NBER WORKING PAPER SERIES

LABOR SUPPLY UNDER DISABILITY INSURANCE

Frederic P. Slade

Working Paper No. 860

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge MA 02138

February 1982

NBER Working Paper #860
February 1982

LABOR SUPPLY UNDER DISABILITY INSURANCE

Abstract

There has been a significant recent growth in the Social Security Administration's Disability Insurance (DI) program, both in the number of covered workers under the program and in the amount of monthly benefits. One possible factor causing this growth has been labor supply disincentives under the program. The labor supply decision by an individual involves the effect of the disability benefit structure (potential benefits) on labor force participation. Probit estimates from the 1969 original sample of the Longitudinal Retirement History Study (LRHS) indicated an elasticity of participation with respect to benefits of -.031 for married men aged 58-63, and -.023 for all men of the same age group. The magnitude of these estimates are much less than those found by authors such as Parsons, and suggest relatively insignificant efficiency losses in terms of reduced work effort.

Frederic P. Slade
Department of Economics
Rutgers University
Newark College of Arts and Sciences
Newark, New Jersey 07102
(201)648-5259

I. Introduction

A major characteristic of the Social Security Administration's Disability (DI) program has been the significant recent growth in the program. The number of covered workers under DI increased from 59.6 million in 1954 to 98.7 million in 1973. Table 1 shows the large increase from 1960-75 in the amount of monthly benefits. DI monthly benefit payments in 1975 were over ten times what they were in 1960.

Disability is defined under the DI program as an inability to engage in any substantial gainful activity by reason of a medically determinable physical or mental condition that has lasted or is expected to last for a continuous period of not less than twelve months or result in death.[1] Since the definition of disability is both work (and health) dependent, this focuses attention on the effectiveness of labor supply incentives under the program.

If disability were an involuntary condition for the individual, and if the Disability Insurance program was truly screening only the severely disabled, the labor supply issue would not be a factor. However, disability may be a voluntary condition for the individual. The decision to become disabled may depend on factors such as declining stamina and motivation, assets, and family composition. Also likely to influence the decision is the structure of the DI program, the net market wage rate, the existence of private employer disability plans, and the availability of alternative income maintenance plans. To the extent that the availability of DI enters the labor supply decision of the

TABLE 1

Social Security (OASDI) Disability Insurance and Retirement Insurance Monthly Benefits in Current Payment Status, 1960-1975

	Disability Insurance (amount in thousands)	Retirement Insurance (amount in thousands)
1960	48,000	888,320
1965	120,986	1,395,817
1970	242,400	2,385,926
1971	295,934	2,763,022
1972	401,462	3,514,741
1973	448,698	3,821,165
1974	556,748	4,445,170
1975	680,102	5,047,656

Source: Social Security Bulletin, Vol. 43, No. 11, November 1980.

individual, the efficiency loss from adverse incentives must be balanced against the equity gains from insurance coverage of the disabled. The following section examines labor supply under the Disability Insurance program.

