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ABSTRACT

Past research on the economic effects of income transfer policies has concentrated on the primary incidence impacts or resource allocation effects related to labor supply, fertility, and migration. This study analyzes the effect of income transfer programs on patterns of consumption expenditures and then traces the effect of these patterns on regional output (by industry), employment (by occupation), and earnings (by earnings class). A short-run disequilibrium simulation model is employed to estimate these induced effects.

The estimates presented here suggest that the final income distributional effect of explicitly propoor transfer programs will be offset by these induced effects. The increments to earned income induced by the programs are more heavily concentrated among high earnings classes than even the preprogram distribution of earned income. In effect, the structure of employment will be shifted away from low-skill, low-earnings classes toward high-skill, high-earnings classes. Similarly, although the bulk of net transfer benefits is targeted at low-income (primarily southern) states, most of the indirect employment and output gains were recorded in the relatively prosperous North Central and Northeast regions.

EFFICIENCY AND EQUITY EFFECTS OF INCOME TRANSFER POLICY: A SIMULATION ANALYSIS

I.

Policy measures designed to alter the nation's income support system have efficiency and equity consequences similar to those generated by exhaustive public expenditures. Yet, heretofore, analysis of the economic consequences of income transfer policy has been substantially narrower in scope than that applied to exhaustive expenditure programs. Analyses of equity effects of income support programs have been limited to evaluation of the first-round or primary incidence effects,[1] while work on resource allocation impacts has concentrated on labor supply,[2] headship and family structure,[3] fertility,[4] and migration effects.[5]

In this study, the framework for evaluating income transfer policies is expanded to encompass a wide range of economic impacts not previously considered. Through an explicit demand side model, the effects of income transfer programs in altering patterns of consumption expenditures are estimated, and, in turn, the implications of these alterations on regional output (by industry), employment (by occupation), and earnings (by earnings class) are analyzed. By focusing on the impact of policy on goods and factor markets, the extent to which behavioral responses and market adjustments induced by the policy change tend to reinforce or offset the initial or first-round equity and efficiency effects of the policy can be determined.

First, a heuristic description of the economic adjustment process reflected in the analysis is presented, as are the programs to be

analyzed. A more formal version of the several components of the model is described in an Appendix. Then, the results of the simulation are presented and interpreted. These results emphasize both the relationship of the first-round incidence with the indirect income-distributional effect of the policy, and the induced impacts of the policy on various regions, industries, and occupations.

II.

Public policy measures can be viewed as exogenous shocks to the economic system that induce a complex set of adjustments in both individual and firm behavior and in markets. Policy-induced disturbances affecting particular, spatially distinct markets cause shifts in relative prices, yielding changes in relative output levels among industries and regions and changes in relative employment levels among various occupational groups. These shifts, in turn, imply alterations in the distribution of incomes among regions, factors, and individuals. Such distributional shifts--which can be considered first-round changes--loop back into the economic system, bringing forth additional alterations in spatial and sectoral output and employment patterns and in income distribution.

The nature of this full general equilibrium adjustment process is complex; the framework employed here captures only a portion of this complexity. Stated in terms of a short-run disequilibrium model, the analysis first traces the disbursement of benefits and the incidence of taxes associated with an assumed income redistribution program among individual families classified by income, region, and other socioeconomic characteristics. Then, relying on a separate analysis of marginal

consumption expenditures and budget shares, the induced changes in commodity-consumption expenditures are evaluated for families grouped by region. Such regional expenditure shifts, interpreted as changes in final demands, call forth increases in the outputs of some industries in some regions and decreases in the outputs of others. These differential first-round industrial impacts stimulate further demands for intermediate inputs, resulting in a final pattern of induced gross output changes by industry and region. In response to these changed gross output levels, primary factor inputs--sectorally and spatially distinguished--experience differential changes in demand. Some occupations in some regions experience increased employment; others contract. As a result of the differential labor skills and capital investments required for meeting the induced output changes, the degree of inequality in the distribution of earned income may be altered.

The simulation model that serves as the basis for this analysis seeks to capture these interrelationships and induced effects. The full model is composed of five submodels (referred to as modules) that portray the economic processes from the incidence of the initial transfer to the ultimate impact on the distribution of earnings. These processes are:

1. the direct tax and transfer allocation process;
2. the consumption expenditure process;
3. the sectoral gross output process;
4. the factor demand process; and
5. the regional earnings distribution process.

The tax-transfer module portrays the gross and net incidence effects of the combination tax-transfer policy change on household disposable incomes. In simulating these effects, the eligibility rules and benefit

(tax) schedules of the components of the policy are applied to a national sample of households, containing both detailed demographic information and earnings and unearned-income information.[6] From this simulation, estimates of the first-round benefits and tax liabilities generated by the policy change are obtained for households classified by race, region, family size, education of the head, and preprogram income level. These estimates presume no response to the program of work effort,[7] migration, or family structure; nor do they account for the impact of the policy change on future years' economic welfare.[8]

These estimates of policy-induced changes in family disposable income imply alterations in the level and composition of family consumption expenditures. Such expenditure responses are estimated in the consumption expenditure module through the application of savings propensities and marginal budget shares defined on current income to the estimated changes in family income.[9]

In estimating the change in total family consumption expenditures that results from the policy, all households in the Current Population Survey (CPS) file are aggregated into six preprogram income classes and income-class-specific marginal expenditure propensities are applied to the policy-induced change in household disposable income.[10] The resulting change in household expenditure is allocated among individual commodity categories by multiplying the expenditure change by a vector of marginal budget shares specific to the income class of the household.[11] From this calculation, induced changes in expenditures by detailed commodity categories are obtained for each household. By aggregating these household vectors over the family units in a region, a vector of

policy-induced changes in expenditures within a region on each of 56 commodities is obtained.

