

PROGRAM PARTICIPATION AND ATTRITION: THE EMPIRICAL EVIDENCE

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I. Introduction

One of the primary goals of the Survey of Income and Program Participation (SIPP) is to provide policy makers, researchers, and others with detailed information on the participation in government assistance programs by persons and households in the United States. Given the importance of the means-tested program or welfare statistics, it is important to examine the effects of attrition on program participation estimates from SIPP. This paper uses well-established attrition models (Heckman, 1976; Ridder, 1990) to examine the direct effect of attrition on means-tested program benefits received by various program participants.

SIPP is a longitudinal survey where individuals are interviewed every four months for a period of two and two-thirds years. Past studies have extensively examined the characteristics of attritors and nonattritors and the cumulative sample loss rates in various SIPP panels. Recently, Tin (1995) found that labor income is not affected by attrition biases in the 1990 SIPP panel. Zabel (1993) showed that attrition has no effect on labor force participation but has an effect on hourly supply of labor. However, the direct effect of attrition on means-tested benefit estimates has yet to be examined.

This paper attempts to bridge this gap by using a two-step

estimation method to examine the direct relationship between attrition and the benefit estimates of major means-tested government assistance programs--namely, Aid to Families with Dependent Children (AFDC), food stamps, General Assistance (GA), Supplemental Security Income (SSI), and the Supplemental Food Program for Women, Infants, and Children (WIC).

II. The Model

The attrition model (e.g., Tin, 1995) used in this study can be stated as

$$y_t = \beta'x_t + e_t \quad (1)$$

and

$$a_t^* = \alpha_0'w_t + \alpha_1 y_t + \mu_t \quad (2)$$

Equation (1) is a program participation equation where y_t is real benefits received by welfare participants, x_t is a set of socioeconomic variables with a set of parameters β . The symbol e_t represents an error term, assumed to be normally distributed with zero mean and constant variance. Equation (2) is an attrition equation where a_t^* is the tendency to attrit at time t and is assumed to be a function of y_t and a set of exogenous variables w_t with parameters, α_0 . The error term is represented by μ_t . The tendency to attrit, a_t^* , cannot be observed. However, actual attrition, a_t , is observable and serves as a proxy for the tendency to attrit. It is assumed that

$$a_t = 1 \text{ if } \alpha'_0 w_t + \alpha_1 y_t + \mu_t > 0 \quad (3)$$

and

$$a_t = 0 \text{ if } \alpha'_0 w_t + \alpha_1 y_t + \mu_t \leq 0 \quad (4)$$

Equations (1) and (2) are simultaneously determined. A change in the explanatory variables in the benefit equation indirectly influences the tendency to attrit. Consistent estimates of the coefficients of the benefit equation can be obtained by using a two-step estimation procedure of Heckman (1976). First, substituting equation (1) into equation (2) to get the reduced-form attrition equation

$$a_t = \phi'_0 z_t + \alpha_1 e_t + \mu_t \quad (5)$$

where ϕ_0' is a vector of reduced-form parameters and z_t is a set of exogenous variables at time t . The coefficient estimates of equation (5) can be obtained by applying a maximum likelihood probit procedure to get an estimate of the attrition correction variable (or the inverse of Mill's ratio), λ_t ,

$$\lambda_t = \frac{f(\phi'_0 z_t / \delta_e)}{F(\phi'_0 z_t / \delta_e)} \quad (6)$$

which is defined as the ratio between the probability density and cumulative distribution functions, f and F , respectively. The symbol δ_e is the standard error of the error term.

In the second step, the estimate of λ_t is used as an independent variable in the benefit equation. The final form of the benefit equation to be estimated is

$$y_t = \beta' x_t + \delta \hat{\lambda}_t + \epsilon_t \quad (7)$$

where $\hat{\lambda}_t$ is the estimate of

the attrition correction variable. For real benefits received by welfare participants, consistent estimates can be obtained by applying ordinary least squares (OLS).

III. Empirical Results

The primary source of data is the 1990 SIPP panel which contains 32 months of data on individuals in the United States. The 1990 panel collects monthly data on about 58,300 persons based on interviews conducted from February 1990 to September 1992. The civilian noninstitutional population of the United States and members of the Armed Forces living off post. The primary focus of SIPP is persons 15 years old and over who are interviewed in the first wave of the panel. These "original sample persons" are followed over the life of the panel. If the original sample persons move during the life of the panel, they are followed to the new address and all persons residing with them are interviewed.

Attrition is defined to be original sample persons missing one or more interviews whether or not they return to the sample. Excluded from the definition of attritors are persons that have left the universe of the sample, primarily those who die or become institutionalized during the life of the panel. Persons who join the survey after the first wave of interviews are also excluded.