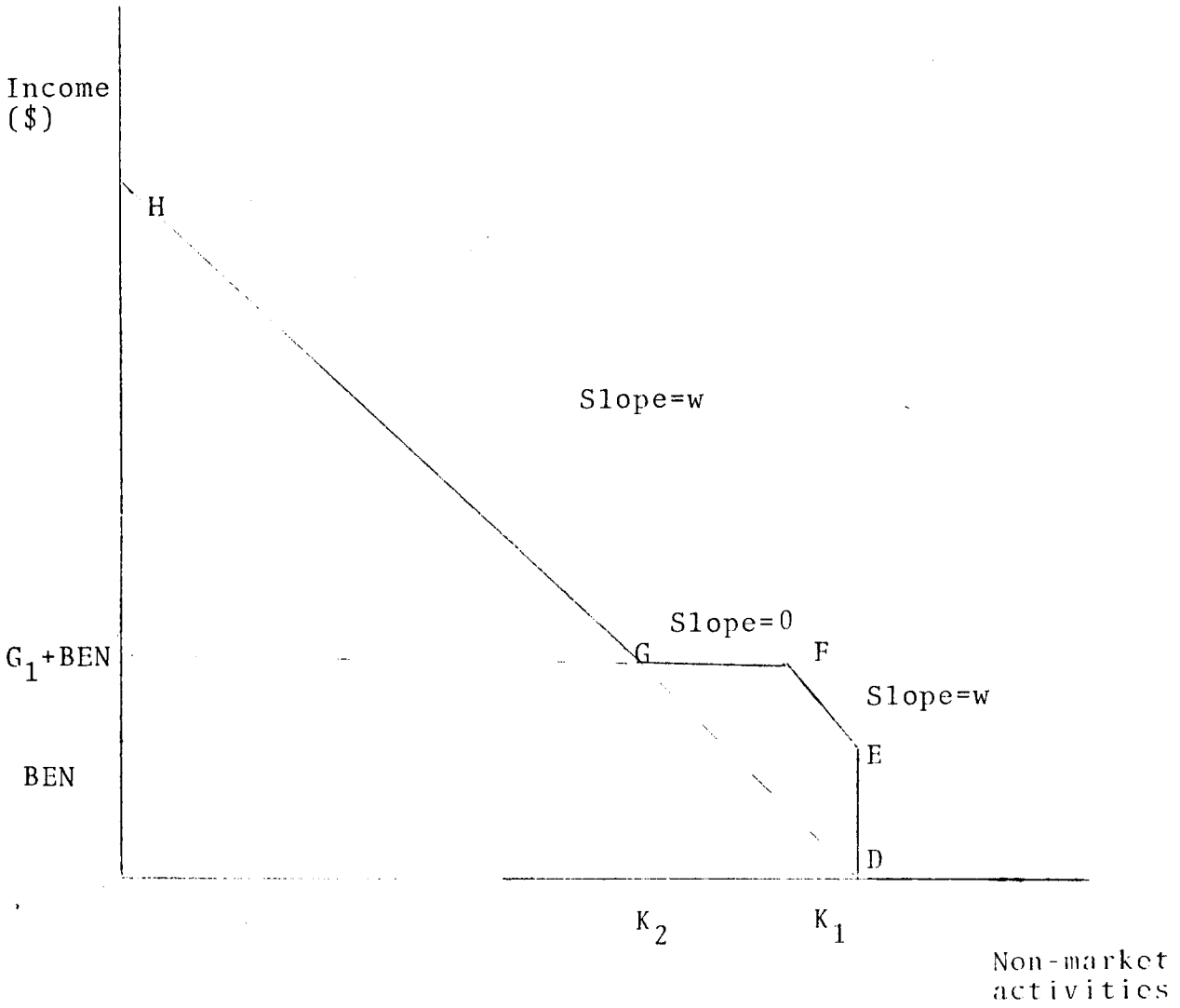
II. Labor Supply Under Disability Insurance

In order to examine the effect of Social Security Disability Insurance or labor supply, one must consider the program's benefit structure. The primary elements of this structure are the basic monthly benefit levels and the Substantial Gainful Activity (SGA) level which is the level of earnings mandated by law beyond which point a medically unrecovered individual would lose their benefits.

Figure 1 shows the budget constraint faced by the individual under Disability Insurance. The potential beneficiary receives the basic level of benefits (BEN). He or she may work without loss of benefits up to $\$G_1$ of earnings which is the SGA level of K_1 hours of work. At this point, the benefit is in effect reduced dollar-for-dollar with earnings along segment $\overline{FG}$.[2] At the point G, where the person works K_2 hours, they no longer receive disability benefits, and they operate along segment $\overline{GH}$ outside of the DI system. The amount of market time needed to earn $\$G_1$ depends on the individual's wage. The amount of market time K_2 needed to exhaust DI benefits depends on both wage and benefit. We denote this version of the DI structure as the "hours model," since the structure of the program is assumed to affect varying hours of work at low levels of work activity.