Such policy-induced changes in the composition of consumption expenditures, by commodity and region, affect individual firms in various markets, leading to a revised pattern of production in the economy. The ultimate impact of these changes on the structure of production is obscured by the complexity of interindustry and interregional dependencies. In the regional gross output module, the indirect regional and industrial production responses to changes in commodity expenditures are estimated. This module distinguishes 79 industries in each of 23 regions.

The empirical model used to develop these interindustry, interregional estimates is an adaptation of the Economic Development Administration-Harvard Economic Research Project multiregional input-output model (MRIO).[12] This model relies on a Leontief production technology--implying linearity, additivity, and nonsubstitutability--for each of 79 sectors in each of 44 regions.[13] The input-output requirements for the several sectors of this model are estimated individually for each region.[14] Trading patterns are estimated by the column coefficients method, and hence presume that all uses of any commodity within a region are supplied in fixed proportions by other regions.[15]

The final steps in this model seek to trace the policy-induced demands back to the household sector--first by developing estimates of the pattern of induced labor demands by occupation and then by deriving the implications of this pattern for the distribution of

earned income. The occupational employment module enables an estimate to be made of the occupational distribution of job opportunities created by the policy, and hence an estimate of the effect of the program on the employment prospects of workers of various skill levels.

A fully specified model of the effects of the policy on labor market adjustment would depict the responses of skill-specific labor demands and supplies, allowing for input substitution possibilities, individual supply responses, interoccupational mobility possibilities, the processes by which workers move into and out of the labor force, and adjustments in market wage rates. However, lacking detailed estimates of occupational demands and interoccupational mobility both within and between firms, the implicit labor market model employed here is much simpler and less satisfactory than the ideal. It extends the assumptions implicit in the Leontief interindustry model to the demand for factor inputs--occupational labor supply functions are assumed to be infinitely elastic, with demand increments in any occupation and region met by expansion of the labor force in that sector.[16]

Estimation of these employment effects is done in two steps. First, the total change in regional and sectoral employment is obtained by multiplying employment-per-unit-of-output coefficients[17] by the detailed gross output impacts obtained from the previous module. Then, the total sectoral employment estimates are distributed over 114 occupational categories by applying a matrix of occupational composition ratios by industry[18] to the sectoral employment estimates.

Finally, the implications of this induced pattern of occupational demands on the marginal size distribution of labor income is ascertained

in the regional earnings distribution module. It is assumed that any earned income attributable to incremental employment in an occupation and region is distributed by earnings class as existing earned income is distributed over those currently employed in an occupation and region.[19] To secure these estimates, the incremental labor demand in each occupation and region (estimated in the previous module) is multiplied by the relative frequency distribution of all employed members of the labor force by earnings class in the corresponding occupation and region.[20] By aggregating these distributions over occupations within a region (or the nation), the induced employment by earnings class for the region (or the nation) is obtained. It is the structure of these marginal distributions that can be compared to the preexisting earnings distribution in the region (or the nation) to determine the effect of the policy on high-skill, high-wage workers relative to low-skill, low-wage workers within the region (or the nation). Through such a comparison, the impact of the indirect demands of the policy change in reinforcing or offsetting the primary incidence of the program can be ascertained.

III.

This sequential simulation analysis is applied to a well-known income transfer proposal--a Negative Income Tax (NIT).[21] The NIT 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; no benefit reduction rate is applied to unearned income. Financing

for the transfer proposal is assumed to come from 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.

Of the many detailed estimates obtained from implementation of the model, two are presented here.[22] In this section, the first-round income distribution effects of the NIT specified above are compared with the ultimate impact of the policy on the earnings distribution. In section IV, first-round and final regional effects are compared.

The aggregate 1973 benefit payments from the NIT are estimated to be $4922 million. The aggregate tax cost for the program is set equal to aggregate benefit payments, implying a federal personal income surtax of 5.28 percent. Hence, for any family or group of families, the net benefit or cost from the program is equal to the benefit payment received (referred to as gross benefit) less the additional tax liability incurred.

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 $6000, all income classes above $6000 incur net costs. The extent of the income redistribution accomplished by the plan is observed by the disparities between the lowest and highest income classes. Families with incomes in excess of $15,000 are estimated to incur income losses of $3.3 billion, while households with incomes below $2000 stand to gain approximately $1.8 billion. Families with incomes between $4000 and $15,000--which constitute the bulk of U.S. households--are relatively unaffected. For example,

TABLE 1

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

Income Class	Net Benefits (in millions)	Net Benefits Per Family
less than $1000	$ 955.5	$494.31
$1000-$2000	867.1	238.02
$2000-$3000	1060.1	255.51
$3000-$4000	854.4	242.64
$4000-$5000	500.5	153.59
$5000-$6000	335.5	107.40
$6000-$10,000	-22.0	-16.59
$10,000-$15,000	-1020.7	-67.87
$15,000-$20,000	-1006.9	-11.77
$20,000 or more	-2327.1	-259.21
Total	≈0	≈0

the total gain of all income classes in this range that show a net gain is less than $.9 billion and the total loss of all classes in this range that show a net loss is $1.3 billion. When the gains and losses from the program are spread over all families within an income group, the average net benefit to the lowest income groups is nearly $500 and the average net loss to the highest income groups is over $250. The average family with about $7000-$8000 of income experiences no net gain or loss.

