

DIFFERENCES IN THE MEASUREMENT OF WEALTH, WEALTH
INEQUALITY AND WEALTH COMPOSITION OBTAINED FROM
ALTERNATIVE U.S. WEALTH SURVEYS

BY F. THOMAS JUSTER

Survey Research Center, University of Michigan

AND

KATHLEEN A. KUESTER

Board of Governors of the Federal Reserve System

Since household wealth surveys have been widely used to study saving and other issues, it is important to examine the reliability of the various survey estimates of wealth. In this paper the authors assess the quality characteristics of the National Longitudinal Survey of Mature Men and the Retirement History Survey, as compared to the 1983 Survey of Consumer Finances. We find that the NLS and especially the RHS underreport wealth and wealth concentration. The underestimates of wealth held in the form of common stock, business equity, and investment real estate equity are substantial. The principal problem lies in underrepresentation of both tails of the wealth and income distributions, with the consequences of underrepresenting the upper tail being especially serious for wealth measurement. We examine several potential reasons for the underrepresentation.

1. INTRODUCTION

In recent years, an extensive literature on life-cycle saving behavior in the U.S. has developed. The empirical base for this literature consists almost entirely of survey measures of household wealth.¹ The two most widely used surveys are the National Longitudinal Survey of Mature Men (NLS) and the Retirement History Survey (RHS). The NLS, which began in 1966 with eleven reinterviews between 1967 and 1983, was comprised of males between the ages of 45 and 59 in 1966. A reinterview of surviving NLS respondents is currently underway. The RHS, which began in 1969 with reinterviews every two years until 1979, initially sampled households with heads between the ages of 58 and 63. More recent data sets containing information on wealth include the Survey of Income and Program Participation (SIPP); the Panel Study of Income Dynamics (PSID), where a wealth module was included in the 1984 and 1989 surveys; and the Survey of Consumer Finances (SCF), where a complete wealth survey was conducted in

Note: The opinions expressed do not necessarily reflect those of the University of Michigan or the Board of Governors or their respective staffs. The authors would like to thank Arthur Kennickell for invaluable guidance throughout the course of this research, Richard Burkhauser and Robert McIntyre for providing some of the data used in the research, and Daniel Kelley for invaluable research assistance. All errors and omissions are the responsibility of the authors.

¹See, for example, Ando and Kennickell (1987), Avery, Elliehausen, and Gustafson (1986), Avery and Kennickell (1989), Darby (1975), Diamond and Hausman (1984), King and Dicks-Mireaux (1981), Mirer (1979), and Munnell (1976).

1983, a relatively brief reinterview in 1986, and a full-scale survey in 1989 that combines a new cross-section and a reinterview of the 1983 sample.

Since the net worth data sets have been widely used to study both saving and other issues, it is important to examine the reliability of their estimates of wealth. In this paper we compare the quality characteristics of the two most frequently used longitudinal surveys with wealth data, the National Longitudinal Survey of Mature Men and the Retirement History Survey, to the 1983 Survey of Consumer Finances. We build on previous work by Avery, Elliehausen, and Kennickell (1988) who compare the 1983 SCF to the Federal Reserve Board's aggregate Flow of Funds data; Curtin, Juster, and Morgan (1989), who make an extensive set of quality comparisons between the 1983 SCF, the 1984 SIPP, and the 1984 PSID; and Duncan and Hill (1989) who assess the quality of the PSID.

We use the 1983 Survey of Consumer Finances as a basis for comparison for several reasons. It compares well to external control totals in terms of both aggregate wealth and wealth composition. Due to its dual-frame sample design, it includes the full range of the income and wealth distributions. It has relatively low item nonresponse rates. And, as shown by Curtin, Juster, and Morgan (1989), it appears to have less measurement error and bias than the SIPP or the PSID.

To summarize our conclusions briefly, we find that the NLS and especially the RHS underreport wealth. The underestimates of common stock, businesses, and investment real estate are largest. The principal problem is underrepresentation of both tails of the income distribution, with the consequences of underrepresenting the upper tail being especially serious for wealth measurement.

In the next section, we briefly discuss the problems with using survey data to study saving behavior. In Section III, we describe the designs of the NLS, the RHS, and the SCF. In Sections IV and V, we compare the population characteristics and the wealth and asset holdings implied by the three surveys. In Section VI, we examine possible explanations for the differences in wealth implied by the surveys, and in Section VII, we discuss the implications of our findings for research on saving and wealth.