On the other hand, it may be the case that the SGA represents such a low level of earnings that it may be considered to be

Figure 1 - Budget Constraint for Individual Under Social Security Disability Insurance



essentially zero to the individual. For example, the SGA level in 1974 was $200 per month, which for most persons would connote less than part-time work. In Figure 1, any positive amount of market time would therefore lead to immediate loss of benefits. The budget constraint is $\overline{DE}$ for zero hours of work, but immediately drops down to $\overline{DH}$ as soon as the individual works a positive amount. The disability system is therefore reduced to a labor force participation decision subject to benefits BEN and market wage w. We denote this alternative form of the DI system as the "participation model."

In the following discussion, we examine labor supply under the "participation model." We do not discuss the hours model since the supply decision from an empirical standpoint is basically a participation decision. Data from the 1969 sample of the Longitudinal Retirement History Study (LRHS) shows that only .76 percent of males aged 58-63 who worked in 1968 worked at or above the SGA level.

III. Participation Model

The participation model under disability insurance can be represented by three equations: a shadow price equation, a wage equation, and a labor supply equation.

We may specify the shadow price equation as

$$s = \beta' y + u_1 \tag{1}$$

and the market wage equation as:

$$w = \alpha' \underline{x} + u_0 \tag{2}$$

with labor supply H specified as:

$$H = \begin{cases} \delta' z + \gamma_1 \underline{w} + u_2 & \text{if } w \geq s \\ 0 & \text{if } w < s \end{cases} \tag{3}$$

where μ_2 may or may not equal $(\mu_0 - \mu_1)$ and H represents annual hours worked.

The reduced form hours and wage equations from equations (1)-(3) may be written as:

$$H_i = \delta'_{1i} z_i + \gamma_{1i} \alpha'_i x_i + \gamma_1 \mu_0 + u_2 \tag{1'}$$

$$w_i = \alpha'_i x_i + u_0 \tag{2'}$$

where disability benefits would be expected to enter the vector z. A priori, we would expect disability benefits to increase the value of nonmarket time, therefore reducing the probability of working.

The conditional hours and wage equations for the population with possible censored sampling become.

$$E(H_i/H_i > 0) = \delta'_{1i} z_i + \gamma_{2i} \alpha'_i x_i + \mu_1 \lambda(\phi_i) + v_{1i} \tag{4}$$

$$E(w_i/H_i > 0) = \alpha'_i x_i + \mu_2 \lambda(\phi_i) + v_{2i} \tag{5}$$

where

$$\mu_1 = (\gamma_1^2 \sigma_0^2 + \sigma_2^2 + 2\gamma_1 \sigma_{20})^{1/2}$$

$$\mu_2 = (\gamma_1^2 \sigma_0^2 + \sigma_{20})/\mu_1$$

$$\phi_i = -(\gamma_{1i} \alpha'_i x_i + \delta_{1i}' z_i)/\mu_1$$

and

$$\lambda(\phi_i) = \frac{f(\phi_i)}{1-F(\phi_i)} \tag{6}$$

In equations (4) and (5), v_{1i} and v_{2i} are the conditional reduced form disturbances, and λ_i is the inverse of Mill's ratio, which in reliability theory is known as the hazard rate.[3]

In order to estimate the extent of sample selection bias, we seek consistent estimates of ϕ_i. Consistent estimates of ϕ_i can be obtained through probit analysis of the decision to work or not to work. Estimates of ϕ_i allows us to estimate $\lambda(\phi_i)$, which allows us to correct for the fact that wages may be significantly higher for participants than nonparticipants--a form of selectivity bias.