This first-round redistribution from higher to lower income groups is reflected in a significant narrowing of the income distribution from before to after implementation of the program. Prior to implementation, the Gini coefficient for the distribution of current family income is estimated to be .489.[23] If it is assumed that NIT and its surtax financing arrangement are put into effect, the inequality of the distribution of family income is substantially reduced. The Gini coefficient falls from .489 to .448, a reduction of .04 or nearly 9 percent.

Whether or not this first-round redistribution is a reliable picture of the ultimate equity impact of the program depends upon the distributional implications of the induced indirect effects. By tracing the induced demands generated by the policy through the several simulation modules, the distributional pattern of the induced employment can be estimated. If this incremental employment is concentrated at the bottom of the earnings distribution, the demand for low-skill, low-wage workers will have been stimulated (relative to the preprogram pattern of labor demand) and the indirect effects of the program will be said to have reinforced the primary distributional impact.[24]

For all regions and for the United States, it is estimated that the NIT will result in an increase in aggregate labor demand. This is

due to the lower marginal propensity to consume of higher income groups (who are net cost bearers) relative to lower income groups (who are net beneficiaries). The aggregate increase in labor demand is estimated to be about 125,000 positions. As a result, the high wage-low wage comparisons to be described focus on relative incremental labor demands by earnings class. The benchmark used is the composition of labor demands by earnings class prior to the program.

The induced effect of the program on any skill or earnings class is measured by an impact indicator.[25] This indicator compares the incremental labor demand in a regional earnings class with the preexisting employment in that class. Within a region, those earnings classes with indicators in excess of (less than) that of the region as a whole will experience an increase (decrease) in their shares of regional employment. Similar comparisons can be made for any regional earnings class relative to the induced national labor demand effect.

In Table 2, the induced earnings distribution impact of the NIT is presented for 23 detailed regions, 4 census regions, and the entire United States.[26] One pattern dominates. The lowest-skill earnings class (less than $4000) has the lowest impact indicator in 21 of the 23 regions. In the remaining 2 regions, the impact indicator of the lowest earnings class lies below that of the region, even though it is not the lowest among the earnings classes. The opposite result is observed for the higher-skill classes. For the $10,000-$20,000 earnings class, the impact indicator is the highest of the earnings classes in 9 of the 23 regions, and in no region is the impact indicator for that earnings class below that for the region as a whole. The results for

TABLE 2

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

Region	Earnings Class: Less than $4000	$4000-$10,000	$10,000-$20,000	More than $20,000	Regional Impact Indicator	Induced Labor Demand (in thousands of jobs)
Northeast	.95†	1.07	1.32	1.55*	1.08	24.3
1) Ct, Ma, Me, NH, RI, Vt	.93†	1.00	1.22	1.58*	1.02	5.8
2) NY	.86†	.98	1.18	1.30*	.98	8.1
3) Pa, NJ	1.04†	1.22	1.53	1.83*	1.21	10.4
North Central	1.29†	1.55	1.78	1.86*	1.49	38.1
4) Oh, Mi	1.09†	1.49	1.72*	1.59	1.38	12.1
5) In, Il	1.14†	1.30	1.68	1.80*	1.35	10.2
6) Wi, Mn	1.10†	1.33	1.58*	1.58*	1.27	4.9
7) Ia, Mo	1.64†	1.85	2.07	2.35*	1.79	6.1
8) Ka, Nb, ND, SD	2.09†	2.25	2.66	3.03*	2.23	5.1
South	2.62†	2.81	3.49*	3.28	2.78	74.8
9) De, DC, Md	.03	.14	.33*	-.09†	.12	.3
10) Va, WV	1.02†	1.41	1.47*	1.25	1.18	3.1
11) NC	2.07†	2.15	3.64	3.89*	2.23	5.3
12) SC	4.17†	4.58	6.90	11.11*	4.92	5.1
13) Ga	1.08†	1.23	1.88*	1.72	1.23	2.5
14) Fl	.52†	.62	.79*	.72	.57	1.6
15) Ky, Tn	2.77†	3.08	4.76	5.47*	3.12	9.4
16) Al	2.94†	3.48	4.33*	4.20	3.30	4.6
17) Ms	14.20	17.82	27.03*	14.11†	16.27	13.9
18) Ark, Ok	2.28†	2.61	3.46	3.52*	2.52	4.9
19) La	8.49†	9.62	11.45	13.81*	9.36	12.8
20) Tx	2.04†	2.36	3.01*	2.96	2.30	11.2
West	1.52†	1.58	1.62	1.94	1.57	24.8
21) Ar, Co, Id, NM, Ut, Nv, Wy, Mt, Ak	2.71†	2.95	3.19	3.81*	2.89	10.9
22) Wa, Or, Hi	2.13†	2.32	2.45	3.40*	2.29	6.7
23) Ca	.70†	.79	.93	1.06*	.79	7.2
United States	1.70†	1.78	1.99	2.13*	1.78	162.4

† - the lowest impact indicator in a region.