II. THE USE OF SURVEY DATA TO STUDY SAVING BEHAVIOR

There are three ways to measure saving from survey data—as the difference in wealth for the same respondents at two points in time, as differences in wealth among respondents in a single cross-section, or as direct reports by respondents of either saving itself or of both income and consumption. Since cross-section studies rely on differences in wealth across cohorts to draw inferences about saving, they are subject to numerous potential biases that disappear when longitudinal wealth measurements are available.² Direct reports of saving, as well as estimates of the difference between consumption and income, have been collected in several studies, including the 1950, 1961, and 1972 Consumer Expenditure Surveys and the current continuous Consumer Expenditure Survey. But the error in these measures is generally thought to be very large and difficult to reduce.³

²See Kennickell (1984) and Jianakoplos, Menchik, and Irvine (1987).

³See Kennickell (1984) and Juster (1981).

We believe that the first method, estimating saving as a difference in net worth between two time periods, is the most reliable way to estimate individual saving. Since reported wealth is a function of true wealth and measurement error, if the measurement errors at two points in time are positively correlated, then measuring saving as the difference in wealth will tend to reduce the measurement error in the estimate of saving. Moreover, lengthening the time between net worth measurements may enable the analyst to detect systematic differences in individual households' saving rather than picking up mainly the measurement errors in the year to year fluctuations in net worth. However, the analytic advantages of using longitudinal differences in net worth depend importantly on the quality of these data.

One aspect of the quality of survey wealth data is survey nonresponse. Household wealth surveys are generally characterized by a nonresponse problem that may cause serious bias. Since area probability surveys generally show relatively low response rates among very wealthy households and since response rates by income class generally cannot be observed in such surveys, most wealth data are likely to contain substantial bias that cannot easily be corrected. Thus, there is a strong presumption that any wealth survey that does not adequately represent the upper tail of the wealth distribution will seriously underrepresent total wealth, the concentration of wealth, and probably personal saving. The effects on more complex statistics, such as regression estimation, are poorly understood.

While we focus on wealth and saving, it is also the case that net worth data permits analysis of a number of other issues, for example, income security among older households, and the relation between net worth, retirement and health. Underrepresentation of the upper end of the income and wealth distribution does not by itself seriously limit the study of many of these issues. However, any data set would have severe limitations for any purposes if the underrepresentation of the upper tail of the distribution occurred for reasons that might affect the validity or representativeness of the data for a broad spectrum of respondents. Such reasons might include high survey nonresponse, systematic item non-response, or nonrandom attrition that cannot be corrected by modifying the weights.

III. DESIGN OF THE THREE SURVEYS

The NLS, the RHS, and the SCF differ substantially in their basic designs and the problems they address. The biggest single difference lies in their population coverage. The SCF was designed to represent the entire population of U.S. households, with special attention paid to the upper end of the wealth distribution. The RHS was designed to represent a narrow cohort at the upper end of the age distribution, and to measure changes in their economic status as they moved through retirement. The NLS was designed to examine the labor force activity of older males as they moved from participation through retirement.

Due to its focus on wealth related issues, in 1983 SCF uses a dual-frame sample design that includes both an area probability sample and, to better represent the upper tail of the income distribution, a small proportion of high

income households drawn from the Statistics of Income (SOI) file who volunteered to participate in the survey. The NLS and RHS, by contrast, are conventional multistage area probability samples. The 1983 SCF has about 4,000 households, the 1966 NLS about 5,000, and the 1969 RHS about 15,000. Since both the NLS and RHS are limited to subsets of the population, the SCF sample sizes available for comparison are restricted to about 600 cases in the NLS cohort range and about 300 in the RHS age range.

Since the surveys had different objectives, the designs of the survey instruments were entirely different. The SCF was designed as a complete survey of household wealth. Thus it obtained complete balance sheet data on both assets and debts, as well as extensive data on work and work history, pension entitlements, and income. By contrast, the NLS and RHS were not primarily wealth surveys. Thus, they had extensive data on work and work history, substantial sections dealing with health and retirement, and relatively modest wealth and income modules.

In addition, the three data sets contain very different adjustments for both survey nonresponse and item nonresponse. For the NLS, data are available on whether members of the original sample have died or been institutionalized. As a result, the weights adjust for mortality and it is possible to compute attrition rates. For the RHS, neither mortality data nor any indication of noninterview reason is included on the data tape that we have. As a result, the 1979 weights do not adjust for death or institutionalization.⁴

Perhaps more importantly, neither the NLS nor the RHS have systematically imputed missing values so that substantial item nonresponse exists on the basic data tapes. This is particularly problematic for wealth surveys, since it is not uncommon for households to report ownership of at least one item on a balance sheet for which the amount is not reported. The analyst can choose either to adopt some relatively simple strategy for imputing missing values, or to drop cases with any missing data. Dropping cases with missing values or, as we show below, imputing using simple methods can create bias. The SCF public data tape, on the other hand, contains a fully cleaned and imputed data set.