The general form of the structural participation equation can be written as:

$$LFP = f(w, BEN, X) \tag{7}$$

where w is the market wage, BEN is the level of potential disability benefits, and X represents a vector of variables which are expected to affect individual preferences between leisure and consumption goods--such as family assets and productivity at home. We do not consider here the case of fixed costs of working which affect the shadow price but have a negligible effect on hours worked. Hausman (1979) has pointed out the possible problems arising from the wage-shadow price approach when fixed costs are present.[4]

IV. Empirical Results

Tables 3 and 4 show maximum likelihood probit estimates of the structural labor force participation equation for males aged 58-63 from the 1969 original sample of the Longitudinal Retirement History Study (LRHS). These males were eligible for Disability Insurance benefits based on their past earnings and employment covered by Social Security.

Two variables are used which, in addition to entering the shadow price equation, also standardize for the probability of being certified as disabled by the Social Security Administration. The first variable is LIMIT, which is a dummy variable equal to one if the individual is limited in getting around, and zero otherwise. This is a measure of the person's level of (poor) health, which is an important criterion in being certified as disabled. We would prefer a more lagged measure of health than LIMIT. This is because a lagged measure would have a greater degree of exogeneity, and would allow for the time period between onset of disability and the decision whether or not to apply for benefits and/or drop out of the labor force. However, since we are using the 1969 original sample which does not include retrospective health questions, we use the variable LIMIT which partially reflects past health states.

The second variable used is UE, which is the number of quarters in the 40 quarters preceding 1968 in which the individual was not credited with a quarter of coverage by the Social Security Administration ($50 or more in wages in a calendar quarter or $100 or more in self-employment income). Although the Social Security Administration does not specifically require a particular pattern of past

TABLE 2

Definition of Variables Used in Labor Force Participation Equations

Independent Variables

RURAL = dummy variable equal to 1 if person resides in rural area code, 0 if otherwise

MARRIED = dummy variable equal to 1 if married, 0 otherwise

RACE = dummy variable equal to if if black, 0 otherwise

LIMIT = dummy variable equal to 1 if person limited in getting around, 0 otherwise

EDUC = individual's years of schooling completed

AGE = age of individual

HHSIZE = number of persons in household

BEN = potential monthly benefits from Social Security disability insurance, given that the individual is eligible based on their earnings records as of 1968

WAGE = hourly wage rate of individual in 1968

ASSETS = total net family assets in 1968

UE = number of quarters in the 40-quarter period preceding 1968 in which the individual was not credited with a quarter of coverage

KIDS = number of children

SIBS = number of brothers and sisters of individual

REDBEN = potential monthly reduced retirement benefits for those aged 62-63

SPED = wife's years of schooling completed

SPERN = wife's earnings in 1968

Dependent Variable

LFP = dummy variable equal to 1 if worked more than zero hours in 1968, 0 otherwise

TABLE 2

Mean and Standard Deviation of Variables Used in Participation Equations, Males Aged 58-63

Independent Variables	Mean		Standard Deviation	
	Total Sample	Married Sample	Total Sample	Married Sample
RURAL	.29	.30	.45	.46
MARRIED	.90	1.0	.30	0
RACE	.07	.066	.26	.25
LIMIT	.23	.23	.42	.42
EDUC	10.0	10.1	3.6	3.6
AGE	60.3	60.3	1.7	1.7
HHSIZE	2.6	2.7	1.3	1.2
BEN	140.9	141.6	22.0	21.5
WAGE	4.8	4.8	3.5	3.6
ASSETS/100	51.8	54.8	127.0	132.1
UE	2.2	2.1	4.7	4.4
KIDS	2.5	2.6	2.2	2.2
SBIS	3.2	3.3	2.4	2.4
REDBEN	40.8	40.9	64.8	65.0
SPED	--	10.4	--	3.3
SPERN/100	--	14.1	--	25.7
Dependent Variable				
LFP	.91	.91		

TABLE 3

Maximum Likelihood Probit Estimates of Labor Force Participation Equation for Males Regardless of Marital Status Aged 58-63
(N = 4504, t-values in parentheses)

