ECONOMIC EFFECTS OF INTERSECTORAL INCOME TRANSFERS

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As dissatisfaction with existing welfare programs has become more widespread, increased attention has been given to various income transfer plans that would gurantee all U. S. citizens a minimum annual income. One alternative which is being given serious consideration is the negative income tax (NIT).The negative income tax has been proposed in various forms, most notably President Nixon's family assistance plan.

Despite growing amount of literature regarding the NIT and other plans as tools for reducing poverty, relatively little information is available about the effects of such programs on the distribution of income in the U. S., beyond examining their immediate tax incidence.[1] While an analysis of immediate tax incidence provides worthwhile information, it does not answer questions about longer term macroeconomic aspects of reducing income inequality. As Meyer and Saupe [4] point out that little has been written about the consequences of income maintenance programs on various sectors of the economy. In view of this, we wish to report results of a study that attempts to measure the effects of alternative intersectoral income transfers on the distribution of income among wage earners, the farm sector, and the nonwage-nonfarm or business sector as well as the long-run effects of such transfers on general economic activity.

In this paper we first present empirical results from estimating the structural parameters of a simultaneous equation model of the U. S. economy. Next, we present the effects on the estimated values of the endogenous variables that result from hypothetical lump sum income transfers assumed to have taken place during 1957-1967. Finally, we conclude with some comments on policy implications.

THE EMPIRICAL MODEL

The model used here is a sub-system of the Klein-Goldberger econometric model of the U. S. [3]. There are twelve simultaneous equations and twelve jointly determined variables in the sub-system, each equation describing some important feature of the economy. Eight equations are stochastic in nature and four are definitional equations or identities which hold exactly in each time period. Since the model is a priori over identified, two-stage least squares was used to estimate the structural parameters. All data used are annual observations for the period 1931-67. The war years, 1941-45, were excluded from the analysis because of the unusual economic policies in effect during that time.

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[1] The Office of Economic Opportunity (OEO) in cooperation with the Ford Foundation is conducting an experiment to assess the effects of various NIT plans on a sample of approximately 1,250 urban families in several New Jersey cities. This five million dollar experiment to be completed in 1971, should have substantial implications for the feasibility of inaugurating a NIT plan. The need for additional experimentation was recognized by the Ford Foundation and the OEO, and in the summer of 1969, the rural NIT experiment was begun. The rural experiment will continue for 3 years and is patterned after the one in New Jersey [1, p. 439].

The Estimated Structural Equations

In presenting the empirical estimates the equations are presented in standard form.

The consumption equation[2]

$$C_t = -6.51681 + .79880\,(L - T_L)_t + .48168\,(Z - T_Z - S_Z)_t \quad (1)$$
$$(6.591)_{**} \qquad (2.103)_{*}$$
$$+ .63536\,(A - T_A)_t + .28460\,C_{t-1} - .25575\,P_{S,t-1}$$
$$(1.582) \qquad (2.525)_{**} \qquad (1.815)_{*}$$
$$R^2 = .998$$

The consumption equation relates consumer expenditures during period t to: (1) disposable income of the wage earners sector ($L - T_L$), the farm sector ($A - T_A$), and disposable income less corporate savings of the nonwage-nonfarm, i.e. business sector ($Z - T_Z - S_Z$); (2) consumption in period t - 1 (C_{t-1}); and (3) personal saving in t - 1 ($P_{S,t-1}$). Definitions of the variables follow, with all variables expressed in billions of dollars of 1958 purchasing power:

C	=	consumer expenditures,
L	=	wage earners' compenstation,
T_L	=	personal and payroll taxes less transfers associated with, wage and salary income,
$L-T_L$	=	disposable wage earners' compensation,
Z	=	nonwage - nonfarm income,
T_Z	=	personal and corporate taxes less transfers, associated with nonwage - nonfarm income,
S_Z	=	corporate saving,
$Z-T_Z$	=	disposable nonwage - nonfarm income,
A	=	farm proprietors' income,
T_A	=	taxes less transfers associated with the farm sector,
$A-T_A$	=	disposable farm income, and
P_S	=	personal saving.

Signs of the coefficients in the consumption equation agree with theoretical expectations, with the exception of lagged personal saving, where a positive coefficient was expected. The negative coefficient obtained, however, might be reasonable if lagged personal savings is interpreted as a measure of change in consumer attitudes towards spending. The empirical estimates imply short-run marginal propensities to consume of about .80, .48 and .64 for the wage, business and farm sectors respectively.