To reduce the potential for bias associated with item nonresponse, we have devoted considerable effort to imputing net worth components, income, and key demographic variables for the 1966 and 1981 NLSs and the 1969 and 1979 RHSs. We used imputation techniques that, as far as we could judge, had the effect of ensuring that the direction of bias, if any, was known and did not contribute to discrepancies between the NLS or the RHS and the SCF for the most important of our analyses. Based on the results of the analysis below, our imputations probably overestimate the value of the assets for the NLS and the RHS, reducing the deviations from the SCF. The imputations also appear to underestimate total family income, overstating the differences between the surveys, especially for the NLS for which income had to be imputed for over a third of the respondents.

⁴The 1979 weights provided on the RHS tape that we have are identical to the 1969 weights. Mortality data are available from other sources. The mortality data we use in the attrition portion of the analysis was taken from Social Security Administration records. It was made available to us by Richard Burkhauser. It is only for the original 1969 respondents, not for the surviving spouse who was reinterviewed if the original respondent died.

In addition, the imputations appear to reduce the variance of the distributions of income and of net worth. The subsequent comparisons should be interpreted with these caveats in mind.

IV. COMPARISON OF THE POPULATION CHARACTERISTICS IMPLIED BY THE NLS, THE RHS, AND THE SCF

In Tables 1 and 2, we compare the population characteristics implied by the 1981 NLS and the 1979 RHS to those implied by the 1981 and 1979 CPSs and the 1983 SCF. The CPS is used as the standard of comparison for demographic characteristics, since it is generally regarded as the benchmark household survey in the U.S. The SCF is the standard of comparison for financial characteristics for the reasons discussed above. For all the comparisons in this paper that use the 1983 SCF, the net worth figures are deflated to 1981 or 1979, respectively using asset specific growth rates from the Federal Reserve Board's Flow of Funds aggregate balance sheets for the household sector. The income figures are deflated using the growth in median family income from the Current Population Reports. The SCF and the CPS are limited to subsamples comparable to either the NLS or the RHS sample.

TABLE 1
COMPARISON OF IMPLIED NLS POPULATION CHARACTERISTICS

Population Characteristic	Percent of Population			
	1981 NLS	1981 CPS Subsample	1983 SCF Subsample, Deflated to 1981	
			APS	Full Sample
Age				
60 to 64	40.6	40.8	41.0	41.1
65 to 69	35.0	34.2	35.7	35.8
70 to 74	24.4	25.0	23.3	23.1
Race				
White	92.0	90.4	89.4	89.4
Black	7.5	8.1	8.0	8.0
Other	0.5	1.5	2.6	2.6
SMSA Residence				
Central city of SMSA	26.3	27.0	29.2	
Balance of SMSA	38.8	39.5	41.4	
Non-SMSA	34.9	33.6	29.3	
Home ownership	83.5	84.2	84.7	84.9
Farm ownership	11.7	3.9	5.0	4.6
Employment status				
Employed	36.1	36.9	42.5	42.7
Retired or unable to work	56.7	52.1	55.7	55.5
Other	7.0	20.9	1.8	1.8
Occupation, if employed				
Professional, technical	12.4	13.9	12.9	13.8
Managers, administrators	18.1	17.7	21.6	22.1
Clerical, kindred	4.9	7.0	7.4	7.3

