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THE LABOR SUPPLY EFFECTS AND COST OF ALTERNATIVE NEGATIVE INCOME TAX PROGRAMS: EVIDENCE FROM THE SEATTLE AND DENVER INCOME MAINTENANCE EXPERIMENTS

PART II

National Predictions Using the Labor Supply Response Function

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ABSTRACT

Results from the Seattle and Denver Income Maintenance Experiments are used to predict nationwide labor supply effects and costs of six different negative income tax programs. To make the predictions, a labor supply model parameterizing the experimental treatments is estimated using experimental data. The parameters of this model are introduced into a microsimulation model called the Transfer Income Model (TRIM). The simulations employ the March 1975 Current Population Survey (CPS), which is a weighted random sample of the U.S. population. The simulations are performed within a partial equilibrium framework under the assumption that the demand for low-income labor is perfectly elastic. The simulation results indicate that coverage, costs, and labor supply effects of a national NIT program vary widely with the parameters of the system.

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1 INTRODUCTION

This paper presents predictions of the labor supply effects and costs of six alternative nationwide negative income tax (NIT) programs. To make the predictions, a labor supply response function is estimated using data from the Seattle and Denver Income Maintenance Experiments (SIME/DIME) and is applied to each individual in the March 1975 Current Population Survey (CPS). The aggregate predictions are calculated as weighted sums of individual responses and costs. A national sample is used to generate the predictions, rather than the experimental sample, because the experimental sample is highly stratified.*

The plan of the paper is as follows. Section 2 describes the Seattle and Denver Income Maintenance Experiments. Section 3 discusses how the experimental data are used to estimate a labor supply response function. Section 4 discusses the assumptions necessary to make national predictions using the experimentally derived response function. Section 5 presents predicted labor supply effects and costs for six alternative NIT programs. Finally, in Section 6, the paper is summarized and policy implications of the analysis are discussed.

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*Theoretically, predictions can be generated from the experimental sample by weighting responses in individual stratification cells. Because of the relatively small size of the experimental sample, however, and because the experimental sample is truncated by income, many of the cells in a national sample are empty and predictions cannot be made. In addition, such a procedure does not take into account regional differences in existing tax and transfer programs. For an approach similar to the one taken in this paper, but using nonexperimental labor supply functions, see Greenberg and Kosters (1973) and Greenberg and Hosek (1975).

2 A DESCRIPTION OF THE SEATTLE AND DENVER INCOME MAINTENANCE EXPERIMENTS

A negative income tax program is characterized by a support level (or guarantee) and a tax rate. The support level is the grant that a family receives if it has no other income, and the tax rate is the rate at which the grant declines as other income increases. SIME/DIME has 11 different financial treatments, which are described in Table 1. In addition, about one-half of the sample are assigned null treatments and serve as controls. Programs with support levels of $3,800, $4,800 and $5,600, normalized for a family of four persons in 1971 dollars, are being tested along with four different tax systems: two with constant tax rates of 50% and 70% of income, and two in which the marginal tax rate declines as income increases. Families are enrolled on the experiments for either 3 years or 5 years.*

In a controlled income maintenance experiment, the influence of other tax and transfer programs is eliminated by fully taxing public transfers and by reimbursing positive taxes. A national program would presumably have the same characteristics. Because positive taxes are reimbursed, the payment a person receives depends on gross income and both experimental and nonexperimental tax rates.

In Figure 1, the interrelationship between an NIT program and the positive tax system is depicted graphically. Two breakeven levels are distinguished. Point B is the tax breakeven level, where disposable income is equal before and after the imposition of an NIT. All persons to the left of B (with gross income initially less than B') are better off with the program. Point G is the grant breakeven level, the point

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*A small number of families are enrolled for 20 years but are not considered in this study. Different durations are being tested because of difficulties in inferring permanent effects from finite-length experiments; see, for example, Metcalf (1973).

Table 1

PLAN BREAKEVEN LEVEL FOR THE SEATTLE AND DENVER INCOME MAINTENANCE EXPERIMENTS
(1971 Dollars)

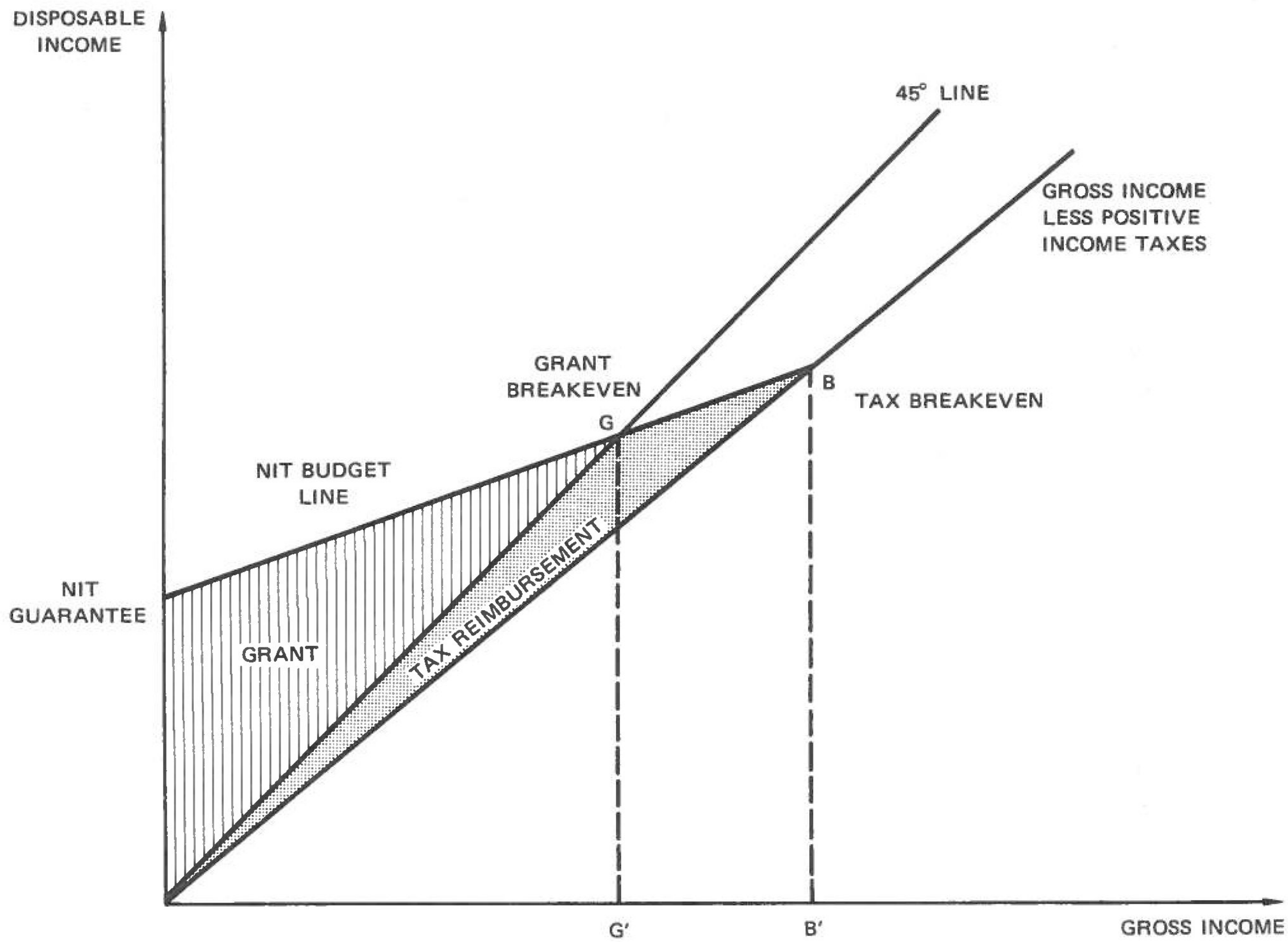
Plan	Grant Breakeven Level	Tax Breakeven Level
F1 (S = 3800, t_e = .5, r = 0)	$ 7,600	$10,250
F2 (S = 3800, t_e = .7, r = 0)	5,429	6,350
F3 (S = 3800, t_e = .7, r = .025)	7,367	10,850
F4 (S = 3800, t_e = .8, r = .025)	5,802	7,800
F5 (S = 4800, t_e = .5, r = 0)	9,600	13,150
F6 (S = 4800, t_e = .7, r = 0)	6,867	8,520
F7 (S = 4800, t_e = .7, r = .025)	12,000	19,700
F8 (S = 4800, t_e = .8, r = .025)	8,000	11,510
F9 (S = 5600, t_e = .5, r = 0)	11,200	15,700
F10 (S = 5600, t_e = .7, r = 0)	8,000	9,780
F11 (S = 5600, t_e = .8, r = .025)	10,360	16,230

Note: These figures are for a family of four with only one earner and no income outside of earnings. Positive tax reimbursements include the federal income tax and Social Security taxes. The federal income tax assumes the family takes the standard deduction. State income taxes, which are relevant only for the Denver Experiment (there is no state income tax in Washington), are ignored in calculating the tax breakeven levels. The tax breakeven levels are thus slightly higher for the Denver Experiment.