The investment equation

$$I_t = -14.21189 + .39057\,(Z+A+D-T_Z-T_A)_{t-1} \quad (2)$$
$$(4.498)_{**}$$
$$+ 1.41464\,P_{Z,\,t-1}$$
$$(6.872)_{**} \qquad R^2 = .939$$

The investment equation relates gross private domestic investment (I) in year t to corporate profit after taxes (P_Z) in t - 1 and to the sum of disposable income plus capital consumption allowances in the farm and business sectors.[3] All variables are expressed in dollars of 1958 purchasing power; D stands for capital consumption allowances and other variables are defined previously. Signs of the coefficients agree with a priori expectations, namely that investment varies directly with farm and business income and corporate profits.

The depreciation equation

The depreciation equation relates capital consumption allowances to capital stock in a simple linear fashion:

$$D_t = 3.03304 + .04867\,[(K_t + K_{t-1})/2] \quad (3)$$
$$(18.649)_{**} \qquad R^2 = .920$$

where K = end of year capital stock in billions of 1958 dollars. Results for the depreciation equation appear reasonable, in that the coefficient, .05, of the capital stock variable is consistent with a depreciation period of 20 years.

The demand for labor equation

The demand for labor equation relates wage earners' compensation to current and lagged gross national product, all expressed in billions of 1958 dollars.

$$L_t = -16.11478 + .49213\,(Y+T+D)_t + \quad (4)$$
$$(17.522)_{**}$$
$$.12078\,(Y+T+D)_{t-1} \qquad R^2 = .999$$
$$(4.075)_{**}$$

where:

Y	=	national income,
T	=	indirect taxes less subsidies, and
Y+T+D	=	gross national product.

[2] Numbers in parentheses are values of the student t-test. The symbols * and ** indicate when coefficients are significantly different from zero at either 95 and 99 percent probability levels, respectively. The coefficient of determination, R^2 is also indicated.

[3] Some overlap between the P_Z and $Z + A + D - T_Z - T_A$ variables is recognized. The theoretical implications of this is discussed in [2, p. 10].

The wage adjustment equation

The wage adjustment equation expresses year-to-year changes in the index of hourly wages ($w_t - w_{t-1}$) as a function of the unemployment level ($N - N_L - N_{ZA}$) and changes in the general price level ($P_{t-1} - P_{t-2}$).

$$(5)\ (w_t - w_{t-1}) = 22.92693 - 1.89428\ (N - N_L - N_{ZA})_t \qquad (4.039)_{**}$$

$$+ .65328\ (P_{t-1} - P_{t-2}) \qquad (.944)$$

$$R^2 = .530$$

where:

- w = index of hourly wages,
- N = number of persons in the labor force, including armed forces,
- N_L = number of wage and salary earners.
- N_{ZA} = number of proprietors of unincorporated enterprises, farm and nonfarm, and
- p = the general price index.

Results of the wage adjustment equation are consistent with the hypothesis of wages being rigid in the downward direction. Taken together, the constant term and the coefficient of the unemployment variable imply unemployment would have to reach 12 million persons before money wages decline.

The agricultural income and price determination equations

The agricultural income equation relates farm proprietors' income to prices received by farmers, government payments and agricultural exports.

$$(6)\ A_t = 5.74396 + .15524\ P_{A,t} + 1.67651\ G_{A,t} \qquad (10.544)_{**} \qquad (2.802)_{**}$$

$$- .08982\ F_{A,t} \qquad (5.901)_{**}$$

$$R^2 = .785$$

where:

- P_A = index of prices received by farmers,
- G_A = deflated government payments to farmers, in 1958 dollars, and
- F_A = index of agricultural exports.

The formulation of the agricultural income equation is consistent with the hypothesis of a farm economy which is controlled almost entirely by government actions, since P_A, G_A and F_A all are influenced substantially by government programs. Several alternative formulations were tried that would have been more consistent with a free market hypothesis; however, none gave acceptable empirical results. The formulation used appears reasonable in many respects, but it carries direct implications for estimating the effects of income transfers, as will be seen later.

The agricultural price determination equation relates farm prices in year t to farm prices in t - 1. The formulation and results are consistent with the hypothesis of a government controlled farm sector, where one of the major goals is price stabilization.

$$(7)\quad P_{A,t} = 1.57625 + .98455\ P_{A,t-1} \qquad (22.030)_{**} \qquad R^2 = .941$$

The production function

labor input, capital stock and to GNP lagged one period.

$$(8)\ (Y+T+D)_t = -108.2658 + 3.61351\ (hN_L + N_{ZA})_t \qquad (4.186)_{**}$$

$$+ .19823\ [(K_t + K_{t-1})/2] + .39938\ (Y+T+D)_{t-1} \qquad (4.810)_{**} \qquad (3.082)_{**}$$

$$R^2 = .994$$

where h is an index of hours worked per person per year.

