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ECONOMIC EFFECTS OF TAX-TRANSFER POLICY: THE POTENTIALS AND PROBLEMS OF MICRODATA SIMULATIONS

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Abstract

The last two decades have witnessed rapid growth in both the volume of taxes and transfers in developed Western economics (both absolutely and as a percentage of public budgets and GNP) and in research designed to estimate the economic impacts of such policy measures. This paper deals with the latter phenomenon and, in particular, concentrates on the recent development of microdata simulation models designed to evaluate the microeconomic effects of public finance alternatives. The paper defines microdata simulation. It discusses four such models, all based in the United States, and indicates the kind of data base that underlies each and the nature of the estimates each is designed to produce. It then presents illustrative results from one of these.

It ends by presenting some thoughts on both the value of such modelling and the problems encountered. The merits of the approach are given as its ability to provide (1) estimates of program impact that reflect both behavioral responses and the inherent linkages and interdependencies of the economic system; and (2) estimates of the impact of a policy change on narrowly-defined sectors of the economy (regions, industries, occupations) and specific demographic and economic groups. The costs of the approach are given as (1) the sizable research, manpower, computer, and survey requirements; (2) the inherent weaknesses of the survey data on which they rest; (3) the difficulty of modelling appropriately the behavioral responses to program, price, or income incentives; and (4) the debilitating computational difficulties that may be encountered in any efforts to expand the complexity of such models.

ECONOMIC EFFECTS OF TAX-TRANSFER POLICY:
THE POTENTIALS AND PROBLEMS OF MICRODATA SIMULATIONS

This paper deals with the recent development of microdata simulation models designed to evaluate the microeconomic effects of public finance alternatives.

The first section of the paper will define what is meant by microdata simulation and describe some of the reasons why research efforts to build such models have grown rapidly in recent years. The second section will discuss four of these models (all based in the United States), indicating the kind of data base that underlies each and the nature of the estimates each is designed to produce. In the third section, some illustrative results of one of these models--that designed to estimate the regional, occupational, industrial, and income distribution effects of tax-transfer policy--will be presented. The final section will present some thoughts on both the value of such modelling efforts and the problems which are encountered by such efforts.

1. Definition of and History behind Microdata Simulation

Microdata simulation involves the construction of models that (a) rely on microdata in estimating the behavioral effects of policy measures, (b) incorporate such estimated relationships in comprehensive sectoral models which emphasize the interdependence of sectors of the economy, and (c) are structured so as to yield estimates of the induced effects of policy measures on detailed economic sectors. Through such microdata-based models, richer analyses than were previously possible--involving simulated impacts of actual and proposed public policies on detailed demographic and income groups, industries, regions, and occupations--can be undertaken.

While research on the economic effects of tax-transfer policy has grown rapidly since the early 1960s, substantial efforts to construct microdata simulation models did not occur until about 1970. Prior to that time, the bulk of empirical research on tax-transfer policy fell into one of two categories--(1) research designed to estimate the first-round (or direct) incidence or income distribution effects of policy measures, and (2) research aimed at estimating particular behavioral responses to such measures.

Within the first category are the well-known distributional impact studies of Social Security benefits, the public transfer system, the total tax-transfer system, and particular taxation and transfer programs [Lampman, 1966; Lurie, 1969; Okner, 1972]. (For more recent and comprehensive efforts along this line see Smeeding [1975] and Plotnick and Skidmore [1975]). In effect, the methodology adopted in these studies involved mapping the rules of actual or proposed measures onto survey or published census-type data and, through the mapping, to estimate the allocation of total benefits paid to (or taxes collected from) various types of household units.

The second category of research sought to estimate the behavioral responses of individuals or family units to the incentives implicit in tax-transfer policies. The bulk of such analyses was concerned with estimation of labor-supply effects [Cain and Watts, 1973], although analyses of the migration, consumption, family structure, and fertility responses were also undertaken [Kain and Schaefer, 1972; Moeller, 1970;

Lerman, 1974; Honig, 1974; Cutright and Scanzoni, 1974; and Cain, 1972]. These studies have relied primarily on the analysis of cross-section data, both grouped data and survey observations of individuals and household units. Estimation of labor-supply responses based on an experimental methodology is a more recent development [Pechman and Timpane, 1975].

While these analyses represented marked improvements over earlier empirical studies of tax-transfer programs, they stimulated still further efforts to develop reliable estimates of distributional and behavioral responses. With respect to the distributional analyses, it was recognized that the estimates of incidence assumed no shifting of benefit or burden due to either labor-leisure or other substitutions. Moreover, the estimates did not account for the fact that the initial (or first-round) tax or transfer would stimulate a series of reactions which, in a highly interdependent economy, would lead to further distributional effects--effects which would either complement or offset the initial impact.

Similarly, the studies of behavioral response, while advancing markedly the reliability of policy evaluations, adopted a partial equilibrium framework. While the evidence they provided revealed much regarding how individuals directly impacted by the policy would react to its incentives, this evidence revealed little about the subsequent economic impacts generated by this behavior. For example, such studies may reveal the extent and composition of consumption expenditure changes by poor persons in response to a change in income transfer policy, but they reveal little about the allocative effects of this change on individual regions, industries, or occupations, and, in turn, the distributional effects of this reallocation. Again, the interdependence of the various sectors of the economy is neglected in the analysis.