Key: S = NIT annual support level.

t_e = initial NIT tax rate.

r = rate of decline of the average NIT tax rate per thousand dollars of income.



NOTE: Figure assumes no income outside of earnings and a linear positive income tax system.

FIGURE 1 A NEGATIVE INCOME TAX PROGRAM WITH POSITIVE TAX REIMBURSEMENT at which the NIT grant (but not the payment) is zero. At point G an individual does not receive an NIT grant but also does not pay taxes.

As Table 1 illustrates, there are considerable differences between the grant breakeven level and the tax breakeven level.* Below the grant breakeven level, taxes are fully reimbursed; between the grant and tax breakeven levels, taxes are only partially reimbursed. Thus, persons with gross incomes above G' pay positive taxes, while persons with gross incomes below G' receive NIT payments.

Because of the assignment and sample selection procedures used in the experiments, the distribution of families by race, family structure, and income differs from the distribution of families in the U.S. population.† As shown in Table 2, greater proportions of experimental families are in the lower income groups, compared with the U.S. population. Moreover, within the experimental population, families receiving financial treatments have lower incomes than control families. When analyzing the impact of the experiment on labor supply, and when extrapolating the results to the U.S. population, these distributional differences must be taken into account.

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*Except for Keeley et al. (1977), all previous studies of the effect of an NIT on labor supply fail to distinguish between the grant breakeven level and the tax breakeven level. This distinction is important, however, both in estimation and in prediction of nationwide effects.

†See Conlisk and Kurz (1972) for a discussion of the assignment model used in SIME/DIME.

Table 2

DISTRIBUTION OF INCOME IN THE SIME/DIME EXPERIMENTAL AND CONTROL SAMPLES AND IN THE U.S. POPULATION

Income Category*	Percent in Income Category					
	Husband-Wife Families			Female-Headed Families		
	Financials†	Controls†	U.S.	Financials†	Controls†	U.S.
<$1,000	9.8%	6.3%	1.1%	39.9%	36.9%	29.0%
$1,000-$3,000	8.2	6.3	1.8	16.1	11.8	17.5
$3,000-$5,000	9.7	6.9	3.9	13.5	13.1	8.5
$5,000-$7,000	12.8	10.3	5.3	18.8	19.6	12.2
$7,000-$9,000	18.7	19.5	6.1	8.9	12.2	9.4
$9,000-$11,000	17.3	18.5	10.3	1.9	3.8	7.2
$11,000-$13,000	10.3	16.0	11.3	.5	1.7	6.5
$13,000-$15,000	6.9	7.5	10.4	.3	.6	2.5
$15,000-$17,000	3.6	5.2	9.6	.1	.2	1.9
$17,000-$20,000	2.2	2.5	13.4	0	0	1.9
>$20,000	.5	1.1	26.1	0	.2	3.3
Total number of families	1,023	1,158	39.7 million	968	654	5.0 million

*Income is defined as earnings of all family members plus family nonwage income, excluding taxes and public transfer payments. The incomes in the SIME/DIME sample are for the year before enrollment and are inflated to 1974 dollars. The U.S. incomes are from the March 1975 Current Population Survey and cover the year 1974.

†Black and white families only. There are approximately 800 Mexican-American families participating in the Denver Experiment, but these families are excluded from the tabulations.

3 ESTIMATION OF A LABOR SUPPLY MODEL USING EXPERIMENTAL DATA*

3.1 The Model

The economic theory of the labor supply of an individual indicates that hours of work is determined by the net marginal wage rate and net nonwage income:

$$H = H\left(w, Y_n\right) \quad , \tag{3.1}$$

where H is hours of work, w is the net marginal wage rate, and Y_n is net nonwage income. By totally differentiating equation (3.1) and substituting in the Slutsky equation, changes in labor supply can be decomposed into an income effect and a substitution effect.†

$$dH = \left.\frac{\partial H}{\partial w}\right|_U \cdot dw + \frac{\partial H}{\partial Y_n}\left[Hdw + dY_n\right] \quad , \tag{3.2}$$

Where U is utility, $(\partial H/\partial w)|_U$ is the substitution effect, $\partial H/\partial Y_n$ is the income effect, dw is the change in the net wage rate, and $Hdw + dY_n$ is the change in disposable income, holding hours of work constant. Equation (3.2) forms the basis of the empirical response function that is actually estimated. For a family with more than one potential worker, this formulation can be generalized by including cross-substitution

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*Sections 3.1 and 3.2 are a summary of Research Memorandum 38, which is Part I of this paper. The reader is referred to Part I for a more detailed description of the model and estimation procedure.

†The Slutsky equation decomposes the total effect of a wage change on labor supply into a substitution effect and an income effect:

$$\frac{\partial H}{\partial w} = \left.\frac{\partial H}{\partial w}\right|_U + H\frac{\partial H}{\partial Y_n} \quad .$$

effects and by noting that the change in disposable income depends on both spouses' initial hours of work and changes in wage rates. The response function actually estimated, however, assumes cross-substitution effects are zero.*

To estimate income and substitution effects empirically, a discrete approximation is made to equation (3.2):

$$H_e - H_p = \Delta H \approx \alpha\Delta w + \beta\left[H_p\Delta w + \Delta Y_n\right] \quad , \qquad (3.3)$$

where H_p and H_e are labor supply before and during the program, α is the substitution effect, and β is the income effect.

The measurement of the change in the net wage rate and the change in disposable income, holding initial labor supply constant, is depicted graphically in Figure 2. The preprogram budget line is ABT; its slope is $-w(1 - t_p)$, where t_p is the preprogram tax rate and w is the gross wage rate. The NIT budget line is ABE, with slope equal to $-w(1 - t_e)$ along segment BE, where B is the tax breakeven level. If the person is initially to the right of the tax breakeven level on segment BT and has an initial equilibrium such as H_p, then $\Delta Y_d(H_p)$, the change in disposable income holding initial labor supply constant, is given by FC.† The change in the net wage rate is given by $\Delta w = -w(t_e - t_p)$.

For persons initially above the tax breakeven level on segment AB, response is measured by three variables:

FABOVE - a dummy variable that equals 1 if a family is eligible for payments and is above the tax breakeven level.

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*Zero cross-substitution effects are assumed in estimation partly because the net wage changes of both spouses are highly correlated, and their effects are difficult to distinguish empirically.

†The change in disposable income, calculated on the basis of preprogram labor supply, can be interpreted as the NIT payment an individual would receive if he did not respond to the program.