* - the highest impact indicator in a region.

the highest-skill class (more than $20,000), show a similar pattern: For 15 of the 23 regions the impact indicator for this earnings class exceeds that of any other earnings class. Indeed, if the two highest earnings classes are aggregated, the lowest earnings class has the lowest impact indicator in all of the regions and the highest class has the highest indicator in all of the regions.

This same pattern is also present when the impacts are simulated for the nation as a whole: The lowest impact is on the below-$4000 class and the highest impact is recorded for the above-$20,000 class. The indicator for the lowest earnings class is 96 percent as great as that of the national impact indicator, while that of the $20,000-or-more class is about 120 percent of the national indicator.

The underlying economic adjustments that account for this adverse effect of the program on the employment of low-wage, low-skill workers can be perceived by examining the policy-induced demands placed on detailed industrial and occupational categories. For the NIT simulation, a number of prominent low-wage occupations receive very low or negative incremental labor demands, while some recognized high-wage occupations are relatively heavily impacted. The low-skill, low-wage occupations with very low or negative demand effects (together with their impact indicators[27]) include: Textile Operatives (-.76), Health Service Workers (.84), Laborers (1.73), Personal Service Workers (.51), Protective Service Workers (.07), and Farmers and Farm Workers (.72). While these low-wage occupations are estimated to experience an increase of 11,400 jobs, they would have to experience an increase of 26,000 jobs if their share of total national employment were not to decline from before to after the program.[28]

These comparisons suggest the following: The final distributional effect of explicitly redistribution-oriented 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 propoor than the initial redistribution, these induced effects, in fact, appear to undo the initial redistribution. The earnings increments are more heavily concentrated among high earnings classes than even the preprogram distribution of earned income. In effect, low-income families tend to spend their income increments on goods and services produced by groups with relatively high earnings, while higher-income families tend to concentrate their spending reductions on sectors employing workers with relatively low earnings. While the program achieves 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.

IV.

When the indirect effects are analyzed from a regional point of view, much the same sort of moderating impact is observed. While net transfers are heavily concentrated in certain regions, the induced industrial output and employment impacts tend to fall heavily in other regions.

Table 3 presents the distribution of net transfers by region for the NIT. On balance the South receives substantial net transfers--over $500 million. Each of the other three major regions incurs net costs. The average Mississippi family experiences an increase in disposable

TABLE 3

Distribution of Net Transfers of a Negative Income Tax, By Region, 1973

Region	Total Net Transfers (in millions)	% Gross Transfers % Taxes	Per-Family Net Transfer
Northeast	$-222.1	.83	$-13.85
1) Ct, Me, Ma, NH, RI, Vt	-42.3	.85	-11.11
2) NY	-92.8	.83	-15.61
3) Pa, NJ	-86.9	.83	-13.84
North Central	-274.5	.80	-14.90
4) Oh, Mi	-160.3	.69	-25.11
5) In, Il	-108.5	.74	-19.90
6) Wi, Mn	-39.5	.81	-13.57
7) Ia, Mo	8.4	1.07	3.78
8) Ks, Nb, ND, SD	25.3	1.29	17.37
South	530.3	1.41	26.96
9) De, DC, Md	-60.8	.68	-34.22
10) Va, WV	-15.8	.88	-9.21
11) NC	41.8	1.47	26.62
12) SC	58.4	2.16	68.37
13) Ga	4.9	1.08	3.33
14) Fl	-35.1	.88	-15.15
15) Ky, Tn	71.0	1.59	32.64
16) Al	45.0	1.70	44.79
17) Ms	174.6	6.97	214.38
18) Ar, Ok	35.0	1.49	27.73
19) La	149.7	3.54	117.18
20) Tx	61.6	1.24	17.93
West	-35.9	.96	-3.01
21) Az, Co, Id, Nm, Ut, Nv, Wy, Mt, Ak	84.5	1.44	31.43
22) Wa, Or, Hi	21.6	1.14	10.13
23) Ca	-142.0	.76	-19.99
Total	≈0		≈0

income of $214, while the average family in Delaware-D.C.-Maryland incurs a liability of $34. In terms of this first-round flow-of-funds effect, then, there is a substantial redistribution of post-tax, post-transfer income from the richer to the poorer states in general and from the North to the South in particular.

In response to these changes in disposable income, some regions experience increases in consumption demand, while expenditures in other regions are decreased. While some of these expenditure changes result in increased demand on local or regional industries, other demands fall on businesses far from the site of increased expenditure. This is especially true after the second-, third-, and nth-round interindustry demands are accounted for.

Table 4 presents the regional distribution of gross outputs generated by NIT.[29] It is estimated that an increase in gross output (and labor demand) is elicited in all regions and for the nation. Of the projected increase in gross output of over $4 billion, the South receives $1.7 billion--about 40 percent of the total. The North Central region receives about one-third of the increase and the Northeast and West account for about 15 percent each of the total national increase in gross output.

To adjust for the widely varying output capacities of the various regions, Table 4 also presents an impact indicator for each region.[30] For the nation, this indicator is 2.3. Among regions, it ranges from 15.9 (Mississippi) to .93 (Florida). Of the 13 regions with indicators above 2.5 in the NIT simulation, 8 are in the South.