While concern with the "partial" analytical framework of the early studies stimulated efforts for more comprehensive and systematic analysis, an additional factor has also encouraged the search for more extensive models of analysis. This factor is the growing availability of data. Until recent years, the data required for more systematic analysis involving the interrelationships of detailed sectors of national economies (individuals, regions, industries, occupations) has not been available. By and large, researchers have had to rely on inadequate survey data containing limited information on observations drawn from specially selected populations (and, hence, not reliable for estimating impacts on the nation as a whole). Moreover, coefficients describing the interrelationships of various sectors of the economy (industry to industry, region to region, occupation to industry, and occupation or industry to income class), were either unavailable or very crude. The scarcity of such data served as a serious constraint on more comprehensive and systematic analysis.

In recent years, this constraint has been significantly relaxed in the United States. Self-weighting national sample surveys with significant numbers of observations have recently become available on computer tape: these include the Consumer Expenditure Survey (13,000 households, 1961-1962), the Survey of Economic Opportunity (65,000 households, 1965), the Current Population Survey (50,000 households, now available for each year since 1965), and the O.E.O.--Michigan data (5,000 households, longitudinally observed since the late 1960s). While detailed national input-output models have been available for two decades, the first multi-regional input-output model (involving input-output coefficients and inter-regional trade relationships for 79 industries in 44 regions) became available on computer tape only in the early 1970s.[1] Similarly, data required to evaluate the relationship of changes in industrial output and the demand for labor of various skills and occupations has been released only recently. Such information is the material out of which more systematic and comprehensive analyses are built.

For all these reasons, then, efforts of recent years have turned to the construction of microdata simulation models.

2. Four U.S. Based Microdata Simulation Models

While the several recently developed models involving both the extensive use of microdata and the simulation of public policy measures have much in common, they vary widely in their structure and in the outcomes which they are designed to evaluate. In this section, four microdata-based simulation models will be briefly described and, to a limited extent, compared. The discussion will move from the least to the most complex modelling efforts, with the degree of complexity reflecting both the nature of the underlying data and the extent of the behavioral interdependencies each model is designed to capture.

The Brookings MERGE Data File

For several years, analysts at the Brookings Institution--primarily Benjamin Okner and Joseph Pechman--have worked on the development of a microdata file (the MERGE file) to be used in simulating the incidence of the existing tax system (under various incidence assumptions) and that of various proposals to alter the tax-transfer system.[2] While the data base of this model is a very complex one, it incorporates no behavioral relationships. The incidence estimates it yields reflect the various assumptions on incidence patterns for the policy changes analyzed. Through use of this file, the aggregate incidence of the entire U.S. tax system--federal, state, and local--on income classes has been simulated. Several alternative simulations have been presented, each based on a particular set of incidence assumptions for the various taxes.

The original MERGE file was based on the combination of two micro-data bases and included information on 72,000 family units for the year 1966. The original file has since been updated to portray the structure of U.S. families in 1970. This second file--called MERGE-70--contains virtually the same economic information as the original MERGE file. The primary difference is in the definition of income, which in the later file includes the value of certain in-kind transfers (Medicaid, Medicare, Food Stamps) in addition to the traditional sources of income. For both files, the two component data bases are (a) the U.S. Internal Revenue Service file containing information from 87,000 federal income tax returns, and (b) the Survey of Economic Opportunity (SEO) data file containing income, employment, and demographic information based on interviews with 30,000 families. Employing income and demographic information on the SEO, the nature of the tax returns filed by a family with various governmental units was estimated. On the basis of this information, one of the returns from the tax file was assigned to each unit in the SEO file. The assignment process involved matching the observation units in the SEO with units in the tax file on the basis of pre-selected characteristics--marital status, age, family size and structure, and the amount and pattern of income[3] as a first step, and home ownership, assets, farming activities, and business activity as a second step.

The resulting file contains income figures from the more reliable tax files (for tax filers) and demographic information from the SEO. After the merge, adjustments were made in the file to correct for weighting discrepancies between the two files, the difference between national income (in the national income accounts) and family income, and errors due to misreporting and nonresponse. Additional imputations (primarily for the rental value of owner-occupied houses and capital gains) were made to add information not present on either of the merged files. Finally, extrapolating from the 1960-1961 Survey of Consumer Expenditures, consumption expenditures were added to each family record.

A number of analyses not heretofore possible have been made with the MERGE file. These include simulations of the first-round impact of the entire U.S. tax system (federal, state, and local taxes) on the size distribution of income and on various demographic groups and income sources under a variety of assumptions regarding the incidence patterns of those taxes for which there is disagreement regarding incidence[4], a variety of tax credit plans for aiding low-income families [Okner, 1975], a number of other income maintenance proposals [Watts and Peck, 1975], and a series of proposals for "reforming" the federal income tax [Break and Pechman, 1975].

The NBER IDIOM Model

The NBER model, which has been in the process of development since the early 1970s, is designed to evaluate the incidence of particular policy measures on the price, output, employment configuration of the economy, relative to the configuration which would exist under some alternative policy. The full title of the model is Income Determination Input-Output Model.[5] It proceeds in two stages.

