prec Prod	−17	11	79	4	15	−2	−26	−26	−33	−13
16	Op, Fab, & Lat	−14	−10	21	19	85	14	−30	−26	−37	−16
17	Capital	55	6	−2	−2	−26	−16	5	23	25	−16
18	Other Property	1	82	−32	68	−23	86	12	77	13	−55

Redistribution Elasticities—Overall

		1	2	3	4	5	6	7	8	9	10
11	Mgmt & Prof	−0.005	−0.001	−0.020	−0.008	−0.010	−0.010	−0.002	−0.004	0.011	0.084
12	Tech & Sales	−0.004	−0.001	−0.021	−0.008	−0.005	−0.002	0.007	0.000	−0.007	0.076
13	Service	−0.006	−0.001	−0.058	−0.019	−0.062	−0.015	−0.001	−0.008	0.003	0.231
14	Farm Ind	0.082	−0.001	−0.050	0.026	−0.058	−0.016	−0.009	−0.006	−0.009	0.096
15	Prec Prod	−0.005	0.000	0.142	0.002	0.021	−0.001	−0.004	−0.008	−0.015	−0.058
16	Op, Fab, & Lat	−0.005	0.000	0.039	0.009	0.121	0.007	−0.004	−0.008	−0.016	−0.078
17	Capital	0.019	0.000	−0.004	−0.001	−0.041	−0.008	0.001	0.008	0.012	−0.084
18	Other Property	0.000	0.001	−0.018	0.010	−0.010	0.012	0.001	0.008	0.002	−0.081

TABLE 3

INSTITUTIONAL INCOMES FROM SECTORAL PRODUCTION

Multiplier Submatrix		1	2	3	4	5	6	7	8	9	10	Ave	Gov	Inv	ROW
19	Farms	0.06	0.05	0.05	0.05	0.04	0.06	0.05	0.07	0.06	0.04	0.05	0.05	0.04	0.05
20	Prp nonfarm	0.09	0.07	0.07	0.08	0.06	0.09	0.08	0.11	0.09	0.07	0.08	0.07	0.07	0.07
21	Corporations	0.58	0.45	0.44	0.47	0.35	0.55	0.47	0.67	0.54	0.38	0.49	0.42	0.41	0.44
22	White Rur	−0.04	−0.02	−0.05	−0.04	−0.04	−0.04	−0.05	−0.04	−0.05	−0.08	−0.05	−0.06	−0.04	−0.05
23	White Urb	−0.14	−0.11	0.06	−0.04	0.05	−0.07	0.02	−0.16	0.00	0.22	−0.02	0.12	−0.06	−0.01
24	NW Rural	−0.01	0.00	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01
25	NQ Urban	0.00	−0.02	0.00	−0.01	0.01	−0.02	−0.01	−0.04	−0.02	0.02	−0.01	0.01	−0.01	−0.01
	Total Effect	0.21	0.18	0.10	0.12	0.08	0.16	0.10	0.27	0.11	0.24	0.16	0.18	0.14	0.14
Redistributed Income (Billions)		1	2	3	4	5	6	7	8	9	10	Ave	Gov	Inv	ROW
19	Farms	−0.02	−0.01	−0.04	−0.03	−0.03	−0.03	−0.03	−0.02	−0.03	−0.06	−0.03	−0.04	−0.03	−0.03
20	Prp nonfarm	0.02	0.02	0.00	0.01	0.00	0.02	0.01	0.03	0.01	−0.01	0.01	0.00	0.02	0.01
21	Corporations	0.18	0.16	0.03	0.10	0.02	0.14	0.07	0.24	0.10	−0.09	0.09	−0.02	0.13	0.10
22	White Rur	−0.04	−0.02	−0.05	−0.04	−0.04	−0.04	−0.05	0.04	−0.05	−0.08	−0.05	−0.06	−0.04	−0.05
23	White Urb	−0.14	−0.11	0.06	−0.04	0.05	−0.07	0.02	−0.16	0.00	0.22	−0.02	0.12	−0.06	−0.01
24	NW Rural	−0.01	0.00	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01
25	NQ Urban	0.00	−0.02	0.00	−0.01	0.01	−0.02	−0.01	−0.04	−0.02	0.02	−0.01	0.01	−0.01	−0.01
	Total Effect	0.21	0.18	0.10	0.12	0.08	0.16	0.10	0.27	0.11	0.24	0.16	0.18	0.14	0.14

Redistribution Shares (Percent)

		1	2	3	4	5	6	7	8	9	10
19	Farms	−10	−7	−37	−21	−37	−16	−33	−7	−29	−23
20	Prp nonfarm	11	12	5	13	5	13	10	12	12	−4
21	Corporations	89	88	28	87	27	87	70	88	88	−36
22	White Rur	−18	−14	−53	−34	−54	−27	−50	−14	−46	−31
23	White Urb	−68	−62	64	−31	60	−42	20	−61	−1	90
24	NW Rural	−3	−3	−10	−6	−9	−5	−9	−2	−8	−5
25	NW Urban	−1	−14	3	−7	8	−10	−8	−16	−15	10