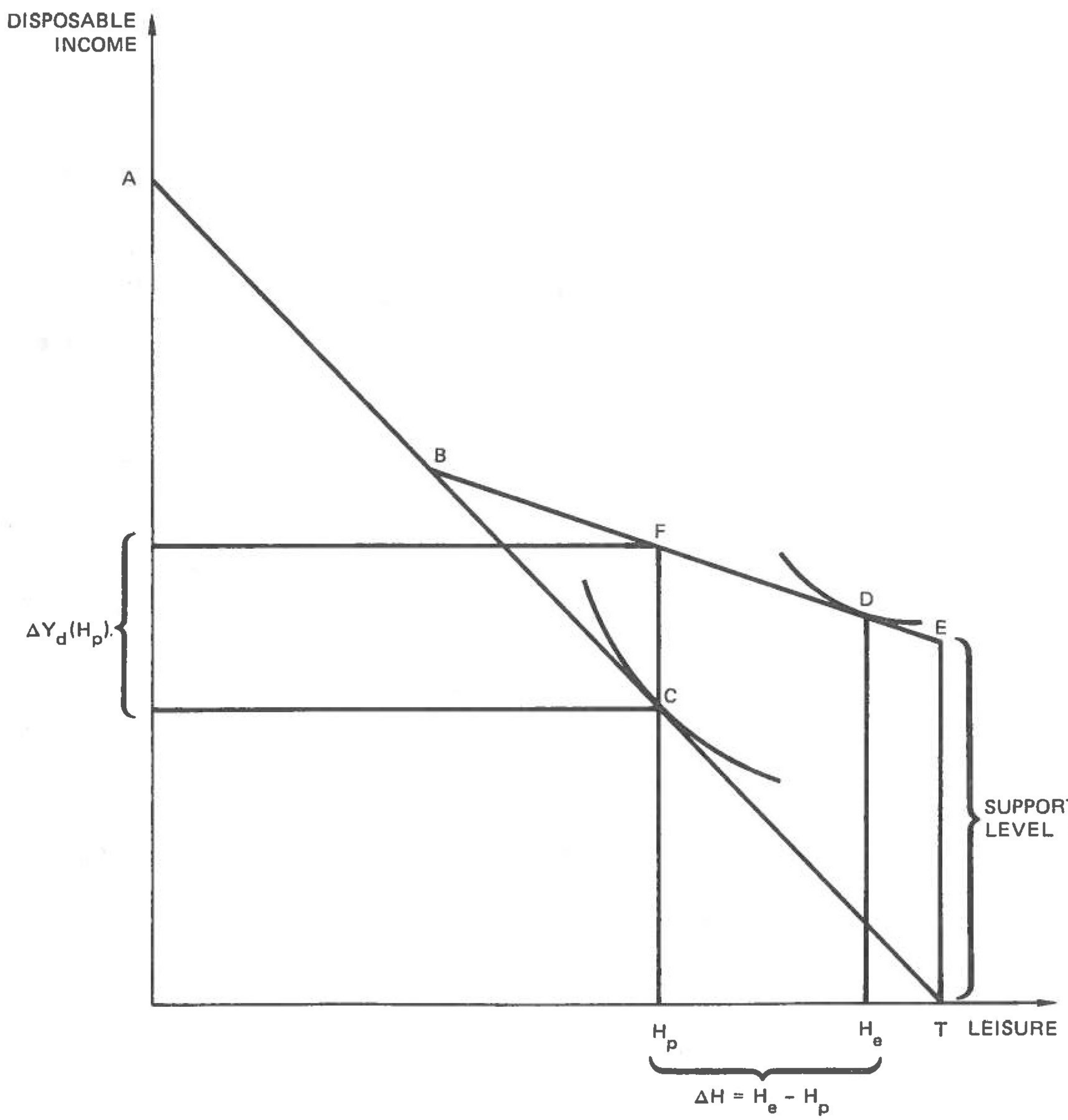

FIGURE 2 THE EFFECTS OF A NEGATIVE INCOME TAX ON LABOR SUPPLY

BREAK	-	the breakeven level of family earnings.
EARNABV	-	distance, in family earnings, above the breakeven level.

For persons above the breakeven level, Δw and $\Delta Y_d(H_p)$ are set equal to zero. Also included in the empirical specification is a dummy variable, labeled DECLINE, for families on the declining tax rate programs. This variable is intended to capture differences in response arising from the linearization of the budget constraint.* Finally, a set of assignment and other control variables, C, is included to account for nonexperimental effects, and variables are included to measure the effects of the manpower component of the experiment, M.† The empirical model thus becomes:

$$H_e - H_p = \Delta H = b_0 + b_1 C + b_2 M + b_3 \Delta w + b_4 \Delta Y_d(H_p) + b_5 FABOVE + b_6 BREAK + b_7 EARNABV + b_8 DECLINE + \epsilon \quad , \qquad (3.4)$$

where ϵ is an error term.

This model is estimated using data from the Seattle and Denver Income Maintenance Experiments.‡ The response variables Δw and $\Delta Y_d(H_p)$ depend on the treatment to which an individual is assigned, on his or her preprogram budget constraint, and on the preprogram equilibrium position. Hours of work and income are both measured on an annual basis.

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*See Keeley et al. (1977) for a discussion of the linearization procedure.

†See Kurz and Spiegelman (1971, 1972) for a discussion of the manpower component of the experiment.

‡The model is not estimated in first difference form because of statistical factors. See Keeley et al. (1977) for a discussion of the estimation procedure.

Preexperimental labor supply, H_p, refers to hours of work in the year before the experiment; experimental labor supply, H_e, refers to hours of work in the second year of the experiment. Control families are included in the sample to increase the efficiency of the estimated effects.

Because the approach described here measures the change in each individual's budget constraint directly, the stratified random assignment of treatment does not affect the analysis.[*] Similarly, since the effects of preprogram enrollment in other welfare programs on the preprogram budget constraint are accounted for, this procedure controls for participation in other welfare programs before the initiation of the NIT program.[†]

3.2 Estimation Results

Table 3 presents estimates of experimental treatment effects.[‡] Because of truncation of the dependent variable at zero hours of work, the tobit estimation procedure is used.[§] Races (black and white) and sites (Seattle and Denver) are pooled, although separate estimates are obtained for husbands, wives, and female heads.[**] Persons are included in the sample regardless of changes in marital status between enrollment

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[*] The procedure is not affected by the assignment process if the response model is correct. The only theory-free way of controlling for the assignment process is to use a completely interactive analysis of variance model. See Spiegelman and West (1976) for a discussion of estimating response functions by analysis of variance techniques.

[†] For a discussion of the welfare tax rates used in estimation, see Maxfield (1977).

[‡] Estimates of the effects of the control and manpower variables are presented in Keeley et al. (1977).

[§] See Tobin (1958) or Amemiya (1973) for a discussion of the tobit model.

[**] Formal tests of separate race and site effects indicate no statistically significant differences.

Table 3

ESTIMATED EXPERIMENTAL EFFECTS ON LABOR SUPPLY
(Tobit Estimates)

Independent Variable	Coefficient: Husbands	Wives	Female Heads
Below breakeven			
$\Delta Y_d(H_p)$	-34.4*** (27.3)	-142.9*** (44.4)	-101.1** (39.4)
Δw	83.2** (37.1)	168.0* (91.2)	125.8* (65.9)
Above breakeven			
FABOVE	-12.7 (174.6)	-430.8* (255.6)	-344.8 (291.3)
BREAK	-5.5 (21.1)	8.3 (29.5)	73.2 (64.7)
EARNABV	11.5 (27.3)	47.5 (42.0)	35.1 (55.6)
DECLINE	-86.3* (48.4)	119.5 (78.1)	21.8 (73.2)
χ^2	21.55***	26.84***	20.24***
S	720 (14)	1,086 (28)	990 (25)
$\bar{H}_e$	1,736 (825)	659 (825)	975 (935)
N	1,592	1,698	1,358

Note: Standard errors in parentheses.

* Indicates significance at 10% level.
** Indicates significance at 5% level.
*** Indicates significance at 1% level.

Key: $\Delta Y_d(H_p)$ = Change in disposable income, thousands of dollars per year.

Δw = Change in net wage rate, dollars per hour.

FABOVE = Dummy for above breakeven.

BREAK = Breakeven level of family earnings, thousands of dollars per year.

EARNABV = Family earnings above breakeven level, thousands of dollars per year.

DECLINE = Dummy for families on the declining tax rate programs.

χ^2 = Chi-square test for treatment effects.

S = Standard error of estimate.

$\bar{H}_e$ = Mean of dependent variable, hours of work per year.

N = Sample size.

and the end of the second year of the experiment.* Statistically significant substitution effects are estimated for all three family heads. Statistically significant income effects are estimated for wives and female heads. The results also indicate no significant differences in response by 3-year and 5-year families.† Treatment variables together are statistically significant at the 1% level for each group.