In the first stage--the National Model--an exogenous set of final demands by 83 input-output sectors is specified and applied to the 1970 U.S. Bureau of Labor Statistics national input-output matrix. From this calculation, the gross outputs of the 83 sectors is estimated; and, by applying estimated value added coefficients to the gross output estimates, the income of labor and capital suppliers required to fulfill these demands is derived. Employing consumption coefficients for both capital and labor income and a standard Keynesian multiplier analysis, sectoral consumption demands are generated, which in turn have induced effects.

The system equilibrates when the sum of exogenous and consumption final demands equals total income. At this stage in the flow of the model, baseline estimates for gross output, labor and capital income, and final demand (exogenous and endogenous) by production sector is estimated. By applying vectors of raw material requirement and effluent production coefficients, and a matrix of industry-occupation employment coefficients, estimates of the raw materials required, effluents produced, and occupational employment required by the baseline economy are obtained. In the model, 11 raw materials, 14 effluents, and 25 occupations are identified.

Then, given these baseline estimates, a specified public policy measure is introduced in one of three forms: (1) a change in exogenous demands via change in <u>public expenditures</u>, (2) a change in final demands via estimated consumption responses to <u>tax changes</u>, and (3) a change in final demands via estimated consumption responses to <u>transfer income changes</u>. Simultaneously, a compensating policy instrument is specified, an operating criterion (e.g., unchanged employment, GNP, or labor income) is identified, and the model is solved. The changes in the economic variables of interest indicate the impacts of the policy substitution.

The second stage--the Regional Model--is designed to estimate how the policy substitution affects the 50 states plus the District of Columbia. In this model, the 83 production sectors are divided into national and local industries depending upon the extent to which their outputs are sold in national or local markets. Following the procedures of what is known as a "balanced regional model," for elaborations of which see Leontief et al. [1965], the gross outputs of the national industries (estimated in the first stage) are distributed over regions on the basis of the share of each region in the total output of the industry. The estimated final demands for the outputs of local industries are allocated to the region in which the demand actually occurs. The regional configuration of local industry demands, in turn, generates additional local and national demands which are estimated by the simultaneous solutions of the set of intra-regional input-output equations. The implicit assumption here is that any purchases from a local industry within a region are supplied from within the region--local industries have no inter-regional trade. From this model, the regional distribution of the gross outputs by production sector--estimated in the National model--is derived. With the industrial gross outputs stimulated by a policy change now allocated by region, the other relevant variables (labor and capital income, employment by occupation, raw material demands and effluent production), all of which are related to gross outputs, are also estimated by region.[6]

While this model is applicable to a wide variety of compensating policy changes, its primary use until now has been in estimating the economic impacts of a contraction of 20 percent in the U.S. military budget, compensated by a variety of policies--including increased exports to developing countries, increased private consumption stimulated by income transfers to low-income families, and increases in state and local spending for health and education.

The Poverty Institute Regional and Distributional Model

The third simulation model to be described is designed to estimate the impact of tax-transfer policies on a variety of sectors of the economy--industries, regions, occupations, and income classes.[7] The logic of this model is straightforward: Changes in disposable income from income transfer programs (and the taxes required to finance them) lead to changes in the level and composition of consumption expenditures for those affected by the policy measures. These expenditure changes will affect the demands experienced by (and hence the output of) the various industries that supply consumers. Such changed output patterns will, in turn, alter the demands placed on supplying industries. Because of the interdependence of the industries in the economy, all sectors located in various regions of the economy will experience such changes in gross outputs. In response to increased or decreased output levels, production sectors will alter the demand for labor of various occupational groups. These changes in occupational demands imply changes in the distribution of earnings and income--to the extent that the relative change in demand for high-skill workers differs from that for low-skill workers.

This model is formed by the linkage of five separate modules. In the first module, the microdata of the 1971 Current Population Survey is adjusted for underreporting and aged to the year 1973. Given the eligibility and benefit (tax) structure of the program to be analyzed, the net cost or benefit impact on each of 50,000 households is calculated. This first-round impact can be shown for various regions of the country and income classes. The second module simulates the changes in the level and pattern in consumption spending induced by the policy for each of the 50,000 families. This consumption demand simulation is obtained by applying the relevant expenditure sector coefficients to families distinguished by a variety of economic and demographic traits. The coefficients were estimated by fitting a 56-sector (equation) log-linear consumption expenditure system to the microdata of the 1960-1961 Consumer Expenditure Survey. From this simulation, the change in consumption demand for 56 production sectors in 23 regions is obtained.

The third module transforms this final demand vector into an estimate of changes in gross output required of all production sectors in various regions of the economy by incorporating the indirect demands placed by industries on each other. This is accomplished by means of a 79-industry-23-region, multi-regional input-output study.[8] From this module the changes in gross outputs required of each of 79 industries in each of 23 regions by the policy change is estimated.

In the final two modules, the simulated changes in sectoral gross outputs are transformed, first, into estimates of the change in man years of labor demand by occupation (module 4) and, second, into dollars of induced earnings by earnings and income class (module 5). The estimates in the fourth module are derived by applying an industrial-occupation matrix containing labor-demand-per-dollar-of-gross-output coefficients to the gross output vector obtained in the previous module. The coefficients in the matrix were developed by the U.S. Department of Labor from Census data. In this simulation, 114 occupations in 23 regions of the country are distinguished. In the final module, the simulated estimates of occupational man-hour demands are combined with occupational earnings data to estimate changes in earned income for each occupation in each region.