Identities

The number of definitional equations or accounting identities also appear in the model. Gross national product is the sum of consumption, investment and government expenditures plus net exports of goods and services:

$$(9)\qquad (Y+T+D)_t = C_t + I_t + G_t + X_t$$

where:

- G = government expenditures for goods and services, and
- X = net exports of goods and services.

National income is the sum of wage earners, business and farm income.

$$(10)\qquad Y_t = L_t + Z_t + A_t$$

Net investment is defined as the addition to capital stock.

$$(11)\qquad K_t - K_{t-1} = I_t - D_t$$

The last identity ties together the real wage rate, index of hours worked, the number of wage earners employed and the wage bill.

$$(12)\qquad h_t\ (w_t/p_t) N_{L,t} = L_t$$

The reduced form and forecasting

Reduced form parameters were derived for two reasons: (1) to facilitate the expost prediction of endogenous variables, given observed values of the predetermined variables; and (2) to bring out the explicit dependence of each dependent variable on all predetermined variables. Whereas structural coefficients indicate only the direct effect which a change in a predetermined variable has on a jointly dependent variable, the reduced form coefficients indicate the total effect of such a change after taking into account the mutual interdependence among all the current endogenous variables.

Simulated Income Transfers and Implications

A two-step procedure is followed in order to evaluate the effects of alternative income transfer payments. First, values of all current endogenous variables are estimated or "predicted" for the period 1957-67 using observed values of the predetermined variables. These estimates are referred to as the base projection. Next, simulated changes are made on the observed tax-transfer variables. For example, for donor groups the value of the tax transfer variable may be increased while for recipients it may be decreased. Having specified the policy variables at simulated levels, new forecasts of endogenous variables are obtained and compared to the base forecast generated by observed data.

The alternative income transfer payments considered in this paper are as follows:

Program I: Program I entails a \$5 billion transfer from the nonwage-nonfarm sector to wage earners. As a result, T_Z increases and T_L decreases by \$5 billion, ceteris paribus.

Program II: Program II entails a \$5 billion transfer from the nonwage-nonfarm sector with distribution as follows: \$4 billion to the wage earners and \$1 billion to the farm sector.

Program III: Program III assumes a \$5 billion transfer to a new sector, designated the welfare sector or nonworking poor with \$3 billion coming from the nonwage-nonfarm sector, and \$2 billion from wage earners.[4]

Predicted values of selected endogenous variables for 1957-67 obtained from the base model, and Programs I, II and III are presented in Table 1. In what follows, we discuss the effects of each program on consumption, employment, national income, and income of the three sectors.

Consumption

All three transfer programs result in increased levels of consumption expenditures when compared with the base projection from 1957 through 1962. Consumption under Variants I and III also is greater from 1963 through 1967 when compared to the base projection, but under Variant II consumption expenditures decline. In general, the greatest increases in consumption would occur with Program III, especially during later parts of the sample time period. Undoubtedly this is due to the cumulative multiplier effects of the marginal propensity to consume among welfare recipients. The smaller increase in consumption under Program II probably is due to the fact that a substantial part of the transfer is to the farm sector. In the model, the marginal propensity to consume of the farm sector is only 0.64, hence multiplier effects are less than when the transfers are to wage earners with an MPC of 0.80 or to welfare recipients with an assumped MPC of unity.

Employment

Compared to the base projection obtained by using observed values of the predetermined variables, all three income transfer programs exhibit increased levels of employment from 1957 through 1963. Variants I and III also show increased employment during the 1964-67 period when compared to the base projection. Variant II is the only variant for which employment is less than in the base projection. As was the case with consumption, the effect of Program II on employment probably is due to the cumulative effects of the low marginal propensity to consume of the farm sector. This result highlights an important consideration in evaluating alternative transfer programs, namely that the effects may be greatly different in the long than in the shor-run. If only the first five years of the program are considered, Variant II would appear to increase both consumption and employment. In the longer run, however, results are the opposite.

National Income

Variants I and III both result in increased levels of national income throughout the sample period when compared with the base projection. Increases are greatest for Program III, undoubtedly due in large part to the high marginal propensity to consume of welfare recipients and wage earners. Program II increases income during 1957-61, but results in lower income levels thereafter.

[4] Introducing the welfare sector made it necessary to modify the consumption equation in the structural model. It was assumed the amount of income received by welfare recipients is exogenously defined, and the short-run MPC of welfare recipients equals unit. See [2, p. 71].