3.3 Comparison of SIME/DIME Results with New Jersey Results

It is of interest to compare SIME/DIME results with those of the widely cited New Jersey Income Maintenance Experiment. To make this comparison, it is necessary to estimate a model similar to one in the New Jersey report. The simplest such model employs an analysis of variance approach, controlling for preexperimental labor supply and demographic variables such as education and family size, but not controlling for preexperimental assignment variables (normal income). The New Jersey results for white husbands are shown in Table 4 and are compared with SIME/DIME results for the same periods.

These results indicate that the reduction in weekly hours of work by white husbands in the New Jersey experiment and black and white husbands in the Seattle and Denver experiments are similar. The comparisons, however, cannot be regarded as evidence of similar response, because they are means from different experimental samples. The New Jersey sample is one with considerably lower average incomes, less generous experimental treatments, and a different assignment process.

Because the assignment process allocates a larger proportion of higher income families to the control group than to the treatment group

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*The subgroups for analysis are defined as of the date of enrollment. Thus, some wives and husbands are divorced and some female heads are married at the end of the second year of the experiment. This approach is used to estimate reduced form effects of the experiment on labor supply instead of responses conditional on unchanged marital status.

†Formal tests of 3-year and 5-year differences in substitution and income effects indicate no significant differences.

Table 4

COMPARISON OF SIME/DIME AND NEW JERSEY RESULTS

	Average Weekly Hours of Work Differential			
Quarters	New Jersey Results†		SIME/DIME Results	
5-8	-1.97	(33.4)	-2.61***	(35.1)
3-10	-2.07	(33.6)	-2.16***	(35.0)

Note: New Jersey results are for white husbands. SIME/DIME results are for white and black husbands. Mean hours of work for control families are in parentheses. Control variables include age (piecewise linear with breaks at 25 and 45 years), education (piecewise linear with a break at 8 years), family size, number of children, preexperimental hours of work, preexperimental weeks worked, site dummies, and, for the SIME/DIME equations, three dummy variables for the manpower component of the experiments.

†Source: Watts and Rees (1974), Vol. 1, Part A, Table 2, pp. BII-7.

***Indicates significant at 1% level.

(c.f Table 2), an artificial labor supply differential is created between financial and control families This bias in the mean response is not fully corrected by including preexperimental labor supply variables in the control set (as in Table 4). Table 5 shows the mean SIME/DIME responses with and without the assignment variables included in the control set. As this table indicates, the mean responses for husbands and female heads are reduced when the assignment variables are included in the control set.*

Mean responses, as reported in Tables 4 and 5, cannot be directly translated into national effects for several reasons. First, mean responses in the experimental sample are averages over several different

*Because assignment is made on the basis of family income, the results for wives, whose incomes represent a small proportion of the family total, are virtually unaffected by the presence of the assignment variables.

Table 5

ESTIMATED EXPERIMENTAL EFFECTS ON
AVERAGE WEEKLY HOURS OF WORK

	Husbands		Wives		Female Heads	
	Qtrs. 5-8	Qtrs. 3-10	Qtrs. 5-8	Qtrs. 3-10	Qtrs. 5-8	Qtrs. 3-10
Assignment variables excluded	-2.61*** (.66)	-2.16*** (.63)	-2.48*** (.65)	-2.19*** (.61)	-3.21*** (.79)	-3.15*** (.75)
Assignment variables included	-2.22*** (.66)	-1.84*** (.62)	-2.45*** (.66)	-2.14*** (.62)	-2.56*** (.79)	-2.61*** (.76)
Mean hours of work for controls	35.1	35.0	14.7	14.6	21.6	21.9
Sample size	1,592	1,436	1,698	1,562	1,358	1,278

Note: Assignment variables include eight dummy variables for normal income categories.

*** Indicates significant at 1% level.

programs and thus are not representative of any single program. Second, according to equation (3.4), mean responses in the experimental sample depend on mean changes in disposable income and the net wage rate. These mean changes, which depend on the preexperimental distribution of income, welfare payments, tax rates, and demographic variables, are different from the mean changes in a national sample. Finally, the assignment model leads to a much smaller average response (by assigning higher income persons to more generous programs) than would occur under random assignment. Thus, it may be concluded that to provide meaningful predictions of the effects of a particular national program, a labor supply response model similar to the one given by equation (3.4) must be used.

4 USING THE LABOR SUPPLY RESPONSE MODEL FOR PREDICTION

The response model given by equation (3.4) is used to predict the labor supply effects of particular NIT programs. For families below the tax breakeven level, this is done by first calculating the change in disposable income and the change in the net wage rate for each individual. Because of differences in preprogram budget constraints, these changes vary considerably across individuals. Once the change in disposable income and the change in the net wage rate have been calculated, predictions of the labor supply effects of an NIT program are derived by multiplying these changes by the estimated income and substitution effects and then summing the results over individuals. For persons above the tax breakeven level, predictions are calculated from the above-breakeven variables. Additional information, such as program costs, are calculated using the predicted labor supply responses and the hypothesized rules of the program.

The predictions are generated using a computer program called the Transfer Income Model (TRIM).* TRIM is designed to predict the effects of potential transfer programs such as an NIT, using as input a microeconomic data base. In this study, the March 1975 Current Population Survey (CPS) is used to predict the effects of six NIT programs.

The income data from the CPS are annual data for the year 1974. Thus, the calculations represent what the effects of an NIT would have been in 1974. No attempt is made to update response or cost estimates to later years.

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*TRIM was originally developed at the Urban Institute. The calculations reported in this study were performed for SRI by Mathematica Policy Research and the Hendrickson Corporation using a recently modified version of TRIM, called MATH (Micro Analysis of Transfers to Households). See Beebout (1977) and Maxfield (1977) for a description of the MATH model.

The six programs for which predictions are made have constant tax rates of 50% and 70% on earnings and support (guarantee) levels of 50%, 75%, and 100% of the poverty level ($5,000 for a family of four in 1974). Because the poverty level increases with family size, the support level also increases with family size. The nominal support level is constant across regions.* The NIT is assumed to replace the existing AFDC and Food Stamps programs, and all other nonlabor income is taxed by the program at a rate of 100%.

There are two ways in which families can be made worse off--i.e., holding labor supply constant, their disposable income is reduced--by the NIT. First, the NIT support level may be lower, and the tax rate higher, than the support levels and tax rates of the AFDC and Food Stamps programs. Second, the filing unit for the NIT, which is assumed to consist of all related persons living in a household, may be larger than the filing units for the AFDC and Food Stamps programs. If these additional members are working, the family as a whole may be worse off under the NIT, even if the NIT is a more generous program.

Given the response model, the average labor supply effects of an NIT can be calculated in a variety of ways. Appendix A describes the method used in this paper and shows that it provides unbiased predictions of average labor supply effects under the assumptions of the model.

One of the key assumptions of the model is that the demand for labor is perfectly elastic. The assumption of perfectly elastic demand implies that gross wage rates are not affected by the NIT. Whether this is a good assumption depends in part on the substitutability of the labor of low-income persons, who are likely to be participants in an NIT, for labor in general. If there is substantial substitutability, the effect of an NIT on wage rates is likely to be very small since total labor supply is not affected much by an NIT.

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*This implies that the real support level varies across regions because of regional cost-of-living differences. The calculated variables used in the response function are corrected for regional cost-of-living differences. Thus, the responses differ across regions for persons who have the same nominal values for all variables.

It is not possible to assess the effects of a downward-sloping demand curve on labor supply a priori, since knowledge of the aggregate supply curve of labor, and how this supply curve shifts (the shift is not a parallel shift), is needed.* Actual response may be either larger or smaller than the calculated response, depending on the slope of the aggregate supply curve. If aggregate labor supply is upward sloping, the aggregate labor supply response would be smaller than is calculated assuming perfectly elastic demand. If aggregate supply is assumed to be backward bending, actual labor supply response would be larger than that calculated assuming perfectly elastic demand.

An additional problem in calculating cost, but not labor supply response, is due to experimentally induced changes in marital status or fertility. Because the labor supply response function is a reduced-form equation, not conditional on unchanged marital status or fertility, our estimates of the impacts of an NIT on labor supply include any indirect effects caused by changes in marital status or family size. Our calculation of costs, however, assumes unchanged marital status or fertility. Thus, the costs calculated are due only to the labor supply response.†

Another key assumption of the model is that there are no changes in the positive tax system. This assumption implies that no consideration is taken of how the additional revenue is generated to finance the program. The most likely source, an increase in federal income tax rates, could have additional labor supply effects.‡ The approach followed in this study is to analyze the effects of an NIT on only those who are likely to participate in the program.