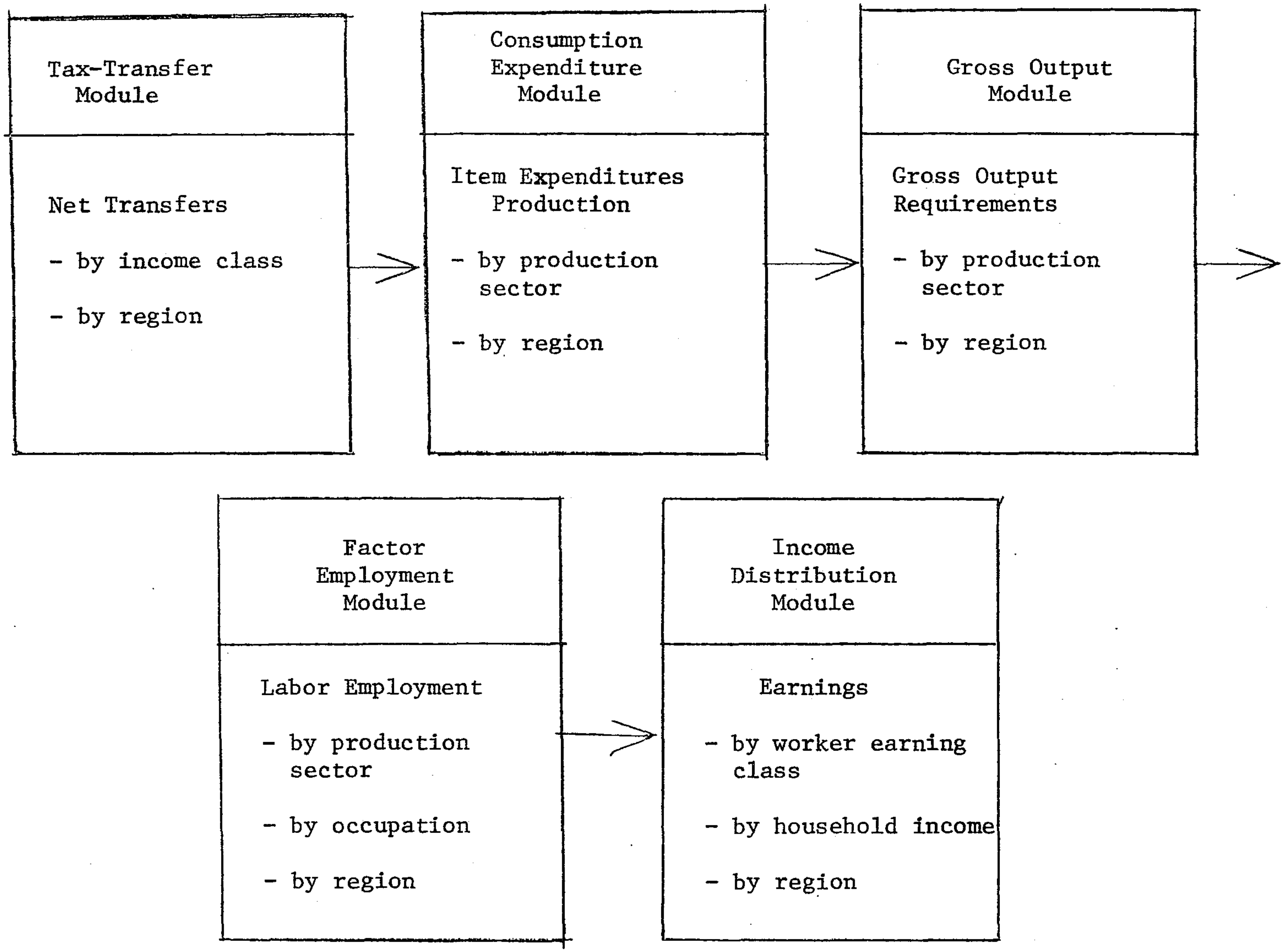
As a final step, the regional-occupational earnings estimates are mapped into incremental size distributions (consisting of 15 earnings and income classes) for each region and for the nation as a whole. The coefficients for this last mapping are from special tabulations employing the 1-in-1,000 data tapes of the 1970 Census. The flow of this model is summarized in Figure 1. Hence, the final output of the model displays the distribution of policy-induced earnings by 15 income classes in each of 23 regions and in the nation as a whole.

While the structure of this model is such as to enable estimation of the regional, industrial, occupational, and distributional effects of any policy measure that results in a change in final demand, its use heretofore has been confined to the analysis of various tax-transfer proposals. In particular, two variants of a negative income tax financed by a surtax on the federal personal income tax (each involving modification of existing cash-transfer programs) have been extensively analyzed.

The Urban Institute Dynamic Microsimulation Model

The most ambitious microsimulation model currently operating and under development is the DYNASIM model of the Urban Institute. As its title suggests, the objective of this model is to forecast through time the implications of major demographic and economic trends. This distinguishes it from the three other models described, all of which are basically static in nature.