Independent Variable	Maximum Likelihood Estimate (1)	(2)	$\frac{LFP}{x}$ at Independent Variable Means (1)	(2)
RURAL	.07 (1.0)	.0007 (.01)	.007	.00006
MARRIED	.23 (2.5)*	.20 (1.99)*	.025	.017
RACE	-.043 (-.4)	-.14 (-1.2)	-.005	-.012
LIMIT	-1.2 (-19.1)**	-1.07 (-16.2)**	-.13	-.09
EDUC	.036 (3.9)**	.047 (4.7)**	.004	.004
AGE	-.14 (-4.6)**	-.15 (-4.4)**	-.015	-.013
HHSIZE	.022 (.9)	.038 (1.3)	.002	.003
BEN	.010 (7.4)**	-.0017 (-1.1)	.001	-.0001
WAGE	.004 (.4)	.001 (.1)	.0005	.0001
ASSETS	-.00001 (-.04)	.0001 (.3)	-.000001	.000009

(continued on next page)

TABLE 3 (concluded)

Independent Variable	Maximum Likelihood Estimate (1)	(2)	$\frac{LFP}{x}$ at Independent Variable Means (1)	(2)
UE		-1.1 (-17.8)**		-.0095
KIDS	.009 (.6)	.011 (.7)	.001	.0010
SIBS	.008 (.7)	.008 (.6)	.0009	.0007
REDBEN	.0002 (.2)	-.0001 (-.2)	.00002	-.00001
CONSTANT	8.3 (4.4)**	10.5 (5.2)**	.91	.91
Log of Likelihood Function	-1075.8	-910.4		
(-2.0) Times Log Likelihood Ratio	654.0	985.2		

*Denotes significance at the 5 percent level.

**Denotes significance at the 1 percent level.

TABLE 4

Maximum Likelihood Probit Estimates of Labor Force Participation Equation for Married Males Aged 58-63
(N = 4064, t-values in parentheses)

Independent Variable	Maximum Likelihood Estimate (1)	Maximum Likelihood Estimate (2)	$\frac{LFP}{x}$ at Independent Variable Means (1)	$\frac{LFP}{x}$ at Independent Variable Means (2)
RURAL	.08 (1.2)	-.008 (-.1)	.009	-.0006
RACE	-.06 (-.5)	-1.5 (-1.2)	-.006	-.012
LIMIT	-1.1 (-17.3)**	-1.04 (-14.7)**	-.11	-.082
EDUC	.028* (2.5)*	.036 (2.95)**	.003	.003
AGE	-.14 (-4.2)**	-.14 (-3.8)**	-.014	-.011
HHSIZE	.026 (.9)	.04 (1.2)	.0026	.0031
BEN	.009 (6.4)**	-.0026 (-1.4)	.001	-.0002
WAGE	.02 (1.4)	.022 (1.2)	.002	.0017
ASSETS	-.0002 (-.5)	-.00001 (-.04)	-.00002	-.000001

(continued on next page)

TABLE 4 (concluded)

Independent Variable	Maximum Likelihood Estimate (1)	(2)	$\frac{LFP}{x}$ at Independent Variable Means (1)	(2)
UE		-.11 (-16.7)**		-.0088
KIDS	.023 (1.4)	.029 (1.6)	.0023	.0023
SIBS	.007 (.5)	.0054 (.4)	.0007	.0004
REDBEN	-.00009 (-.1)	-.0005 (-.6)	-.000009	-.00004
SPERN	.0015 (1.1)	.0029 (1.95)	.0002	.0002
SPED	.018 (1.5)	.018 (1.4)	.002	.001
CONSTANT	8.2 (4.1)**	10.2 (4.6)**	.83	.80
Log of Likelihood Function	-931.4	-784.8		
(-2.0) Times Log Likelihood Ratio	536.7	829.9		

*Denotes significance at 5 percent level.