The overall cumulative sample loss rate in the 1990 panel is about 21 percent. However, cumulative nonresponse rates differ among means-tested programs. Table 1 shows that the cumulative nonresponse rate for AFDC participants who receive benefits is higher than that of any other means-tested program participant, while SSI has the lowest cumulative sample loss rate among these programs. Generally, the cumulative sample loss rates increase at a decreasing rate; about half of the cumulative sample loss occur in

Table 2. Distribution of Attritors and Nonattritors by Selected Characteristics and Assistance Programs (Numbers in percent)

Characteristic	Food stamps		AFDC	
	Attritor	Nonattritor	Attritor	Nonattritor
AGE				
Under 15 years	1.1	1.5	0.7	2.2
15 to 64 years	94.9	86.5	99.2	95.6
65 years and over	4.0	12.0	0.2	2.2
Chi-square statistics	188.6*		51.8*	
EDUCATIONAL ATTAINMENT				
Under 4 years of high school	47.0	50.3	46.7	46.5
High school graduate	37.3	36.9	36.9	41.4
1 or more years of college	15.6	12.8	16.5	12.1
Chi-square statistics	20.5*		22.9*	
SEX				
Male	27.9	24.0	10.9	10.2
Female	72.1	76.0	89.1	89.8
Chi-square statistics	20.6*		0.6	
MARITAL STATUS				
Married	23.7	33.9	20.2	29.9
Separated, divorced, widowed	37.2	37.2	33.5	30.3
Never married	39.1	28.9	46.3	39.8
Chi-square statistics	161.3*		57.0*	
RACE				
White	57.8	68.2	51.5	61.2
Black	38.9	28.0	43.5	33.1
Other	3.3	3.8	5.0	5.7
Chi-square statistics	134.6*		53.8*	
HISPANIC ORIGIN				
Hispanic origin	15.9	14.9	18.0	15.4
Not of Hispanic origin	84.1	85.1	82.0	84.6
Chi-square statistics	2.0		5.6*	

DISABILITY STATUS

With work disability	41.6	34.1	26.3	23.1
With no work disability	58.4	65.9	73.7	76.9
Chi-square statistics	58.4*		6.6*	

MOBILITY STATUS

Movers	73.2	40.8	78.3	48.8
Nonmovers	26.8	59.2	21.7	81.4
Chi-square statistics	1030.3*		442.7*	

HOUSEHOLD RELATIONSHIP

Nonrelatives	90.4	95.1	92.8	95.3
Relatives	9.6	4.9	7.2	4.7
Chi-square statistics	91.9*		14.7*	

REGION

Northeast	20.2	18.3	38.9	61.1
Midwest	22.4	27.4	30.5	69.5
South	35.5	38.6	32.6	67.4
West	22.0	15.7	41.9	58.2
Chi-square statistics	90.2*		12.5*	

METROPOLITAN RESIDENCE

Metropolitan	80.3	70.6	83.2	75.4
Nonmetropolitan	19.7	29.4	16.8	24.6
Chi-square statistics	118.4*		41.4*	

EMPLOYMENT STATUS

Employed full-time	33.7	29.4	26.3	24.3
Employed part-time	2.4	3.4	2.0	3.8
Unemployed	14.4	11.2	14.7	11.8
Out of labor force	49.6	56.0	57.1	60.1
Chi-square statistics	61.1*		23.8*	

POVERTY STATUS

Poor	49.5	59.8	56.3	63.6
Nonpoor	50.5	40.2	43.7	36.4
Chi-square statistics	106.6*		25.8*	

Note: '*' denotes that the statistic is significant at the percent level.

Table 2. Distribution of Attritors and Nonattritors by Selected Characteristics and Assistance Programs-Con. (Numbers in percent)

Characteristics	GA		SSI		WIC	
	Attritor	Nonattritor	Attritor	Nonattritor	Attritor	Nonattritor
AGE						
Under 15 years	3.0	0.3	0.5	0.7	3.4	0.3
15 to 64 years	97.0	94.5	80.2	63.2	95.8	99.5
65 years & over	0.0	5.2	19.3	36.1	0.2	0.2
Chi-square statistics	56.1*		156.7*		85.2*	
EDUCATIONAL ATTAINMENT						
Under 4 years of high school	43.2	48.2	44.6	63.1	49.7	41.2
High school graduate	36.9	34.9	35.6	26.3	36.2	43.5
1 or more years of college	20.0	16.9	19.8	10.5	14.0	15.4
Chi-square statistics	4.9*		190.7*		26.1*	
SEX						
Male	42.0	35.0	43.1	31.2	10.6	10.5
Female	36.5	65.0	56.9	68.7	89.4	89.5
Chi-square statistics	8.5*		70.5*		0.004	
MARITAL STATUS						
Married	12.4	24.4	20.6	25.4	38.1	45.3
Separated, divorced, widowed	32.8	31.7	37.2	44.3	13.8	13.6
Never married	54.9	44.0	42.2	30.4	48.0	41.2
Chi-square statistics	7.7*		73.5*		19.3*	
RACE						
White	48.8	69.1	61.6	68.1	61.4	70.7
Black	46.7	28.3	32.0	26.4	32.7	27.1
Other	4.5	2.6	6.0	5.5	5.9	2.3
Chi-square statistics	70.7*		23.4*		54.3*	
HISPANIC ORIGIN						
Hispanic origin	11.3	15.0	9.8	14.5	20.3	17.6
Not of Hispanic						