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*Note that the aggregate supply curve is not calculated using the simulation approach; rather, the aggregate quantity of labor supplied is calculated. Thus, our simulation results do not have direct implications for the slope of the aggregate supply curve.

†If family stability is reduced by an NIT or fertility is increased, these calculated costs underestimate the total costs of an NIT.

‡Essentially, we are assuming that the method used to generate the additional revenue does not affect either supply or demand conditions.

5 PREDICTION RESULTS

For each NIT program, the following are calculated:

(1) Average labor supply responses for husband-wife families and for female-headed families with children.*

(2) Net program costs before and after response.

(3) Sources of program costs after response, including grants paid, positive tax reimbursements, tax losses due to labor supply response, and welfare savings.

(4) Allocation of the change in income generated by the program into the consumption of market goods and leisure.

A detailed description of how these variables are constructed is given in Appendix B.

5.1 Labor Supply Responses

The predicted labor supply responses are presented in Tables 6 through 9. Only responses for the heads of families are calculated. The responses are reported in two ways. First, average labor supply responses for families below the tax breakeven level (Tables 6 and 8) are reported. Second, average labor supply responses for the entire U.S. population are reported (in Tables 7 and 9). The average responses are much smaller for the entire U.S. population because many families do not choose to participate in the program.

In interpreting the results, it is important to keep in mind that the responses vary not only because of changing guarantee levels and tax rates, but also because of a changing pool of participants. For example, as the tax rate increases (for a given guarantee), the pool of participants

*The analysis is restricted to families in which the head of household is between the ages of 18 and 65, because the experiments are not testing the labor supply behavior of elderly persons.

Table 6

AVERAGE LABOR SUPPLY RESPONSES OF
HUSBAND-WIFE FAMILIES--BELOW TAX BREAKEVEN

NIT Support Level	NIT Tax Rate = .50				NIT tax Rate = .70			
	Average Hours of Work per Year Before Response	Change In Hours of Work per year Due to NIT	Percent Change	Number of Participating Families (millions)	Average Hours of Work per Year Before Response	Change In Hours of Work per year Due to NIT	Percent Change	Number of Participating Families (millions)
.50P.L.*								
Husbands	1,514	-111	-7.3%		1,288	-150	-11.6%	
Wives	371	-80	-21.6	2.2	332	-92	-27.7	1.2
Total	1,885	-191	-10.1		1,620	-242	-14.9	
.75P.L.*								
Husbands	1,794	-113	-6.3		1,411	-169	-12.0	
Wives	438	-92	-21.0	6.7	350	-113	-32.3	2.6
Total	2,232	-205	-9.2		1,761	-282	-16.0	
1.00P.L.*								
Husbands	1,923	-124	-6.4		1,602	-180	-11.2	
Wives	539	-120	-22.3	14.3	410	-132	-32.3	5.1
Total	2,462	-244	-9.9		2,012	-312	-15.5	

*P.L. = Poverty level ($5,000 per year for a family of four in 1974).

Table 7

AVERAGE LABOR SUPPLY RESPONSES OF
HUSBAND-WIFE FAMILIES--TOTAL UNITED STATES

NIT Support Level	NIT Tax Rate = .50			NIT Tax Rate = .70		
	Change in Hours of Work per Year Due to NIT	Percent Change	Number of Participating Families (millions)	Change in Hours of Work per Year Due to NIT	Percent Change	Number of Participating Families (millions)
.50P.L.*						
Husbands	-4	-0.2%	2.4	-2	-0.1%	1.3
Wives	-2	-0.3		0	0.0	
Total	-6	-0.2		-2	-0.1	
.75P.L.*						
Husbands	-19	-1.0	7.6	-9	-0.5	2.8
Wives	-19	-2.4		-5	-0.6	
Total	-38	-1.4		-14	-0.5	
1.00P.L.*						
Husbands	-47	-2.4	15.7	-23	-1.2	5.8
Wives	-50	-6.3		-18	-2.3	
Total	-97	-3.5		-41	-1.5	

Note: Average hours of work per year before response - husbands = 1,999.
Average hours of work per year before response - wives = 793.
Total number of husband-wife families in United States = 39.8 million.

*P.L. = Poverty level ($5,000 per year for a family of four in 1974).

Table 8

AVERAGE LABOR SUPPLY RESPONSES OF
FEMALE-HEADED FAMILIES WITH CHILDREN--BELOW TAX BREAKEVEN

NIT Support Level	NIT Tax Rate = .50				NIT Tax Rate = .70			
	Average Hours of Work per Year Before Response	Change in Hours of Work per year Due to NIT	Percent Change	Number of Participating Families (millions)	Average Hours of Work per Year Before Response	Change in Hours of Work per year Due to NIT	Percent Change	Number of Participating Families (millions)
.50P.L.*	486	+1	0.0%	2.2	353	-7	-2.0%	1.9
.75P.L.	699	-47	-6.7	3.0	502	-47	-9.4	2.5
1.00P.L.	824	-99	-12.0	3.6	637	-94	-14.8	3.0

*P.L. = Poverty level ($5,000 per year for a family of four in 1974).

Table 9

AVERAGE LABOR SUPPLY RESPONSES OF
FEMALE-HEADED FAMILIES WITH CHILDREN--TOTAL UNITED STATES

NIT Support Level	NIT Tax Rate = .50			NIT Tax Rate = .70		
	Change in Hours of Work per Year Due to NIT	Percent Change	Number of Participating Families (millions)	Change in Hours of Work per Year Due to NIT	Percent Change	Number of Participating Families (millions)
.50P.L.*	+16	+1.6%	2.3	+20	+2.1%	2.0
.75P.L.	-23	-2.4	3.0	-12	-1.2	2.5
1.00P.L.	-69	-7.1	3.6	-52	-5.3	3.0

Note: Average hours of work per year before response = 974
Total number of female headed families in U.S. = 4.9 million.

*P.L. = Poverty level ($5,000 per year for a family of four in 1974).

decreases. On the other hand, as the guarantee increases (for a given tax rate), the pool of participants increases. The manner in which the pools change depends on the distribution of income within the relevant population subgroup.

For husband-wife families below the tax breakeven level (Tables 6 and 8), the magnitudes of the average responses are positively associated (in absolute value) with the tax rate. This probably occurs for two reasons. First, at the higher tax rates, higher income families (who respond less) do not participate in the program, thus increasing the average response of the remaining families. Second, if the income effect of a tax change does not offset the substitution effect, the average responses are positively associated with the tax rate. For female-headed families, the average responses do not vary with the tax rate.

As the guarantee rises, two counteracting forces are operating. First, the pool of participants increases because of a higher breakeven level. Since the additional families have larger incomes, their responses are smaller, implying a smaller average response for the total eligible population. Second, as the guarantee increases for a fixed pool of participants, the responses increase because of the income effect. For both husband-wife and female-headed families, the average responses get larger as the guarantee rises, suggesting that the income effect dominates the effect of an increasing pool of participants.

The results for families below the tax breakeven level indicate fairly sizeable percentage reductions in labor supply for all groups. For husband-wife families, the percentage reductions in total hours worked range from 9% to 16%. Husbands reduce their labor supply by between 6% and 12%; wives reduce their labor supply by between 21% and 32%. Female heads of families reduce their labor supply by between 0% and 15%.*

In Tables 7 and 9, the responses of families above the tax breakeven level are included. The average responses are much lower because most of

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*Response for female heads tends to be lower partly because a sizeable proportion of them are switching to an NIT program from a welfare program and are experiencing smaller changes in disposable income and tax rates than husband-wife families.

the families above the tax breakeven level do not choose to participate in the program. This is particularly true for husband-wife families. As the tax rate increases, the husband-wife average responses fall (contrast this with Table 6, where they rise) because the participating pool falls relative to the total population. For female heads (Table 9), the responses are relatively stable because the participating pool remains fairly constant. An increase in the support level increases the average responses for both husband-wife families and female heads of families.