**Denotes significance at 1 percent level.

labor force experience, the individual's preceding spells of unemployment and/or non-participation may be a factor in the certification decision.

Wages and benefits are entered separately in the equation in order to allow more flexibility in the functional form and in interpreting the results. Collinearity would not appear to be a problem here, with the correlation between the wage rate and benefits being approximately .13 for the sample.

The probit estimates in Tables 3 and 4 were done with non-coverage of work under Social Security (UE) not included (column 1), included (column 2). The results should be interpreted for the case where UE is included, assuming that UE does not reflect a lagged value of current labor force participation.[5] Since UE is defined over the past 40 quarters, this would reduce the likelihood that it is a lagged value.

Table 3, column (2) shows estimates for males regardless of marital status. The coefficients on marital status (MARRIED) and years of schooling completed (EDUC) are positive and significant. The proxy for health (LIMIT), age (AGE), and past non-coverage of work (UE) have coefficients which are negative and significant. The coefficients of LIMIT and UE indicate the expected effect of poor health and past periods of nonwork in discouraging participation as a result of a favorable shift in the probability of certification. The negative effect of LIMIT also reflects the effect of poor health in raising the shadow price.

It is also interesting to examine the coefficient on the race dummy (RACE). Although not highly significant, it is quite negative

(-.14). This is not in line with the result found by Parsons (1980b), whereby the race coefficient became virtually zero when controlling for disability benefits.

The coefficient for potential disability benefits (BEN) was found to be -.0017, with a t-statistic of -1.1.[6] The partial effect of benefits on labor force participation at the mean was -.0001, with an elasticity of participation with respect to benefits of -.023. The effect of benefits on participation found here is far smaller than that found by Parsons (1980a,b). Parsons, in separate studies, found elasticities of -.63 and -1.8 for middle-aged men.

Table 4, column (2) shows probit estimates for the subsample of married men. Estimates for most of the variables were similar to those found for the total (married and unmarried) sample. For the married subsample, wife's schooling (SPED) and wife's earnings (SPERN) were added. The coefficients on SPED and SPERN were positive although not highly significant.

The coefficient on BEN was -.0026, with a t-statistic of -1.4. This coefficient was slightly more negative than was the case for the entire sample in Table 3. The greater negative valuation of disability benefits for married men might reflect the availability of wife's benefits, even when controlling for the wife's contribution to family earnings (SPERN). The elasticity of participation with respect to benefits at the means was -.031, still a great deal lower than Parson's estimates.

V. Conclusion

We have examined one possible factor which has contributed to the significant recent growth in the Social Security Administration's Disability Insurance (DI) program: that of labor supply incentives under the program.

The examination of labor supply effects involved the effect of the disability benefit structure (potential benefits) on labor force participation. A priori, it was expected that an increase in potential benefits would increase the value of time spent outside of the labor market, and would therefore reduce the probability of working.

Maximum likelihood probit estimates of labor force participation for males aged 58-63 in the Longitudinal Retirement History Study (LRHS) indicated an elasticity of participation with respect to benefits of -.023 for all men, and an elasticity of -.031 for married men. The magnitude of these elasticities were far less than those found by other authors such as Parsons.

In interpreting these results from a social policy standpoint, a few caveats should be noted. The analysis has ignored macroeconomic factors such as the unemployment rate. Also not considered have been temporal aspects of the Disability Insurance program such as the five-month waiting period for receipt of benefits, the appeals process, and changes over time in the disability laws.

The results obtained here do suggest a mixed response to the question as to whether the Social Security disability system should be altered, or (as is a topic of lively current debate) significantly diminished. The labor supply effects suggest relatively insignificant

efficiency losses in terms of diminished work effort. These losses may well be counter-balanced by equity gains from insurance coverage of the disabled

FOOTNOTES

[1]From Social Security Handbook, 1974.