Figure 1



Tax-Transfer Module
Net Transfers
- by income class
- by region
Consumption Expenditure Module
Item Expenditures Production
- by production sector
- by region
Gross Output Module
Gross Output Requirements
- by production sector
- by region
Factor Employment Module
Labor Employment
- by production sector
- by occupation
- by region
Income Distribution Module
Earnings
- by worker earning class
- by household income
- by region

The DYNASIM model begins with a sample representation of the U.S. population--the 1970 Census 1-10,000 sample. This sample of nuclear families is then "aged" to years subsequent to 1970 by incorporating relationships based on the observed pattern of behavior of members of the U.S. population.[9] This aging is done on a year-to-year basis and accounts for annual changes in the composition of the population due to death, marriage, divorce, education, and geographic migration. In effect, the model looks at each individual in the original sample and, on the basis of that individual's characteristics, calculates a probability that he or she will give birth, marry, die, become divorced, obtain more education, or move. These probabilities are then employed to actually attribute such changes to individuals in the samples through a Monte Carlo-type simulation exercise. As a consequence, the original sample is transformed into a new, second-year population, which has a different size, a different family structure, a different distribution of income and education, and a different pattern of geographical location. This simulated second-year population then becomes the basis for simulating the third-year population, and so on.[10]

Consider, for example, the simulation of marriage for persons who have never been married. The model assumes that such persons aged 15 to 34 are eligible for marriage, and calculates a probability that the person will be married in the subsequent year on the basis of his or her age, race, and sex. This first stage probability is adjusted by a factor which reflects still other determinants of marriage--education, employment, wage rate, and transfer income. Then, on the basis of the probability, a random draw determines whether the sample individual will be simulated as getting married or not. If he or she is selected for marriage, a subsequent simulation finds the marriage mate on the basis of the race, age, education, and location of those selected for marriage in that year. A simulated marriage may or may not change the number of families in the population, but will change their composition.

In addition to the dynamic demographic simulation, the DYNASIM model also has a labor sector. In it, individuals' wage income is generated from year to year by imputing labor force participation and hours worked, and a wage rate--again based on exogenous individual characteristics such as age, sex, and race. The model also contains a component that enables the imputation of income from a number of government transfer programs--including payments from Social Security, pension funds, Supplemental Security Income, Unemployment Insurance, Aid to Families with Dependent Children, and the Food Stamps Program. This component assigns benefits on the basis of program eligibility and payment rules and the relevant characteristics of families. Family income is simulated by adding imputed transfer payments and returns to physical capital to the simulated earned income for the individuals in a family unit. In addition, family income is decomposed into consumption, taxes, and savings.

In conjunction with this micro-model, there is a macroeconomic model that determines the value of aggregate economic variables for future years. These values are then used to "align" the microsimulations to make them consistent with the aggregate values.

While the DYNASIM model has a large number of potential uses and policy applications, heretofore its implementation has been quite limited. Some explorations have been made into the effect of expected changes in the work behavior of women and divorce patterns on the distribution of earned income and transfer income [Orcutt, Caldwell, and Werthheimer, forthcoming]. In addition, the model has been used to forecast the cost and caseload of a limited number of public transfer programs through the year 1985--each forecast being based on a unique combination of demographic and economic assumptions [Werthheimer and Zedlewski, 1976].

3. The Poverty Institute Model: Simulation of a Negative Income Tax Proposal

One important characteristic of microdata simulation studies is their ability to reveal a substantial amount of sectoral detail on the impact of policies analyzed. This characteristic is illustrated here with some of the summary results of the Poverty Institute model employed to analyze a negative income tax proposal. The policy analyzed guarantees a minimum income of $800 per adult and $400 per child; all families with children are eligible for benefits. Beyond an earnings level of $720, the ratio of marginal benefits to marginal earnings is -.67; a benefit reduction rate of .6 is applied to unearned income. The transfer proposal is assumed to be financed by a surtax on the federal personal income tax. In the simulation, the sum of benefit and tax flows is set at zero, implying no net effect on the public sector budget. The aggregate 1973 benefit payments from the program are estimated to be $3,421 million, implying an income surtax of 3.7 percent.

In Table 1, simulation results of the distribution of the net benefits (transfers less taxes) of the proposal are shown. While net transfers accrue to all income classes below $6,000, all income classes above $6,000 incur net costs. The extent of the income redistribution accomplished by the plan is observed by the disparities between the lowest and highest

Table 1

Distribution of Net Transfers of a Negative Income Tax, by Income Class, 1973

	Net Benefits ($ millions)	Net Benefits per Family $
Less than $1,000	991.8	511.69
$1,000--$2,000	824.0	225.08
$2,000--$3,000	808.5	193.74
$3,000--$4,000	514.7	145.58
$4,000--$5,000	186.8	57.13
$5,000--$6,000	25.4	8.12
$6,000--$10,000	-315.0	-23.54
$10,000--$15,000	-74.4	-47.90
$15,000--$20,000	-699.3	-77.57
$20,000-- or more	-1615.4	-179.89

income classes. Families with incomes in excess of $15,000 are estimated to incur income losses of $2.3 billion while households with incomes below $2,000 stand to gain approximately $1.8 billion. When the gains and losses from the program are spread over all families within an income group, the average net loss to the highest income groups is over $250.