Redistribution Elasticities—Overall

		1	2	3	4	5	6	7	8	9	10
19	Farms	−0.002	0.000	−0.064	−0.014	−0.068	−0.010	−0.008	−0.003	−0.015	−0.107
20	Prp nonfarm	0.004	0.001	0.010	0.010	0.011	0.009	0.003	0.007	0.008	−0.024
21	Corporations	0.005	0.001	0.010	0.012	0.010	0.011	0.004	0.008	0.010	−0.035
22	White Rur	−0.004	−0.001	−0.072	−0.018	−0.076	−0.013	−0.010	−0.005	−0.019	−0.112
23	White Urb	−0.002	0.000	0.010	−0.002	0.010	−0.002	0.000	−0.002	0.000	0.037
24	NW Rural	−0.003	0.000	−0.065	−0.016	−0.069	−0.011	−0.009	−0.004	−0.017	−0.101
25	NW Urban	0.000	0.000	0.003	−0.002	0.007	−0.003	−0.001	−0.003	−0.004	0.021

multipliers, these redistribution effects are net of tax liabilities. Thus they measure the reallocation of disposable incomes and retained profits after taking full account of fiscal adjustments to income distribution.

A final observation on the nominal effects concerns Rural households who, despite their relatively low nominal incomes, finance the majority of the redistribution in all but one of the ten commodity categories. This suggests that they might have the largest elasticity effects, as can be seen from the elasticity matrix. The overall elasticity results indicate that Rural households of both races usually experience an order of magnitude greater own-income effects than other households or enterprises, and again these results are always detrimental. In general, all households tend to lose ground to enterprises with a larger impact affecting Rural households, who lack the factor and redistributed income to offset these losses. The one exception arises from demand for Public Administration, which is detrimental to enterprises on a scale comparable, but still less than, Rural households. This result is due to public ownership of capital in this sector. Racial differences between households rarely alter the qualitative results, which instead are driven by the Rural-Urban dichotomy. However, it is worth noticing that, with the exception of new demand for Agriculture, White Urban households tend to gain more, and lose less, than Non-white Urban households, while the opposite is true for Rural households in all cases.

5. Concluding Remarks

This paper sets forth a methodology for analyzing the changing composition of income and product with a social accounting matrix. The methods given here are designed to reveal the structural components of income and expenditure linkages in the economy as these affect relative incomes. It was shown that, for any appropriately defined model of nominal income determination, a structure can be specified which captures the detailed effects of exogenous shocks on the distribution of income. This model characterizes the process of redistribution as a set of bilateral linkages between institutions in the economy. Each link indicates how one agent's relative income gains affect the distributional status of another.

The SAM-based distribution model was then applied to 1989 data for the United States. The U.S. SAM was analyzed from a number of perspectives, revealing distributional linkages between productive sectors, factors, and household and enterprise income groups. In each case, the analysis revealed systematic asymmetries in the way relative incomes are affected by exogenous forces. It is apparent from these results that the composition of economy-wide income effects cannot be fully understood without detailed analysis of this kind.

Appendix: Label Definitions for the U.S. SAM

Industries

1	Agric	Agriculture
2	Mining	Mining
3	Construc	Construction
4	NDurmfg	Non-durables Manufacturing

5	Durmfg	Durables Manufacturing
6	TrComm	Transportation & Communications
7	Commerce	Wholesale & Retail Trade
8	Finance	Finance, Insurance & Real Estate
9	Services	Private Services
10	Pub Admin	Public Administration Services

Production Factors

11	Mgmt & Prof	Executive, Administrative & Managerial
12	Tech & Sales	Professional Specialty
13	Service	Technical, Sales & Administrative Support
14	Farm Ind	Farming, Forestry & Fishing
15	Prec Prod	Precision Production, Craft & Repair
16	Op, Fab & Lab	Operators, Fabricators & Laborers
17	Capital	Productive Capital Goods
18	Other Property	Productive Property Factors

Enterprises

19	Farms	Farm Enterprises
20	Prp nonfarm	Proprietor Non-farm enterprises
21	Corporations	Corporate Enterprises

Households

22	White Rur	White Rural Households
23	White Urb	White Urban Households
24	NW Rural	Non-white Rural Households
25	NW Urban	Non-white Urban Households

Exogenous Accounts

26	Gov	Government
27	Inv	Capital Account (Investment/Savings)
28	ROW	Rest of the World

References

Board of Governors of the Federal Reserve, *Flow of Funds Accounts*, Federal Reserve Bank of New York, 1983.

Pyatt, G. and Round, J. (eds.), *Social Accounting Matrices: a Basis for Planning*, The World Bank, Washington, 1985.

Roland-Holst, D. W., Bias and Stability of Linear Multiplier Estimates, *Review of Economics and Statistics*, LXXI 4, 1991.

Stone, R. F., *Aspects of Economic and Social Modelling*, No. 126, Librairie Druz, Geneva, 1981.

United Nations, *A System of National Accounts*, Studies in Methods, Series F, No. 2, Rev. 3, Department of Economic and Social Affairs, Statistical Office of the United Nations, New York, 1968.

U.S. Bureau of Labor Statistics, *Employment and Earnings*, 1983.

U.S. Department of Commerce, National Income and Product Accounts, *Survey of Current Business*, 1983.

U.S. Department of Forestry, *IMPLAN Input-output Tables*, U.S.G.P.O., 1980.