[2]The individual actually loses all of their benefits at K_1 hours of work, which we are "averaging" as a dollar-for-dollar reduction along segment $\overline{FG}$. Alternatively, we could have modeled this as a sharp drop in the budget line from point F down to the horizontal axis, and then a resumption of slope w along a segment below segment $\overline{DH}$.

[3]See Heckman (1976).

[4]Hausman (1979) points out that fixed costs may lead to non-convexities in the budget constraint faced by the worker because of minimum labor supply conditions. These nonconvexities may cause multiple tangencies of the indifference curve with the budget constraint, and cause the wage-shadow price approach to break down.

[5]Since the variable UE reflects past labor force experience, this may be measuring to a certain extent lagged values of the labor force participation dependent variable.

Taubman and Rosen (1980) have stressed the difference in interpretation of results when the dependent variable represents a first order difference from period t to period t +1, as opposed to a level in period t.

Consider the case of the effect of disability insurance on labor force participation. If UE represented lagged labor force participation, the coefficient on BEN would represent the difference in slopes between

labor force participation "deterioration functions" where these functions relate participation to time. On the other hand, to the extent that UE did not reflect lagged indicators of participation, the coefficients on BEN would (in a cross-section) be measuring the difference in levels of participation or the distance between deterioration functions at a given point in time. For purposes of the analysis, participation is being treated as a level.

[6]An interaction term LIMIT x BEN was added to the equation. The coefficient, however, was positive and significant. This seems to indicate that the interaction term is picking up a past wage effect as opposed to a benefit effect.

REFERENCES

Berkowitz, M. and W.G. Johnson. "Health and Labor Force Participation," Journal of Human Resources, 9, Winter 1974.

Griliches, Z., B. Hall, and J. Hausman. "Missing Data and Self-Selection in Large Panels," Annales de L'Insee, 1978.

Gronau, R. "The Effect of Children on the Housewife's Value of Time," Journal of Political Economy (March/April) 1973.

_____. "Wage Comparisons - A Selectivity Bias," Journal of Political Economy (November/December) 1974.

Hagens, J. "Social Security and Retirement." Office of Research and Statistics Working Paper No. 17, Social Security Administration, August 1980.

Hanoch, G. "A Multivariate Model of Labor Supply: Methodology for Estimation," Rand Corporation, September 1976.

Hausman, J. "The Effect of Wages, Taxes, and Fixed Costs on Women's Labor Force Participation," Working Paper No. 238, Department of Economics, Massachusetts Institute of Technology, May 1979.

Heckman, J. "Shadow Prices, Market Wages, and Labor Supply," Econometrica, July 1974.

_____. "The Common Structure of Statistical Models of Truncation, Sample Section, and Limited Dependent Variables and a Simple Estimator for Such Models," Annals of Economic and Social Measurement, Fall 1976.

Heckman, J. "Sample Selectivity Bias as a Specification Error (With an Application to the Estimation of Labor Supply Functions)," Econometrica, January 1979.

Leonard J. "The Social Security Disability Program and Labor Force Participation," Working Paper No. 392, National Bureau of Economic Research, August 1978.

Parsons, D. "The Decline in Male Labor Force Participation," American Economic Review, February 1980a.

_____. "Racial Trends in Male Labor Force Participation," American Economic Review, December 1980b.

Pellechio, A. "The Social Security Earnings Test, Labor Supply Distortions, and Foregone Payroll Tax Revenue," Working Paper No. 272, National Bureau of Economic Research, August 1978.

United States Social Security Administration, Social Security Handbook. Washington, D.C.: U.S. Government Printing Office, February 1974.

United States Social Security Administration, History of the Provisions of Old-Age, Survivors, Disability, and Health Insurance, January 1980.

Van de Water, P. "Disability Insurance," American Economic Review, May 1979.

Wales, T.J., and A.D. Woodland. "Sample Selectivity and the Estimation of Labor Supply Functions," paper, University of British Columbia.