These alterations in disposable income are reflected in changes in the level and composition of consumer expenditures, identified by industry and region. As the affected industries alter their outputs to meet the policy-induced change in final demand, second- , third- , and fourth-round demand changes occur. Tables 2 and 3 identify the resulting gross output impacts by industry and region. Table 2 shows that the gross output impact is heavily concentrated in the Nondurable Goods Manufacturing sector, which receives about 28 percent of the total national gross output impact of $3 billion. Table 2 also presents an impact indicator that reflects the size of the induced impact on a sector relative to the total size of the sector. A sector with an indicator greater than the national indicator is impacted more heavily than the nation as a whole.

Table 3 presents the regional distribution of the gross outputs generated by the policy. Industries in the South are estimated to experience an increase in output of $1.6 billion--over one-half of that for the entire nation. Such estimates of regional impact can be misleading because of the widely varying productive capacity among the regions--in terms of capacity, the largest region (New York) is fifteen times as large as the smallest (Mississippi). To adjust for this, the table presents a regional impact indicator which suggests the regional output impact of the program relative to the region's productive capacity. This indicator suggests

Table 2

Gross Output Impact Generated by the Net Transfers from a Negative Income Tax, by Production Sector

	Change in Gross Output (million $)	Indicator of Industrial Impact
Agriculture, Forestry, and Fisheries	158.7	1.65
Livestock & Products	76.8	1.69
Other Agri. Products	70.9	1.51
Other Forestry & Fisheries	10.9	3.00
Mining	101.7	3.29
Construction	48.0	.31
Nondurable Manufacturing	831.4	2.29
Food & Kindred Products	333.2	2.69
Other	498.2	2.07
Durable Manufacturing	632.2	1.67
Primary Iron & Steel	58.3	1.46
Motor Vehicles, Equip.	279.7	4.16
Other	294.2	1.08
Transport and Warehousing	127.1	2.00
Wholesale & Retail Trade	559.0	2.79
Services	510.1	.94
Elec., gas, water, sanitation	57.4	1.31
Finance and Insurance	19.7	.34
Real Estate & Rental	94.7	.73
Med., Educ., Serv., Non-Profit	104.9	1.86
Other	233.4	1.15
TOTAL	2,968.1	1.63

Table 3

Gross Output Impact Generated by the Net Transfers From a Negative Income Tax, by Region

	Gross Output (million $)	Regional Impact Indicator
Northeast	150.1	.32
1) Ct., Me., Ma., N.H., R.I., Vt.	48.6	.48
2) N.Y.	-24.8	-.11
3) Pa., N.J.	126.3	.72
North Central	905.0	1.57
4) Oh., Mi.	265.3	1.31
5) In., Il.	210.5	1.23
6) Wi., Mn.	131.9	1.70
7) Ia., Mo.	169.9	2.33
8) Ks., Nb., N.D., S.D.	127.2	2.60
South	1,570.9	3.31
9) De., DC, Md.	43.3	.98
10) Va., W.V.	78.4	1.62
11) N.C.	134.0	3.23
12) S.C.	83.6	4.60
13) Ga.	75.4	2.17
14) Fl.	53.0	1.35
15) Ky., Tn.	186.5	3.67
16) Al.	91.7	3.83
17) Ms.	189.8	14.85
18) Ar., Ok.	97.1	2.96
19) La.	220.3	6.49
20. Tx.	317.7	3.38

Table 3 continued

	Gross Output (million $)	Regional Impact Indicator
West	342.1	1.12
21) Az., Co., Id., N.M., Ut., Nv., Wy., Mt., Ak.	165.2	2.15
22) Wa., Or., Hi.	80.3	1.53
23) Ca.	96.6	.51
TOTAL	2,968.1	1.63

that the southern regions have a significantly larger indicator than either the nation as a whole or most other detailed regions.[11]

As has been noted, changes in gross output induce changes in the demand for labor. In Table 4, the changes in labor demand by occupation are shown for a few major occupational categories aggregated from the 114 categories included in the model. Of the net increase in labor demand of 119,000 jobs, the clerical and operatives categories account for over one-third. Both these sectors have impact indicators which exceed that for the nation as a whole.

These changes in labor demand have implications for the distribution of income. If the pattern of labor demands favors high-skill relative to low-skill workers, the induced effects are likely to be pro-rich--hence, offsetting the primary (or first-round) distributive impacts of the policy. Table 5 presents the induced earnings distribution impact of the policy by detailed region and the nation as a whole. One pattern dominates. The lowest skill earnings class (less than $4,000) has the lowest impact indicator in 21 of the 23 regions; the highest indicators are recorded for the higher skill classes.