While these results indicate a substantial impact on the South and the West, these regions' share of total gross output is significantly

TABLE 4

Gross Output Impact Generated by the Net Transfers from a Negative Income Tax, By Region, 1973

Region	Gross Output (in millions)	Regional Impact Indicator
Northeast	$ 589.0	1.27
1) Ct, Me, Ma, NH, RI, Vt	113.0	1.07
2) NY	182.9	.93
3) Pa, NJ	293.1	1.69
North Central	1277.2	2.23
4) Oh, Mi	511.5	2.54
5) In, Il	307.3	1.78
6) Wi, Mn	149.4	1.97
7) Ia, Mo	188.6	2.62
8) Ka, Nb, ND, SD	120.4	2.43
South	1673.2	3.54
9) De, DC, Md	50.0	1.07
10) Va, WV	81.9	1.71
11) NC	126.0	2.98
12) SC	78.5	4.30
13) Ga	81.0	2.38
14) Fl	43.0	1.02
15) Ky, Tn	205.0	3.99
16) Al	87.4	3.71
17) Ms	203.4	15.92
18) Ar, Ok	107.7	3.28
19) La	270.0	6.72
20) Tx	339.3	3.61
West	530.9	1.74
21) Ar, Co, Id, NM, Ut, Nv, Wy, Mt, Ak	198.4	3.03
22) Wa, Or, Hi	115.8	1.77
23) Ca	216.7	1.11
Total	4070.5	2.27

smaller than their share of either net transfers or consumption expenditures. There is a substantial leakage of generated demands out of the regions.

The extent of this leakage is indicated in Table 5, which shows (1) the ratio of gross output to consumption expenditures induced by the program for each of the major regions and the nation, and (2) the difference between per capita net transfers and per capita gross output induced by the program. While the ratio of gross output to consumption expenditures is 1.9 for the nation, it is about 1.4 for both the South and the West, and 4.0 for the North Central region. Similarly, while the North Central region experiences negative net transfers from the NIT, the difference between per capita gross output and per capita net transfers for that region is about 150 percent of that in the South and West. As a result of the structure of interregional and interindustry relationships, then, a substantial share of second-, third-, and nth-round demands falls on sectors whose productive capacity is concentrated in the North Central region. The high concentration of net transfers in low-income regions is eroded in the exchange and production process so that the stimulation of economic activity in these regions is substantially smaller than the pattern of net transfers implies.

V.

The objective of this study is to extend the framework for evaluating the economic impacts of tax-transfer policy. This objective has been pursued through the construction and implementation of a short-run multi-sector demand model without supply constraints, which enables impacts of policy-induced changes in consumption expenditures to be

TABLE 5

Indicators of Output Leakage for the NIT Simulation

Region	Ratio of Gross Output to Consumption Expenditures	Per Capita Gross Output less Per Capita Net Transfer
Northeast	1.8	$16.53
North Central	4.0	27.43
South	1.5	18.20
West	1.4	16.28
United States	1.9	20.03

traced through the economy. Through this procedure, both policy-stimulated resource reallocations and equity impacts could be discerned; here the redistributional effects--by income class and region--were emphasized.

In both dimensions, the analysis demonstrates that the indirect output and employment effects tend to offset the primary or first-round distributional impacts of the policy shift. Although the policy proposal analyzed has poverty reduction as its primary objective, more high-skill, high-wage jobs than low-skill, low-wage jobs were created. Moreover, although the bulk of net transfer benefits was targeted at low-income (primarily southern) states, most of the indirect employment and output gains were recorded in the relatively prosperous North Central and Northeast regions.

While results such as these expand the basis for evaluating proposed transfer policies, they neither comprehend the full range of economic impacts nor are immune from criticism. To allow the empirical development of the model, several likely behavioral responses had to be suppressed; no induced labor supply impacts were admitted to the model, nor were migration or household structure responses permitted. Consumption expenditure responses were based on changes in current disposable income; Leontief production functions implying homogeneity, linearity, and nonsubstitutability were employed, and constant market prices were presumed. Moreover, because of the short-run, current-account nature of the model, investment behavior induced by the policy--in particular, housing construction--was excluded. Because the model was not run recursively, second, third, and nth loops of the processes were not estimated, and because of limitations in the consumption data, recent

changes in household consumption behavior and induced changes in direct household employment were not recorded. Finally, no estimates were made of the distributional impacts of the induced income streams other than earnings. It is expected (though not quantified) that the net impact of these omitted effects--especially those related to wage-rate inflexibility,[31] restricted labor supply effects, absence of household labor and investment demands, and the distributional effect of nonlabor income--would tend to reinforce the indirect distributional impacts discussed earlier.

The policy implications of these results are clear. First, the income redistribution and regional impacts of direct tax-transfer schemes are not as powerful as estimates of their primary incidence suggest. Second, if the induced shift in the skill composition of labor demand is combined with presumed reduction in the supply of low-skill labor, the second-, third-, and nth-year cost estimates of the programs are likely to exceed the first-year cost estimates presented here. Finally, by emphasizing the distribution of induced job opportunities in the economy, the analysis forces attention to the full pattern of microeconomic effects of government policy as a basis for policy evaluation. Given the pattern of induced effects, cash transfer schemes with high first-round target efficiency may lose some of their edge when compared to, say, expenditure programs with high indirect employment impacts on low-skill workers.

APPENDIX

This Appendix presents a formal statement of the simulation model described in section II.

Notational Glossary

y_s - a row vector, each element of which is the 1973 income level of a household included in the 1971 Current Population Survey (CPS). Each household is indexed by family size, place of residence, marital status, and all other sociodemographic characteristics that enter the eligibility and benefit rules of the transfer and taxation program to be simulated.