origin	88.7	85.0	90.2	85.5	79.7	82.4
Chi-square statistics	4.9*		22.3*		4.3*	

DISABILITY STATUS

With work disability	59.5	45.3	72.6	61.1	16.7	13.5
With no work disability	40.6	54.7	27.4	38.9	83.3	86.5
Chi-square statistics	32.7*		69.0*		7.2*	

MOBILITY STATUS

Movers	63.4	42.7	59.5	22.2	78.1	52.8
Nonmovers	36.6	57.3	40.5	77.8	21.9	47.2
Chi-square statistics	69.5*		725.6*		226.2*	

HOUSEHOLD RELATIONSHIP

Nonrelatives	86.7	90.2	89.3	95.7	91.2	93.4
Relatives	13.3	9.8	10.7	4.3	8.8	6.6
Chi-square statistics	5.2*		16.5*		1.1	

REGION

Northeast	32.4	35.7	20.8	17.8	16.7	13.3
Midwest	30.4	36.4	19.8	18.4	22.2	27.1
South	17.7	13.9	34.6	42.4	35.4	41.9
West	19.5	14.0	24.8	21.5	25.7	17.7
Chi-square statistics	16.9*		30.7*		51.6*	

METROPOLITAN RESIDENCE

Metropolitan	0.5	0.7	82.0	70.8	75.5	64.2
Nonmetropolitan	80.2	63.2	18.0	29.2	24.5	35.8
Chi-square statistics	30.5*		77.4*		49.6*	

EMPLOYMENT STATUS

Employed full-time	38.5	25.2	26.1	14.0	32.5	39.2
Employed part-time	2.5	5.0	2.3	0.7	2.1	4.6
Unemployed	20.2	17.8	7.0	3.2	11.5	11.0
Out of labor force	38.8	52.0	64.6	82.2	53.9	45.2
Chi-square statistics	46.9*		210.2*		36.4*	

POVERTY STATUS

Poor	38.0	52.8	27.1	47.2	45.1	48.1
Nonpoor	62.0	47.2	72.9	52.8	54.9	51.9
Chi-square statistics	35.9*		195.7*		3.0	

Note: "*" denotes that the statistic is significant at the five percent level.

waves two and three and over seventy percent are lost by wave five. In any event, this does not necessarily imply that AFDC benefit estimates are affected by attrition, while SSI benefit estimates are not. Wave 1 statistics are not included because only those who are interviewed in wave 1 are examined in subsequent waves.

Table 1. Cumulative Nonresponse Rates by Means-Tested Programs and Waves:1990 SIPP Panel

Means-Tested Programs	Wave						
	2	3	4	5	6	7	8
Food stamps	6.0	11.9	15.1	18.3	21.0	22.4	22.3
AFDC	6.8	13.7	17.6	21.1	24.5	26.2	26.9
GA	5.9	11.9	14.6	19.8	23.6	24.8	25.5
SSI	4.6	9.0	11.9	13.8	16.6	17.9	18.4
WIC	4.8	9.2	12.7	16.6	19.4	20.2	22.2

Table 2 contains weighted distributions and Chi-square statistics of attritors and nonattritors among means-tested program participants during the first month of the 1990 panel. Chi-square measures indicate that most characteristics of attritors and nonattritors differ significantly in each assistance program. However, differences in the characteristics of attritors and nonattritors do not necessarily mean that the benefit estimates of all these assistance programs are affected by attrition.

Regression Results for Means-Tested Programs

Regression results for the benefit estimates of food stamps, AFDC, General Assistance (GA), SSI, WIC, and the aggregate are presented in table 3. Monthly weights are used for all sample observations. T-statistics are given in parentheses.

nominal benefit divided by the consumer price index (CPI) is used as the dependent variable. All explanatory variables except age and lambda are dichotomous binary variables with values zero or unity.