These comparisons suggest the following: The final distributional effect of explicitly redistributional policies is likely to be weaker than that indicated by the target efficiency of the net transfers. While the induced consumption and production decisions would be expected to be less pro-poor than the initial redistribution, these induced effects, in fact, tend to undo in part the initial distribution. The earnings increments are somewhat more heavily concentrated among high earnings classes than even the preprogram distribution of earned income. Low-income

Table 4

Labor Demands Induced by Net Transfers

from a Negative Income Tax, by Occupation

	Change in Labor Demand (thousand man years)	Occupational Impact Indicator
Professional, Technical, & Kindred	13.5	1.03
Managerial, Office, & Administration	14.7	1.62
Sales Workers	12.7	2.15
Clerical and Kindred Workers	20.1	1.37
Steno., Typ., and Secretarial	4.7	1.20
Bookkeepers & Accounting Clerks	2.2	1.63
Other	13.3	1.40
Craftsmen, Foremen, & Kindred	15.1	1.33
Construction Craftsmen	4.6	.99
Metalworking Craftsmen	1.4	1.19
Printing Trade Craftsmen	.3	.86
Transportation, Public Utility, Mechanics, and Repairmen	6.4	2.62
Other Craftsmen	2.3	1.66
Operatives & Kindred Workers	22.8	1.54
Drivers (bus, truck, tractor)	4.3	1.83
Textile Operatives	-.2	-.18
Other	18.7	2.49
Laborers except Farm	5.2	1.40
Service Workers	11.5	.87
Food Service Workers	5.5	2.03
Personal Service Workers	2.6	.90
Other	3.4	.45
Farmers	3.2	.96
TOTAL	118.9	1.31

Table 5

Earnings Class Impact Indicators for Net Transfers from a Negative Income Tax, by Region

	Earnings Class				Regional Impact Indicator	Induced Labor Demand (1,000 of jobs)
	Less than $4000	$4000-$10,000	$10,000-$20,000	More than $20,000		
Northeast	.03†	.11	.11*	.05	.08	2.1
1) Ct., Ma., Me., N.H., R.I., Vt.	.29†	.36	.46	.48*	.36	2.0
2) N.Y.	-.29	-.30	-.25*	-.42†	-.32	-2.7
3) Pa., N.J.	.22†	.35	.46*	.39	.32	2.8
North Central	1.00†	1.12	1.23	1.29*	1.08	28.1
4) Oh., Mi.	.45†	.67	.84*	.61	.55	5.8
5) In., Il.	.65†	.83	1.03*	1.00	.80	6.1
6) Wi., Mn.	1.17†	1.34	1.54	1.69*	1.31	5.0
7) Ia., Mo.	1.58†	1.76	1.96	2.21*	1.72	5.9
8) Ks., Nb., N.D., S.D.	2.34†	2.48	2.95	3.39*	2.50	5.7
South	2.54†	2.72	3.35*	3.22	2.69	72.9
9) De., DC, Md.	.22†	.29	.43*	.23	.28	.7
10) Va., W.V.	1.12†	1.44	1.54*	1.27	1.27	3.3
11) N.C.	2.30†	2.39	3.87	4.32*	2.49	5.8
12) S.C.	3.58†	4.93	7.25	11.82*	4.97	5.8
13) Ga.	1.10†	1.22	1.89	1.72*	1.24	2.5
14) Fl.	.78†	.92	1.08	1.15*	.84	2.4
15) Ky., Tn.	2.51†	2.72	4.26	4.76*	2.81	8.4
16) Al.	3.28†	3.85	4.67	4.76*	3.66	5.1
17) Ms.	13.16	16.40	25.08*	12.56*	15.00	12.8
18) Ark., Ok.	2.07†	2.34	3.11*	3.05	2.29	4.4
19) La.	6.76†	7.66	9.19	10.88*	7.47	10.2
20) Tx.	2.15†	2.43	3.01	3.11*	2.37	11.6
West	.99	.99	.98†	1.13*	.99	15.7
21) Ar., Co., Id., N.M., Ut., Nv., Wy., Mt., Ak.	2.25†	2.43	2.62	3.15*	2.40	9.0
22) Wa., Or., Hi.	1.37†	1.47	1.58	2.14*	1.46	4.3
23) Ca.	.22†	.26	.34*	.33	.26	2.4
United States	1.32	1.28†	1.35	1.37*	1.30	118.8

† - the lowest impact indicator in a region.

* - the highest impact indicator in a region.

families tend to spend their income increments on goods and services produced by relatively high earnings groups, while higher income families tend to concentrate their spending reductions on sectors employing workers with relatively low earnings. While the program will achieve some reduction in inequality, the indirect effects tend to shift the structure of employment away from low-skill/low-earnings classes and toward high-skill/high-earnings classes. Much the same result is indicated when the indirect effects are analyzed from a regional perspective.

These summary and aggregated tables illustrate two of the important advantages of microdata simulations. First, the amount of detail regarding the impact of policies on population groups identified in various ways is significantly expanded relative to the information yielded by other modes of analysis. Second, the induced effects of the policy change caused by behavioral responses to income changes or other policy incentives can be estimated. These effects can be compared with the more visible, direct effects and employed to estimate the total impact of the policy (direct plus indirect). However, while estimates of the sort presented in the tables do incorporate impacts beyond those available from alternative methods, they are not comprehensive. In the particular model illustrated, labor supply and migration impacts are neglected, constant market prices are presumed, and Leontief production functions are employed. Moreover, the possible effects of the policy change on capital investment (e.g., housing) or on consumption changes induced by employment and earnings effects are not analyzed.