5.2 Program Costs

Estimated net program costs are presented in Tables 10 through 12. In Table 10, a comparison is made between net program costs before and after the labor supply response. In Table 11, four sources of program costs are enumerated. In Table 12, the allocation of net program costs to the consumption of leisure and market goods is presented.

Estimated net program costs vary widely across programs. Table 10 indicates that the most expensive program (S = 1.00P.L., t = .50) costs $30 billion and has 19.3 million participating families, implying a cost of about $1,550 per participating family. Approximately 39% of all husband-wife families and 73% of all female-headed families with children participate in this program. The least expensive program (S = .50P.L., t = .70) costs $-3.9 billion (which represents a 41% welfare savings) and has about 3.3 million participating families. In this program, only 3% of husband-wife families and 41% of female-headed families with children participate. For programs with positive net costs, the proportion of the net cost due to the labor supply response varies between 23% and 55%.

Table 10 also indicates that the net costs of an NIT program decrease as the tax rate increases, despite the fact that the average response of participants increases. Net costs decrease because of a substantial reduction in the pool of participants, which outweighs the effect of an increase in the average response of those participating. Of course, the

Table 10

PROGRAM COSTS BEFORE AND AFTER RESPONSE--
HUSBAND-WIFE AND FEMALE-HEADED FAMILIES

NIT Support Level	NIT Tax Rate = .50				NIT Tax Rate = .70			
	Net Program Costs Before Response (billions)	Change in Net Program Costs Due to Response (billions)	Net Program Costs After Response (billions)	Number of Participating Families (millions)	Net Program Costs Before Response (billions)	Change in Net Program Costs Due to Response (billions)	Net Program Costs After Response (billions)	Number of Participating Families (millions)
.50P.L.*								
Husband-wife families	$ -.1	$ .3	$ .2	2.4	$ -.8	$ .2	$ -.6	1.3
Female-headed families	-2.9	-.1	-3.0	2.3	-3.3	.0	-3.3	2.0
Total	-3.0	.2	-2.8	4.7	-4.1	.2	-3.9	3.3
.75P.L.								
Husband-wife families	5.4	2.2	7.6	7.6	1.6	1.1	2.7	2.8
Female-headed families	.2	.2	.4	3.0	-.6	.1	-.5	2.5
Total	5.6	2.4	8.0	10.6	1.0	1.2	2.2	5.3
1.00P.L.								
Husband-wife families	19.0	6.5	25.5	15.7	6.5	3.1	9.6	5.8
Female-headed families	4.0	.5	4.5	3.6	2.6	.4	3.0	3.0
Total	23.0	7.0	30.0	19.3	9.1	3.5	12.6	8.8

Note: Total number of husband-wife families in the U.S. = 39.8 million.
Total number of female headed families in the U.S. = 4.9 million.

*P.L. = Poverty level ($5,000 per year for a family of four in 1974).

Table 11

SOURCES OF PROGRAM COSTS AFTER RESPONSE--
HUSBAND-WIFE AND FEMALE-HEADED FAMILIES
(Billions of Dollars)

NIT Support Level	NIT Tax Rate = .50					NIT Tax Rate = .70				
	Grants Paid After Response	Welfare Savings	Positive Tax Reimburse-ment	Tax Loss Due to Labor Supply Response	Net Program Costs After Response	Grants Paid After Response	Welfare Savings	Positive Tax Reimburse-ment	Tax Loss Due to Labor Supply Response	Net Program Costs After Response
.50P.L.*										
Husband-wife families	2.6	2.7	.4	-.1	.2	2.2	2.7	.1	-.2	-.6
Female-headed families	3.7	6.7	.1	-.1	-3.0	3.4	6.7	.1	-.1	-3.3
Total	6.3	9.4	.5	-.2	-2.8	5.6	9.4	.2	-.3	-3.9
.75P.L.										
Husband-wife families	7.0	2.7	2.6	.7	7.6	5.0	2.7	.5	-.1	2.7
Female-headed families	6.7	6.7	.4	.0	.4	6.0	6.7	.2	-.0	-.5
Total	13.7	9.4	3.0	.7	8.0	11.0	9.4	.7	-.1	2.2
1.00P.L.										
Husband-wife families	16.1	2.7	9.5	2.6	25.5	10.2	2.7	1.7	.4	9.6
Female-headed families	10.4	6.7	.7	.1	4.5	9.4	6.7	.3	.0	3.0
Total	26.5	9.4	10.2	2.7	30.0	19.6	9.4	2.0	.4	12.6

Note: Net Program Costs = Grants Paid - Welfare Savings + Tax Reimbursement + Tax Loss.

*P.L. = Poverty level ($5,000 per year for a family of four in 1974).

Table 12

ALLOCATION OF INCOME CHANGE GENERATED BY THE NIT PROGRAM--
HUSBAND-WIFE AND FEMALE-HEADED FAMILIES
(Billions of Dollars)

NIT Support Level	NIT Tax Rate = .50			NIT Tax Rate = .70		
	Earnings Change at Initial Wage Rates	Net Program Costs after Response	Income Change	Earnings Change at Initial Wage Rates	Net Program Costs after Response	Income Change
.50P.L.*						
Husband-wife families	-.4	.2	-.2	.4	-.6	-.2
Female-headed families	.3	-3.0	-2.7	-.4	-3.3	-3.7
Total	-.1	-2.8	-2.9	.0	-3.9	-3.9
.75P.L.						
Husband-wife families	-4.4	7.6	3.2	-1.1	2.7	1.6
Female-headed families	-.2	.4	.2	-.0	-.5	-.5
Total	-4.6	8.0	3.4	-1.1	2.2	1.1
1.00P.L.						
Husband-wife families	-13.3	25.5	12.2	-4.2	9.6	5.4
Female-headed families	-.9	4.5	3.6	-.5	3.0	2.5
Total	-14.2	30.0	15.8	-4.7	12.6	7.9

*P.L. = Poverty level ($5,000 per year for a family of four in 1974).

higher the tax rate (for a given support level) the smaller the effect of the NIT on increasing the welfare of the low-income segment of the population.

Increases in the support level (for a given tax rate) substantially increase the net costs of an NIT program. For example, increasing the support level from .75P.L. to 1.00P.L. with a tax rate of 50% almost quadruples net program costs. Net program costs increase because of increases in both the number of participating families and the average response of participants.

In Table 11, four sources of program costs after response are identified. These include grants paid, welfare savings, tax reimbursement, and the tax loss due to the labor supply response.* For some programs, welfare savings exceed the other components of program costs, thus making the NIT program less expensive. For other programs, welfare savings reduce program costs by between 24% (S = 1.00P.L., t = .50) and 81% (S = .75P.L., t = .70). For all programs with positive net costs, grants paid exceed welfare savings. For the most expensive program (S = 1.00P.L., t = .50), positive tax reimbursement (which may also be termed tax relief) exceeds welfare savings.

A significant portion of net program costs is consumed as leisure (or results in increased home production) as opposed to market goods. Of the programs with positive net costs, the proportion of net costs consumed as leisure ranges from 37% (S = 1.00P.L., t = .70) to 58% (S = .75P.L., t = .50). This means that disposable income rises by 42% to 63% of net program costs. Thus, although all participating families are made better off (in a utility sense) by the NIT program, they do not all choose to increase their monetary income. The families most likely to experience an increase in income are those farthest from the breakeven level (because of the dominance of the income effect); the families most likely to experience a decrease in income are those nearest to the breakeven level (because of the dominance of the substitution effect).

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*See Appendix B for a precise definition of these measures.

6 SUMMARY AND CONCLUSIONS

In this paper a methodology is presented for using experimental data to estimate the labor supply effects and costs of alternative national negative income tax programs. The procedure is to estimate the parameters of a labor supply response function using experimental data and then to use the response function to predict the labor supply response for individuals in a national data set (the Current Population Survey). The predictions are carried out using a microsimulation model called TRIM. A key assumption underlying the procedure is that the demand for low-income labor is perfectly elastic.

The results indicate that both labor supply response and program costs vary widely with the support level and tax rate. The average labor supply response of husband-wife families participating in the program increases in magnitude with the support level and with the tax rate. The average labor supply response of female-headed families participating in the program increases in magnitude with the support level but is virtually unaffected by the tax rate. The average reduction in labor supply of those participating varies between 0% and 32%, depending on the program and the subgroup.