Table 1.— — EXPOST PREDICTED VALUES OF SELECTED ENDOGENOUS VARIABLES UNDER THE BASE MODEL AND PROGRAMS I, II, AND III[a]

Year	BASE PROJECTION						PROGRAM I					
	C	N_L	Y	L[b]	Z	A	C	N_L	Y	L	Z	A
1957 . . .	296.4	57.7	385.0	265.9	106.5	12.6	300.8	58.9	389.4	268.1	108.8	12.6
				(69.1)	(27.7)	(3.3)				(68.8)	(27.9)	(3.2)
58 . . .	330.9	64.1	417.9	286.0	118.0	14.0	337.3	65.1	423.3	289.1	120.2	14.0
				(68.4)	(28.2)	(3.4)				(68.3)	(28.4)	(3.3)
59 . . .	330.8	58.6	415.7	290.4	112.6	12.7	339.0	60.0	422.8	294.5	115.6	12.7
				(69.9)	(27.1)	(3.1)				(69.7)	(27.3)	(3.0)
60 . . .	337.3	60.6	424.9	297.1	117.1	10.7	347.5	62.6	434.4	302.6	121.2	10.7
				(69.9)	(27.6)	(2.5)				(69.7)	(27.9)	(2.5)
61 . . .	358.7	64.9	449.7	312.2	125.6	11.9	371.5	67.4	462.3	319.4	131.0	11.9
				(69.4)	(27.9)	(2.6)				(69.1)	(28.3)	(2.6)
62 . . .	367.9	65.8	463.9	325.4	126.3	12.2	384.0	69.0	480.3	334.9	133.2	12.2
				(70.1)	(27.2)	(2.6)				(69.7)	(27.7)	(2.5)
63 . . .	378.4	66.9	478.2	336.9	130.2	11.2	398.5	70.9	499.1	349.1	138.9	11.2
				(70.4)	(27.2)	(2.3)				(69.9)	(27.8)	(2.2)
64 . . .	394.7	69.3	499.0	350.9	137.8	10.2	419.6	74.3	525.3	366.4	148.7	10.2
				(70.3)	(27.6)	(2.0)				(69.8)	(28.3)	(1.9)
65 . . .	399.3	68.4	509.8	360.8	137.9	11.2	430.1	74.5	542.8	380.2	151.4	11.2
				(70.8)	(27.0)	(2.2)				(70.0)	(27.9)	(2.1)
66 . . .	402.3	70.0	527.9	372.7	143.9	11.4	440.0	77.5	568.8	396.9	160.6	11.4
				(70.6)	(27.3)	(2.2)				(69.8)	(28.2)	(2.0)
67 . .	441.7	80.7	580.6	403.5	165.1	11.9	487.7	89.7	630.9	433.4	185.6	11.9
				(69.5)	(28.4)	(2.0)				(68.7)	(29.4)	(1.9)

Year	PROGRAM II						PROGRAM III					
	C	N_L	Y	L	Z	A	C	N_L	Y	L	Z	A
1957 . . .	299.3	58.5	387.9	267.4	106.3	14.3	301.8	59.1	390.4	268.6	109.3	12.6
				(68.9)	(27.4)	(3.7)				(68.8)	(28.0)	(3.2)
58 . . .	333.9	64.3	419.7	287.1	116.8	15.7	340.9	66.3	427.9	291.5	122.4	14.0
				(68.4)	(27.8)	(3.7)				(68.1)	(28.6)	(3.3)
59 . . .	333.4	58.7	416.6	291.0	111.2	14.4	346.1	61.8	431.5	299.4	119.4	12.7
				(69.9)	(26.7)	(3.5)				(69.4)	(27.7)	(2.9)
60 . . .	339.2	60.8	425.1	297.2	115.6	12.4	359.0	65.2	448.0	310.4	126.9	10.7
				(69.9)	(27.2)	(2.9)				(69.3)	(28.3)	(2.4)
61 . . .	359.9	65.0	449.2	311.8	123.8	13.5	388.0	70.9	481.6	330.7	139.0	11.9
				(69.4)	(27.6)	(3.0)				(68.7)	(28.9)	(2.5)
62 . . .	368.4	65.8	462.7	324.6	124.3	13.9	406.6	73.6	506.4	350.4	143.8	12.2
				(70.2)	(26.9)	(3.0)				(69.2)	(28.4)	(2.4)
63 . . .	378.2	66.9	476.3	335.6	127.9	12.8	428.3	76.8	533.3	369.4	152.8	11.2
				(70.4)	(26.9)	(2.7)				(69.3)	(28.7)	(2.1)
64 . . .	393.7	69.2	496.1	349.0	135.2	11.9	457.8	81.7	569.1	392.6	166.3	10.2
				(70.3)	(27.3)	(2.4)				(69.0)	(29.2)	(1.8)
65 . . .	397.5	68.3	506.1	358.2	135.0	12.9	478.3	83.7	597.9	413.3	173.4	11.2
				(70.8)	(26.7)	(2.5)				(69.1)	(29.0)	(1.9)
66 . . .	399.5	69.8	523.2	369.5	140.7	13.1	500.1	88.7	637.2	438.1	187.7	11.4
				(70.6)	(26.9)	(2.5)				(68.8)	(29.5)	(1.8)
67 . . .	437.9	80.4	574.8	399.7	161.6	13.6	561.9	103.3	715.1	484.3	218.9	11.9
				(69.5)	(28.1)	(2.4)				(67.7)	(30.6)	(1.7)