Φ - a diagonal matrix where Φ_{ii} (the ith element along the diagonal) is the taxation (and/or benefit) rate corresponding to the ith element of y_s.

T_s - a vector of the program-induced change in income of each family in the sample population.

W - a diagonal matrix of weights required to transform the sample population into the national population.

T_n - a vector of the program-induced change in income of each group of families in the national population.

M - a diagonal matrix in which the ith element along the diagonal is the marginal propensity to consume from current income for the ith household.

ε - a vector specifying for each household the weighted total induced consumption expenditure.

$\hat{\varepsilon}$ - a vector of total induced expenditures by region and income class.

β - a block diagonal matrix of marginal budget shares. Each block along the diagonal is a submatrix $(\beta_1 \ldots \beta_r)$ of marginal budget shares for a region, in which $\beta_1 = \beta_2^r = \ldots = \beta_r$. The ith row of a submatrix is the vector of budget shares for the ith income class for that region. That is,

$$\beta = \begin{pmatrix} \beta_1 & & & \\ & \beta_2 & & \\ & & \beta_3 & \\ & & & \ddots \beta_r \end{pmatrix}$$

$$\beta_i = \begin{pmatrix} b_1^a & b_1^b & \cdots & b_1^n \\ b_2^a & & & \\ \vdots & & & \\ b_6^n & \cdots & & b_6^n \end{pmatrix} \qquad b_g^h = \frac{MPE_g^h}{\sum_{i=n}^{n} MPE_g^i}$$

and in which

MPE_g^h = the marginal propensity of households in income class g to spend on commodity h.

E - an 1817-element vector of commodity-specific expenditures for 79 production sectors in each of 23 regions.

E^t - transpose of E.

C - a square matrix of dimension 1817 X 1817 composed of 79 X 79 diagonal matrices. Each element (C_i^{xy}) describes the fraction of total consumption of commodity i in region x that is imported from region y. That is,

$$C_{1817 \text{ X } 1817} = \begin{pmatrix} \hat{C}^{11} & \hat{C}^{12} & \cdots & \hat{C}^{1,23} \\ \hat{C}^{21} & \hat{C}^{22} & \cdots & \hat{C}^{2,23} \\ \vdots & \vdots & & \vdots \\ \hat{C}^{22,1} & \hat{C}^{21,2} & & \hat{C}^{22,23} \\ I & I & \cdots & I \end{pmatrix} \qquad C^{xy}_{79 \text{ X } 79} = \begin{pmatrix} C_1^{xy} & & & \\ & C_2^{xy} & & \\ & & \ddots & \\ & & & C_{79}^{xy} \end{pmatrix}$$

$\hat{A}$ - a block diagonal matrix of dimension 1817 X 1817 with 23 square matrices (79 X 79) of input-output coefficients along the diagonal describing the structure of production in each region. That is,

$$\underset{1817 \text{ X } 1817}{\hat{A}} = \begin{bmatrix} A^1 & & \bigcirc \\ & A^2 & \\ & \ddots & \\ \bigcirc & & A^{23} \end{bmatrix} \qquad \underset{79 \text{ X } 79}{A^r} = \begin{bmatrix} a^r_1 & \cdots & a^r_{1,79} \\ \vdots & & \vdots \\ a^r_{79,1} & \cdots & a^r_{79,79} \end{bmatrix}$$

I - identity matrix.

X - an 1817-element vector of gross output by 79 production sectors in each of 23 regions.

N - an 1817-element vector of total employment requirements by 79 production sectors in each of 23 regions.

λ - a matrix of employment-output coefficients, composed of 23 block diagonal 79 X 79 matrices.

O - a block diagonal matrix of occupational composition ratios, with submatrices $[O^r]$ of dimension 114 x 79, giving occupational composition ratios by region. $[O^1] = [O^2] = \ldots = [O^{23}]$.

L - a 2622-element vector of total employment requirements by 114 occupations in each of 23 regions.

D - a block matrix constructed from 23 regional relative frequency earnings distributions. Each block is a 15 x 114 matrix representing a regional distribution.

F - a 345-element vector of employment requirements by 15 earnings classes in each of 23 regions.

The Model

- The Tax-Transfer Module

$$y_s \Phi = T_s \tag{1}$$

$$T_s W = T_n \tag{2}$$

- The Consumption Expenditure Module

$$\varepsilon = T_n M \tag{3}$$

$$\hat{\varepsilon} = \sum_{\substack{\text{income class,} \\ \text{region}}} \varepsilon \tag{4}$$

$$E = \hat{\varepsilon}\,\beta \tag{5}$$

- Regional Gross Output Module

$$X = (I - C\hat{A})^{-1} CE^t \tag{6}$$

- Occupational Employment Module

$$N = \lambda \cdot X \tag{7}$$

$$L = O \cdot N \tag{8}$$

- Regional Earnings Distribution Module

$$F = D \cdot L \tag{9}$$

NOTES

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[1]Robert J. Lampman, "How Much Does the American System of Transfers Benefit the Poor?" in Economic Progress and Social Welfare, ed. L.H. Goodman (New York: Columbia University Press, 1966); Irene Lurie, "Transfer Payments and Income Maintenance," mimeographed Staff Paper for the President's Commission on Income Maintenance Programs, 1969; Benjamin Okner, "Transfer Payments: Their Distribution and Their Role in Reducing Poverty," in Redistribution to the Rich and the Poor: The Grants Economics of Income Distribution, ed. K. Boulding and M. Pfaff (Belmont, Cal.: Wadsworth Publishing, 1972); and Charles L. Schultze et al., Setting National Priorities: The 1974 Budget (Washington: The Brookings Institution, 1973).