The proportion of net program costs due to labor supply response is substantial, varying between 23% and 55% for programs with positive net costs. Even though labor supply response accounts for a substantial fraction of the total costs of an NIT program, and even though the average labor supply response of those participating varies considerably with support level and tax rate, the most important determinant of net costs is the size of the pool of participants. The size of the pool of participants depends primarily on the preprogram distribution of income. When the NIT program includes families in the dense portion of the distribution, relatively small changes in either support level or tax rate have substantial effects on the number of participants. Similarly, net costs are positively associated with the support level and negatively associated with the tax rate.

Another important finding is that a substantial fraction of program costs is consumed as leisure. The disposable income of recipient families rises by between 42% and 63% of net program costs, depending on the program. Thus, the intended effects of the program on the redistribution of income are lessened somewhat by the increased consumption of leisure. This finding may partially explain why the existing welfare system has had such an apparently small effect on the measured distribution of income.

Appendix A

METHOD USED TO PREDICT LABOR SUPPLY RESPONSE

The basic model determining labor supply of an individual in the absence of an NIT program (H_o) is given by a tobit model:

$$H_o = \text{Max}(\alpha C + \varepsilon_o, 0) \quad , \tag{A.1}$$

where C is a vector of variables affecting labor supply, α is a vector of parameters, and ε_o is an error term with variance σ^2.

In the presence of an NIT program, labor supply (H_n) is assumed to be generated by the following tobit model:

$$H_n = \text{Max}(\alpha C + \gamma T + \varepsilon_n, 0) \quad , \tag{A.2}$$

where T is a vector of variables respresenting the shift in the budget constraint caused by the NIT, γ is a vector of parameters, and ε_n is an error term with variance σ^2.

An exact method for calculating the expected change in labor supply due to the NIT for an individual with characteristics C is given by:

$$\Delta H \equiv E(H_n|C) - E(H_o|C) = \gamma TF_n + \alpha C(F_n - F_o) + \sigma(f_n - f_o), \tag{A.3}$$

where F(·) is the cumulative standard normal distribution, f(·) is the standard normal density, and

$$F_n = F\left(\frac{\alpha C + \gamma T}{\sigma}\right),\ f_n = f\left(\frac{\alpha C + \gamma T}{\sigma}\right),\ F_o = F\left(\frac{\alpha C}{\sigma}\right),\ f_o = f\left(\frac{\alpha C}{\sigma}\right).$$

This procedure is not used, however, for two reasons. First, we do not have accurate measures of C on the CPS. Second, there are other effects of an NIT that we wish to estimate but whose expectations cannot be calculated from ΔH because they are not linear functions of the change in labor supply. An example is the NIT payment, which is not a linear function of the change in labor supply for persons initially above the tax breakeven level.

An alternative procedure, which is much simpler and which is an unbiased estimator of ΔH, avoids these problems. Assuming that $\epsilon_n = \epsilon_o$ for all individuals, we can write

$$\Delta H' = H_n - H_o = \text{Max}(\gamma T, -H_o)^* \quad , \qquad \text{(A.4)}$$

as long as $\gamma T < 0$ or $H_o > 0$. The expected value of $\Delta H'$ is given by

$$E(\Delta H') = \gamma T \; \text{Prob}(H_o + \gamma T > 0|C) - E(H_o|C, H_o + \gamma T < 0) \; \text{Prob}(H_o + \gamma T < 0|C)$$

$$= \gamma T F_n - E(H_o|C, H_o + \gamma T < 0)\;(1 - F_n) \quad . \qquad \text{(A.5)}$$

Noting that

$$E(H_o|C) = \alpha C F_o + \sigma f_o$$

$$= (1 - F_n)E(H_o|C, H_o + \gamma T < 0) + F_n E(H_o|C, H_o + \gamma T > 0) \qquad \text{(A.6)}$$

and

$$E(H_o|C, H_o + \gamma T > 0) = \alpha C + \sigma\frac{f_n}{F_n} \quad , \qquad \text{(A.7)}$$

and substituting (A.7) into (A.6) and rearranging terms gives:

$$E(H_o|C, H_o + \gamma T < 0)(1 - F_n) = \alpha C F_o + \sigma f_o - F_n(\alpha C + \sigma\frac{f_n}{F_n}) \; . \qquad \text{(A.8)}$$

---

*This says that an individual can at most reduce labor supply by H_o.

Substituting (A.8) into (A.5) yields:

$$E(\Delta H') = \gamma TF_n + \alpha C(F_n - F_o) + \sigma(f_n - f_o) = \Delta H \quad . \qquad (A.9)$$

Thus, averaging $\Delta H'$ over persons yields an unbiased estimate of ΔH.

The above discussion assumes that either γT is negative or H_o is positive. Although the estimated response function yields a negative γT for all individuals who are made better off by the shift to an NIT, some individuals made worse off may have positive responses and zero labor supplies. For these persons the model generates a response of

$$\Delta H' = H_n - H_o = H_n = \text{Max}(\alpha C + \gamma T + \epsilon_n, 0) \quad . \qquad (A.10)$$

Since $H_o = 0$, it is known that $\alpha C + \epsilon_n = \alpha C + \epsilon_o \leq 0$. Therefore we have

$$0 \leq H_n - H_o \leq \gamma T \quad . \qquad (A.11)$$

Since most nonworkers are not on the margin of going to work (i.e., $\alpha C + \epsilon_o < 0$), almost all responses are less than γT and many are equal to zero. The relative proportion of zero responses for persons with $H_o = 0$ and $\gamma T > 0$ is given by

$$P = 1 - \frac{F_n - F_o}{F_o} = 2 - \frac{F_n}{F_o} \quad . \qquad (A.12)$$

As long as γT is small relative to σ, the proportion will be only slightly less than one. For example, if half the persons with characteristics C work in the absence of an NIT, then $\alpha C/\sigma = 0$. If it is also assumed that $\sigma = 990$* and $\gamma T = 130$, then the proportion P = .93.

In predicting labor supply response, we assume that when $H_o = 0$ and $\gamma T > 0$, response is zero, even though a small unknown proportion

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*This is the estimate of σ obtained for female heads.

would, in fact, respond.[*] This results in a slight overstatement of the aggregate negative impact of an NIT for the group in which positive responses are most likely (female-headed families on AFDC for whom the NIT is inferior because of a lower NIT support level).

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[*]The proportion is unknown because C is not observed.

Appendix B

CONSTRUCTION OF VARIABLES USED IN THE SIMULATIONS

Define the following:

- E = family earnings,
- U = family nonwage income (excluding welfare benefits),
- G = family welfare benefits (AFDC, AFDC-UP, Food Stamps bonus value),
- S = NIT support (guarantee) level,
- t_n = NIT tax rate,
- T = positive taxes (federal, state, and Social Security income taxes).

Refer to Figure B-1 for the following:

Y_{oo} = pre-NIT disposable income evaluated at pre-NIT labor supply,

$$= E_o + U_o + G_o - T_o \quad , \tag{B.1}$$

Y_{no} = post-NIT disposable income evaluated at pre-NIT labor supply (for families below the tax breakeven level),*

$$= S + (1 - t_n)E_o \quad , \tag{B.2}$$

Y_{nn} = post-NIT disposable income evaluated at post-NIT labor supply (for families below the tax breakeven level),

$$= S + (1 - t_n)E_n \quad , \tag{B.3}$$

Y_{on} = pre-NIT disposable income evaluated at post-NIT labor supply,†

$$= E_n + U_o - T_n \quad . \tag{B.4}$$

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*Assumes U and G are taxed at 100% by the NIT program and that Federal, state, and Social Security income taxes are fully reimbursed by the program.

†Assumes the AFDC, AFDC-UP, and Food Stamps programs no longer exist at Post-NIT labor supply, and that nonwage income is unaffected by the program.