4. Conclusions

On the basis of this overview of microdata simulation efforts and illustration of the sorts of estimates they yield, the final section offers a few comments on both the merits and the difficulties of this research approach. The merits of the approach have already been mentioned: (1) estimates of impact that reflect both behavioral responses to a program and the inherent linkages and interdependencies of the economic system and (2) estimates of the impact of a policy change on narrowly-defined sectors of the economy (regions, industries, occupations) and specific demographic and economic groups. The benefits of these characteristics to policy-makers are not trivial. To the extent that program costs depend upon the response of individuals to the income and incentive effects of the program, more reliable cost estimates are obtained. Similarly, to the extent that the merit of a program depends on who is benefited and who is hurt, and the extent of gains and losses, such analyses contribute to a clearer perception of a program's worth. Finally, such systematic and detailed sectoral analyses are important in the design of programs and policies. The process of designing a program is, by definition, one of considering the effect of various program characteristics on conflicting objectives, and trading-off gains and losses amongst them so as to achieve a program structure that maximizes some weighted objective function. Only through simulations based on microdata can the economic effects of various program sizes and characteristics be discerned, and only by discerning such impacts can programs be structured to achieve desired goals at least cost.

While these are significant gains, they come at some cost. The most obvious cost is the sizable research, manpower, computer, and survey requirements of such modelling efforts. Work with microdata bases is both time-consuming and inherently frustrating. The potential for calculation and programming errors is very large, and because of the cumulative and linked nature of such models, errors discovered at an earlier stage require the recalculation of estimates developed in later stages. Similarly, minor restructuring of earlier parts of models (the potential for which is enormous) requires recalculation and often reprogramming of later stages in the analyses.

A second difficulty of such modelling efforts resides in the inherent nature of the survey data on which they rest. The weaknesses of such data--misreporting, missing data, inadequate economic or demographic information--are well known. And while these problems may undermine the reliability of more aggregative analyses at least as much as microdata studies,[12] the need for microdata analysis to deal with each of numerous observations multiplies--often severalfold--the difficulty of achieving estimates at all.

The problem of appropriately modelling behavioral responses to program, price, or income incentives is a further difficulty of microdata simulation efforts. For example, if the simulation effort requires estimates of labor-supply responses to price and income incentives, the range of elasticity estimates available for inclusion in the model is very large.[13] Under these circumstances, the simulation results from any particular specification are suspect, and the use of sensitivity analyses establishing reasonable bounds around the estimates is called for. Because this problem is so pervasive--involving not only individual response functions to program structures (e.g., labor supply, consumption, and migration relationships), but also coefficients describing input-output relationships, regional trade relationships, marginal output-labor requirements, and labor demand-earned income relationships--the reliance on sensitivity analyses has serious drawbacks. Not only does the sheer number of simulation estimates become unmanageably large, but the range of upper- and lower-bound estimates of the final variables of interest expands significantly. While there are means of controlling this growth, the ultimate interpretation of results is problematic.

A final point should be noted: efforts to expand the complexity of such models (for example, to include dynamic relationships and intertemporal changes in family or enterprise structure) run the risk of introducing debilitating computational difficulties. While additional efforts to refine a model always have potential benefits, if such efforts are carried sufficiently far, a high risk of establishing an unmanageably complex structure is encountered. The efforts required to simplify the structure of such a model so as to make it operational may be substantial.

Footnotes

[1]This model is described in Polenske [1975].

[2]This description relies heavily on Okner [1972a].

[3]Although these characteristics would have yielded more than a thousand cells, the number was ultimately collapsed to 74.

[4]See Pechman and Okner [1974]. This study defended the neglect of impacts beyond the first-round incidence, claiming that "they are believed to be small and are difficult to measure." A more recent paper, using the MERGE-70 file, compares tax burdens for 1966 and 1970 [Okner, 1976].

[5]The brief description of the model here draws heavily from S.P. Dresch and R.D. Goldberg [1973].

[6]The model assumes that the production structure of industries is invariant across regions. Hence, the same labor and capital income, occupational and raw material demands, and effluent releases are generated per dollar of industry x gross output, irrespective of the region in which gross output is produced. However, while labor income is allocated to the region in which gross output occurs, capital income is distributed on the basis of national capital ownership.

[7]This model and the results of policy simulation using it are described in Golladay and Haveman [forthcoming].

[8] The input-output study is the one developed by a group primarily located at Harvard University and known as MRIO. See Polenske [1975].

[9] The DYNASIM model is most fully described in G. Orcutt, S. Caldwell, R. Werthheimer, et al. [forthcoming].

[10] This procedure of dynamic simulation is to be distinguished from an alternative process of "aging" a population which is employed in another microsimulation model also based at the Urban Institute. This model--Transfer Income Model (TRIM)--ages its sample population by altering sample weights to capture the changing age, race, and sex distribution of the population and applying multiplicative factors to income sources of individuals to reflect changing economic patterns. These adjustments fail to capture the formation of new units as well as the second and third order changes which occur as individuals react to initial changes. For a description of this model see Sulvette [1976]. Early development of this model is found in Moeller [1973].

[11] Although not shown, the South's share of total gross output effects is not as great as its share of either net transfers or consumption spending. There is a substantial leakage of generated demands out of this region by the process of consumption and production.

[12] See J.B. Edwards and G.H. Orcutt [1970], who demonstrate the estimation gains from using micro- as opposed to aggregated data.

[13] See G.G. Cain and H.W. Watts [1973]. While the income and substitution effects estimated in the studies reported in this volume generally had the expected signs, the range of estimated coefficients varied widely.

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