[2]See Glen G. Cain and Harold W. Watts, eds., Income Maintenance and Labor Supply (New York: Rand McNally, 1973); Harold W. Watts et al., "The Labor Supply Response of Husbands," Journal of Human Resources, 9, No. 2 (Spring 1974): 181-200; and Irwin Garfinkel and Stanley Masters, Transfer Programs and Labor Supply: An Empirical Investigation, Institute for Research on Poverty Monograph Series (New York: Academic Press, forthcoming).

[3]See Marjorie Honig, "AFDC Income, Recipient Rates, and Family Dissolution," Journal of Human Resources, 9, No. 3 (Summer 1974): 303-322.

[4]See Glen G. Cain, "The Effect of Income Maintenance Laws on Fertility in the United States," in Population, Resources, and the Environment, Commission on Population Growth and the American Future, Vol. 6 (Washington: Government Printing Office, 1972), pp. 327-373.

[5]See John Kain and Robert Schaefer, "Income Maintenance, Migration, and Regional Growth," Public Policy, 20, No. 2 (Spring 1972): 199-225.

[6]The Current Population Survey (CPS) was the micro-data file employed in this module. The March 1971 Survey--containing 1970 information on 50,000 family units--was aged to represent the structure of the population in 1973; the aging procedures allowed for demographic changes, economic growth, and inflation. In addition, the 6.0 percent unemployment rate of 1970 was adjusted to 4.9 percent by randomly

6 (cont.)

assigning unemployment and duration-of-unemployment experiences to groups identified by age, sex, occupation, and unemployment experience. This data base was developed by the Urban Institute as part of its RIM model. See Nelson McClung, John Moeller, and Eduardo Siquel, "Transfer Income Program Simulator," Working Paper 950-3 (Washington: Urban Institute, 1971). Additional details regarding this data base and the simulation procedures are available from the authors or the Urban Institute.

[7]Recent studies of the labor supply effects of income support policies indicate that this assumption may not be far from the mark for male family heads. These studies indicate moderate work-effort reductions by spouses, however. The structure of the model is such that tests of the sensitivity of household disposable income to alternative behavioral responses may be readily introduced.

[8]This impact could be significant if the policy change is interpreted by households as a permanent shift in the structure of the income-generation process. Because the benefits and tax costs of the policies simulated are income conditioned, estimation of future effects would require a forecast of individual household work and leisure choices and changes in aggregate economic variables, all of which are a complex function of the host of forces that determine family income and transitory fluctuations in it over the life cycle.

[9]In the full study, estimates of the benefits and taxes from the policies were made on a normal-income as well as a current-income basis. In these estimates, the vector of program-induced changes in income for each family in the sample population is partitioned into 177 subvectors on the basis of the permanent demographic characteristics of the family, the mean net transfer received by members of a group is assigned to each family of the group, and a new vector is formed. By employing estimates of changes in current income, this approach implicitly assumes that it is changes in current rather than normal or permanent income that motivate consumption behavior. As noted earlier, if the policy change represents a permanent alteration in the income-generation process, the evaluation of normal income will be affected. As a result, families not eligible for benefits in any given year may well experience increments in their normal income because of the policy, and in response alter their consumption behavior. Moreover, because of transitory shifts in income, the change in normal income may well be quite different than the change in current income for families eligible for benefits in any given year. Simulation estimates of consumption responses to changes in normal income have been developed, and while not presented here, are available from the authors on request. The primary empirical results from this normal-income approach are not, in substance, different from those presented here.

[10]The marginal propensities are based on analysis of the 1960-61 Survey of Consumer Expenditures reported in I. Friend and R. Jones, Conference on Consumption and Savings (Philadelphia: University of Pennsylvania Press, 1966). See U.S. Department of Labor, Bureau of Labor Statistics, Consumer Expenditures and Income: Survey Guidelines, Bulletin 1684 (Washington, 1971) for a description of this survey. In applying these marginal propensities to program-induced income changes, adjustments were made for price-level changes between 1960-61 and 1973. Because of the high degree of transitory behavior of households in the lowest current-income class, the Friend-Jones marginal propensity estimate for that class is smaller than those of other classes. To obtain a monotonic relationship between marginal propensities and income, the propensities in the higher income classes were extrapolated down to the lowest class and the estimated value substituted for the Friend-Jones estimate. For the six preprogram income classes (in 1960-61 dollars), the marginal propensities are: less than $2500, 1.09; $2500-$3500, 1.01; $3500-$4500, .89; $4500-$6250, .84; $6250-$8750, .70; $8750 or more, .57.

[11]The marginal budget-share vectors were obtained from a piecewise log-linear regression analysis in which household expenditures on each of 56 commodities were regressed against family income, family size, education of head, home ownership, region, age of head, and urban-rural location. The specification of the regression model was chosen to accommodate nonlinearities observed in previous studies and was patterned after the model developed in John F. Moeller, Household Budget Responses to Negative Income Tax Simulations (Ph.D. dissertation, University of Wisconsin-Madison, 1970). The analysis employed household data from the Survey of Consumer Expenditure file containing commodity expenditure estimates for 343 categories and 14,000 consumer units. These expenditures were inflated to 1973 values through use of the components of the Consumer Price Index.