[a]All in billions of 1958 dollars, except the number of wage and salary earners, N_L, in millions.

[b]Numbers in parentheses are values of relative income shares in percentage terms, L/Y, Z/Y, and A/Y.

Wage Earners' Income

Wage earners' income is increased above the base projection by Programs I and III throughout the entire sample period. Such a result is hardly surprising for Program I, since the wage earner sector is the recipient of the transfer under that program. With Program III, however, wage earners are a donor group. Hence Program III satisfies one prime criterion of welfare economics, namely it represents a change which benefits all groups and harms none.

Program II increases wage earners' income through 1960, but results in decreased income thereafter. This result is especially striking since wage earners are a recipient group under Program II. The reason probably lies in the drag on increases in national income resulting from diverting income to the other recipient group, the farm sector, with its low propensity to consume. As with other variants, Variant II emphasizes that results may be quite different in the long run than in the short run. Also, the fact that a sector is a recipient of an income transfer in no way gurantees the sector is better off than it would be without the transfer, too many other things which cannot be assumed to hold constant, are involved.

Nonwage-Nonfarm Income

Income of the business sector is a key variable to consider from the welfare standpoint, since the business sector is a donor group under all three programs. Under Program II, business income declines throughout the entire sample time period; hence Program II results in a distinct welfare loss for the business sector.

Variants I and III both result in increased income for the business sector. However, in order to see whether these programs satisfy the welfare criterion that donor groups be made better off as a result of the transfer, it is necessary to examine disposable income of this sector, i.e., income after the increase in taxes is deducted. With respect to disposable income, Variant I results in increased income after 1961, but in decreased business income prior to 1961. Variant III results in increased disposable income for the business sector by 1959, two years after the start of the program. Both Variants I and III, therefore, seem to satisfy the welfare criterion in the longer run, although not necessarily immediately.

Farm Income

Relatively little can be said about the effects of the three programs on farm income within the confines of the model, mainly because of the manner in which the farm income equation was formulated. In the model farm, income is specified as a function of predetermined variables only. While this appears reasonable as a description of much of the farm sector, it means changes in income among other sectors will have little effect on farm income. This is seen most readily by noting that farm income under Variants I and III is the same as under the base projection.

Under Variant II, farm income increases throughout the sample period when compared to the base projection. This is a direct result of the assumption that the income transfer is accomplished through increasing government payments to agriculture.

CONCLUDING COMMENTS

Results of this study highlight several facts of significance. First, the effect of income transfers must be examined in both long and short run contexts when evaluating such programs. Results quite possibly, and in some cases extremely likely, will vary substantially with the length of time allowed for the policy to be effective. Second, recipient sectors are not necessarily beneficiaries of increases in social welfare. The income of any one recipient sector may vary substantially depending on which other sectors are recipients in the same program, and the marginal propensity to consume of such sectors. Third, depending on the choice of recipient sectors, it appears feasible that income transfer programs may be designed which benefit the donor group as well as the recipients at least in the longer run. In this regard, the farm sector is not a desirable choice to be a recipient. The small multiplier effects resulting from the low marginal propensity to consume of the farm sector makes it less likely that sufficient increases in national income will be generated to make the donor group better off, even in the longer run. From the standpoint of the economy in general, increases in welfare might better be served by transferring income to farm workers, who are members of the wage-earners group, rather than to farm proprietors.

In any event, the major inference to be drawn from this study is that extreme care should be exercised in assessing income transfer programs. The choice of program can have substantial implications for the economic welfare of the nation.

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