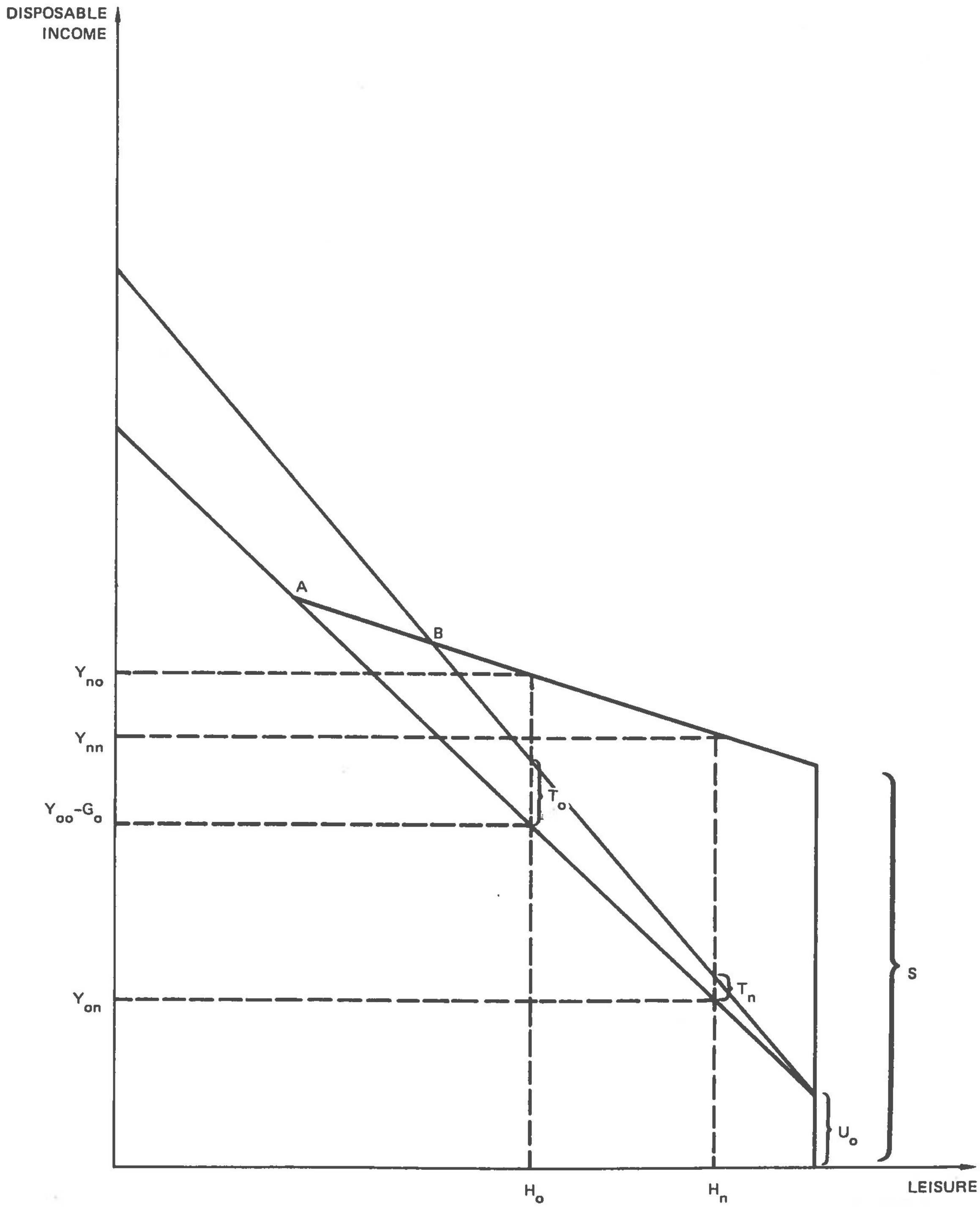

FIGURE B-1 PRE- AND POST-NIT MEASURES OF INCOME

If $Y_{no} - (Y_{oo} - G_o) \geq 0$, the family is defined as being below the tax breakeven level (point A in Figure B-1).* Under the assumption of a linear positive tax system, the tax breakeven level of earnings is given by $(S - U_o)/(t_n - t_o)$, where t_o is the positive tax rate.†

1. Calculation of Labor Supply Responses

Total annual hours of employment before imposition of the NIT, calculated from the CPS, are defined as the product of weeks worked in the year before the survey and hours worked in the week before the survey. If weeks worked are positive and hours worked per week are zero, a value is assigned to the latter. This assigned value is the mean of weekly hours over persons who report positive weeks worked and positive weekly hours. Separate values are assigned according to marital status and several categories of weeks worked.

To calculate the change in labor supply due to the NIT, the following response functions are used‡:

For families below the tax breakeven level:

$$\Delta H = H_n - H_o = \begin{cases} a_1(Y_{no} - Y_{oo}) - a_2\hat{w}(t_n - t_o) \text{ if } H_o, H_n > 0, \\ -H_o \text{ if } H_o > 0, H_n \leq 0, \\ 0 \quad \text{otherwise,}^{\S} \end{cases} \tag{B.5}$$

*Thus, the tax breakeven level is defined at pre-NIT labor supply after elimination of the various welfare programs.

†In defining the tax breakeven analytically, the positive tax schedule is linearized at the pre-NIT labor supply.

‡The parameters of these response functions are tobit estimates.

§Thus, persons who are initially not working are not given a response. This will generate a slight overestimate of the overall (negative) labor supply impact because some nonworkers made worse off by replacing welfare with the NIT will enter the labor force. We are unable to identify such persons on the CPS.

where

H_o = pre-NIT hours of work,

H_n = post-NIT hours of work,

$\hat{w}$ = an imputed pre-NIT wage rate,*

t_o = the pre-NIT marginal tax rate,

a_1 = the estimated income effect,

a_2 = the estimated substitution effect.

For families above the tax breakeven level:

$$\Delta H = H_n - H_o = \begin{cases} b_1 + b_2 BREAK + b_3 EARNABV \text{ if } Y_{nn} - Y_{on} > 0, \\ 0 \text{ otherwise}, \end{cases} \quad \text{(B.6)}$$

where

BREAK = tax breakeven level of family earnings,

EARNABV = family earnings above the tax breakeven level,

b_1, b_2, b_3 = estimated parameters for families above the tax breakeven level.

Thus, families above the tax breakeven level are assigned a response only if they go below the tax breakeven level.† Total hours of work after response are given by $H_n = H_o + \Delta H$ and total earnings by $E_n = wH_n$, where w is the observed wage rate before response.‡

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*See Maxfield (1977) for a description of how the wage rate and marginal tax rates are calculated using the CPS data.

†This is an underestimate if there is a distribution of responses for families at a given point (on the budget constraint) above the breakeven level.

‡If demand is not perfectly elastic and if aggregate supply is upward sloping, the procedure we use underestimates post-NIT earnings and overestimates post-NIT program costs.

2. Calculation of Program Costs

Program costs before response are calculated in the following manner:

$$PC_o = Y_{no} - Y_{oo} = S - U_o - G_o - t_n E_o + T_o \quad . \qquad (B.7)$$

Thus, the program costs before response are defined net of welfare costs. Program costs after response are given by

$$PC_n = Y_{nn} - Y_{on} - G_o + T_o - T_n = S - U_o - G_o - t_n E_n + T_o \quad . \qquad (B.8)$$

Program costs after response are also defined net of welfare costs and include the loss in positive tax revenue resulting from the labor supply response.

The various sources of program costs after response can be identified by rewriting (B.8) as follows:*

$$PC_n = \underbrace{S - U_o - t_n E_n}_{\text{grants paid}} \underbrace{- G_o}_{\text{welfare savings}} + \underbrace{T_n}_{\text{tax reimbursement}} + \underbrace{T_o - T_n}_{\text{tax loss due to labor supply response}} \quad . \qquad (B.8a)$$

3. Calculation of Income Change

The income change resulting from the NIT can be broken down into two components, an earnings loss (evaluated at the initial wage rate) and program costs after response:

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*This allocation applies only for families below the grant breakeven level. For families between the grant and tax breakeven levels, tax reimbursement is equal to $T_n + S - U_o - t_n E_n$ and grants paid is equal to zero.

$$IC = Y_{nn} - Y_{oo} = \underbrace{S - U_o - G_o - t_n E_n + T_o}_{\text{program costs}} + \underbrace{E_n - E_o}_{\text{earnings loss}} \quad . \tag{B.9}$$

The income change may be either positive or negative, depending on the magnitude of the labor supply response.

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