The estimated income coefficient from each regression indicates the change in expenditures on any commodity in response to a change in household income for that income class, controlling for other social and demographic variables that could affect commodity expenditures. To transform these marginal propensity vectors into marginal budget-share vectors, the total of marginal expenditures in any income-class vector was divided into each element in the vector, yielding a vector of budget shares the sum of whose elements is unity.

[12]This model is described in Karen Polenske, The United States Multi-Regional Input-Output Model (Lexington, Mass.: Heath-Lexington, forthcoming).

[13]In order to insure conformability between the regional breakdown in the prior modules and this module, it was necessary to reduce the dimensionality of the regionalization from 44 to 23. Aggregation was in transactions and shipments form to assure the appropriate dimensionality.

[14]The regional technical coefficients are based upon the 1963 input-output study for the United States and upon sector studies for agriculture, mining, and construction. See Karen Polenske, State Estimates of Technology, 1963 (Lexington, Mass.: Heath-Lexington, 1974).

[15]The interregional trade flows are from a study conducted by Jack Fawcett Associates and are based upon sources for the standard public modes of transportation. See John M. Rodgers, State Estimates of Commodity Trade Flows, 1963 (Lexington, Mass.: Heath-Lexington, 1973).

[16]Given the short-term nature of the model and the relatively small demand increments induced by the policy, neither the linearity nor the nonsubstitutability assumptions appear unreasonable.

[17]The employment-output coefficients are from Bureau of Labor Statistics estimates for 1947, 1958, and 1963 and from estimates of employment by sector and region reported in the MRIO project. See John M. Rodgers, State Estimates of Outputs, Employment, and Payrolls, 1947, 1958, 1963 (Lexington, Mass.: Heath-Lexington, 1972). Annual compound productivity growth rates computed for each sector for the 1947-1963 period are employed in aging the 1963 coefficients to 1973.

[18]The sectoral occupational composition ratios are from a Bureau of Labor Statistics study based on the 1970 Census of Population. For a description of the methodology employed, see U.S. Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs, Vol. 4, Bulletin 1606 (Washington, February 1969). It is assumed that the occupational employment patterns in any sector are constant across regions, implying that all occupations participate in incremental employment in a sector in the same proportion as they participate in total employment in that sector.

[19]This implicitly assumes that the preexisting distribution of earned income reflects the distribution of skill, ability, and work effort of the pool of workers available in an occupation in a region.

[20]The regional relative frequency distributions are from a special tabulation using the 1-in-100 tapes of the 1970 Census of Population. A total of 114 occupational categories and 23 regions is employed, implying 2622 relative frequency distributions. Fifteen earnings classes are distinguished in each distribution.

[21]In the full study, variants of this NIT were analyzed, as well as the Family Assistance Plan of the Nixon administration. In the latter proposal, a benefit program is combined with abolition of the Aid to Families with Dependent Children program and a provision for state

21 (cont.)

supplementation of federal benefits. The empirical results of these analyses do not differ in any significant way from those presented here. A detailed specification of the programs is available from the authors on request.

[22]A more complete presentation of the results is included in a forthcoming monograph, a draft of which is available from the authors on request.

[23]The procedure for estimating the Gini coefficient is from N. C. Kakwani and N. Podder, "On the Estimation of Lorenz Curves from Grouped Data," International Economic Review, 14, No. 2 (June 1943): 278-292. For the preprogram Gini coefficient, the standard error was .03; it was .017 for the post-NIT Gini coefficient.

[24]It would be desirable if the induced earnings flows could be identified with families grouped by income class--as in Table 1. Unfortunately, data on induced employment refer to individual jobs, and these are not readily matched with family units--the basis of the income distributions. Moreover, because transfer-income receipts are dependent on earnings, induced changes in transfer income would also have to be estimated.

[25]The earnings-class indicator is the ratio of induced labor demand in a regional earnings class to 1970 employment in that earnings class times .001. Symbolically,

$$S_i = \frac{M_i}{.001\ (E_i)},$$

where S_i is the impact indicator for a regional earnings class, M_i is the program-induced change in employment in that earnings class, and E_i is the total 1970 employment in that earnings class.

[26]In each region, the highest and lowest impact indicators are noted in the tables. The impact indicator denoted by † is the lowest indicator in a region; that denoted by * is the highest.

[27]These indicators are to be compared to the national indicator of 1.78 (Table 2).

[28]The reverse story could be told by observing the detailed occupations with simulated demand increases yielding high impact indicators. These occupations tend to be relatively high-skill, high-wage occupations. They include Managers, Officials, Administrators, Physicians and Surgeons, and Teachers.

[29]The regional patterns described for gross outputs will be very close to those for induced employment, the latter being highly dependent on the former. Regional labor demands are shown in Table 2.

[30]This indicator is of the same form as that described in note 27. Gross output is substituted for labor demand and total 1970 regional output is substituted for total 1970 employment.

[31]The implications of the constant-wage-rate assumption should, in particular, be noted. With imperfect occupational mobility, relatively full employment, or segmented labor markets, a shift in the structure of labor demands toward high-skill occupations might lead to relative wage rate--and hence earnings--increases in these occupations. This result would magnify the adverse indirect distributional effects described earlier.