Table 3. Regression Results for Means-Tested Programs: 1990 SIPP Panel

Explanatory variables	Means-Tested Programs					
	Total	Food stamps	AFDC	GA	SSI	WIC
Constant	1.32 (.2)	1.84 (7.8)	.58 (1.5)	.42 (1.2)	1.82 (5.4)	-.88 (5.1)
Age	-.02 (10.5)	-.04 (9.3)	-.01 (.2)	-.02 (2.9)	-.02 (7.3)	-.01 (3.7)
No high school	-.10 (1.5)	.20 (1.3)	-.18 (2.9)	.01 (.1)	-.42 (3.4)	.09 (1.8)
High school	-.09 (.8)	.23 (1.7)	-.08 (1.4)	.01 (.02)	-.12 (1.3)	.05 (1.3)
Female	-.03 (.4)	-.08 (.6)	-.16 (1.5)	.37 (3.8)	-.2 (.3)	-.11 (1.7)
Married	.17 (2.2)	.27 (2.3)	.08 (1.4)	.17 (1.4)	.18 (2.5)	.01 (.3)
Black	.14 (2.2)	.57 (3.6)	-.33 (2.4)	.20 (1.5)	.37 (3.5)	.08 (1.7)
Hispanic	.19 (2.3)	.34 (2.3)	-.03 (.2)	.32 (2.5)	.19 (2.3)	-.01 (0.2)
Disabled	.01 (.3)	.35 (2.3)	-.23 (1.9)	.37 (2.7)	.37 (4.0)	.10 (1.6)
Mover	.22 (3.5)	.25 (2.2)	-.11 (.8)	-.06 (0.6)	.32 (4.1)	.10 (1.8)
Nonrelative	.15 (.8)	.42 (1.4)	-.34 (1.1)	.04 (.2)	.99 (3.6)	-.15 (1.7)
Northeast	.14 (2.8)	.12 (1.0)	.14 (2.2)	.18 (1.9)	.29 (3.0)	.06 (1.4)
Metropolitan residence	.17 (2.6)	.12 (.9)	.12 (1.6)	.13 (1.1)	.21 (3.0)	.07 (1.6)
Employment status	-.61 (6.1)	.18 (1.4)	-.26 (4.1)	-.25 (1.9)	.69 (2.9)	-.12 (2.8)
Poverty status	.13 (2.0)	-.24 (1.3)	.21 (1.2)	-.15 (.9)	-.50 (4.2)	-.06 (1.2)
Lambda	.55 (.4)	-3.18 (3.6)	1.27 (1.4)	-.41 (1.0)	-2.43 (3.7)	-0.063 (1.8)

Note: T-statistics are in parentheses.

In the benefit equation, the log of

The coefficients of lambda in the regressions for food stamps and SSI are significantly different from zero at the five percent level, suggesting that attrition has an effect on the benefit estimates of food stamps and

SSI. However, no attrition effect has been detected for AFDC, General Assistance (GA), and WIC benefit estimates. The aggregates of these means-tested benefits are also not affected by attrition.

It should be noted here that the standard errors of the coefficient estimates in the regressions are computed with 100 sets of replicate weights and monthly nonreplicate weights. Specifically, the formula used to calculate the variance of a coefficient estimate, B , is

$$VAR(B) = (4/100) \sum_{i=1}^{100} (B_{rep_i} - B_{pnl})^2$$

where VAR is the variance of B , B_{rep} represents coefficient estimates generated by the replicate weights, and B_{pnl} represents the coefficient estimate generated by the nonreplicate weight.

IV. Summaries and Conclusions

Empirical results in this study indicate that data on food stamp and SSI benefits are affected by attrition in the 1990 SIPP panel. However, there is little or no evidence that the benefit data of AFDC, General Assistance, and WIC are affected by attrition. Weighting adjustments are applied to SIPP longitudinal data to help compensate for nonresponse bias, but the extent of improvement is unknown. Additionally, this study shows that the magnitudes of cumulative nonresponse rates and differences in the characteristics of attritors and nonattritors are not appropriate indicators of attrition biases. Nonetheless, these findings are preliminary and further refinements can certainly be made in

many directions.

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References

- Heckman, J., 1976. "The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for such Models," *Annals of Economic and Social Measurement*, 5, pp. 475-492.
- Ridder, G. 1990, "Attrition in Multi-Wave Panel Data," in *Panel Data and Labor Market Studies*, eds, J. Hartog, G. Ridder and J. Theeuwes. North-Holland: Amsterdam, pp. 45-68.
- Tin, J., 1995. "A Model of Attrition and Income for Dynamic Longitudinal Surveys," *Applied Economics*, 27, pp. 705-717.
- Zabel, J., 1993. "An Analysis of Attrition in the PSID and SIPP With an Application to a Model of Labor Market Behavior," SIPP Working Paper Series No.9403, Washington, D.C.: U.S. Bureau of the Census.