TABLE 1—continued

Population Characteristic	Percent of Population			
	1981 NLS	1981 CPS Subsample	1983 SCF Subsample, Deflated to 1981	
			APS	Full Sample
Sales	9.2	8.1	10.7	10.3
Craftsmen, kindred	20.3	17.7	14.1	13.9
Operatives, kindred	11.1	11.9	13.8	13.6
Private household workers	0.1	0.2	0.0	0.0
Other service workers	7.4	10.6	8.9	8.8
Farmers, farm managers	9.2	6.7	5.7	5.4
Farm laborers, foremen	2.0	1.6	0.9	0.9
Other laborers	5.3	4.6	4.0	3.9
Marital status				
Married	83.8	84.6	88.2	88.2
Widowed	7.2	6.3	6.3	6.3
Divorced	3.8	4.0	2.9	2.9
Separated	1.2	1.3	0.6	0.6
Never married	4.1	3.7	2.1	2.1
Education				
7 Years or less	16.2	16.9	12.6	12.5
8 or 9	23.1	20.8	21.5	21.2
10 or 11	13.8	10.9	10.6	10.6
12	26.4	28.2	26.6	26.7
13 to 15	9.4	10.2	12.4	12.3
16 or more	11.1	13.0	16.4	16.8
Receipt of income from				
Social Security	54.5	69.2	68.2	67.8
Pension	51.1	38.6	50.6	50.8
Public Assistance	7.6	5.3	4.7	4.7
Farm	7.1	3.4		
Non-farm business	15.0	9.4		
Farm or business	20.6	12.3	14.3	14.6
Income				
Less than \$8,000	18.1	21.4	16.8	16.6
\$8,000 to \$14,999	24.2	27.6	28.6	28.4
\$15,000 to \$24,999	30.2	24.7	22.2	21.6
\$25,000 to \$39,999	18.5	16.9	15.7	16.2
\$40,000 to \$49,999	4.1	4.0	5.6	5.6
\$50,000 to \$74,999	3.8	4.3	6.0	5.9
\$75,000 or more	1.2	1.0	5.2	5.5
Mean income	\$20,266	\$19,523	\$28,686	\$29,657
Median income	\$16,260	\$15,200	\$16,937	\$17,179
Net worth				
Less than \$10,000	20.9%		22.4%	26.5%
\$10,000 to \$39,999	23.6		25.5	25.1
\$40,000 to \$99,999	34.3		26.7	22.4
\$100,000 to \$249,999	16.2		15.5	14.9
\$250,000 to \$499,999	3.4		5.6	5.3
\$500,000 to \$999,999	1.6		3.0	3.8
\$1,000,000 or More	0.0		1.4	1.4
Mean net worth	\$125,747		\$165,834	\$222,486
Median net worth	\$80,283		\$67,075	\$67,394

TABLE 2
COMPARISON OF IMPLIED RHS POPULATION CHARACTERISTICS

Population Characteristic	Percent of Population			
	1979 RHS	1979 CPS Subsample	1983 SCF Subsample, Deflated to 1979	
			APS	Full Sample
Age				
68 to 69	37.0	36.6	33.3	34.5
70 to 71	32.9	34.2	34.3	34.0
72 to 73	30.1	29.3	32.2	31.4
Race				
White	89.6	89.8	88.1	88.1
Black	9.8	9.2	9.8	9.9
Other	0.6	0.9	2.1	2.1
Male head	63.8	58.2	61.1	61.7
Home ownership	73.5	75.2	78.2	79.0
Farm ownership	5.9	3.0	5.3	5.1
Employment status				
Employed	20.5	18.0	20.6	20.5
Retired, keeping house or unable to work	78.3	72.2	74.4	74.6
Other	1.2	9.8	5.0	5.0
Occupation, if employed				
Professional, technical	11.9	12.6	3.3	5.2
Managers, administrators	11.5	12.9	23.7	22.3
Clerical, kindred	9.6	11.5	11.9	11.8
Sales	9.3	9.7	12.0	11.9
Craftsmen, kindred	10.1	6.0	7.9	7.8
Operatives, kindred	7.3	9.1	4.2	4.2
Private household workers	4.5	4.5	3.4	3.4
Other service workers	16.1	17.8	18.3	18.2
Farmers, farm managers	10.6	8.5	7.9	7.8
Farm laborers, foremen	3.2	2.6	2.0	2.0
Other laborers	5.9	4.8	5.4	5.4
Marital status				
Married	53.8	47.5	51.4	51.9
Widowed	31.8	39.4	39.5	39.0
Divorced	5.7	5.2	3.0	3.0
Separated	1.7	2.0	1.8	1.8
Never married	7.0	5.9	4.3	4.3
Education in 1969				
7 years or less	22.9	21.0	15.6	15.4
8 or 9	26.5	25.5	23.9	23.6
10 or 11	12.1	11.8	13.2	13.1
12	21.8	23.8	23.9	23.7
13 to 15	8.1	8.1	8.5	8.9
16 or more	8.6	9.8	14.9	15.2
Receipt of income from				
Social Security	92.2	92.0	76.1	75.6
Pension	40.3	36.3	63.8	63.9
Public Assistance	9.7	8.7	8.5	8.4
Farm or business	9.5	8.9	10.0	9.6

TABLE 2—continued

Population Characteristic	Percent of Population			
	1979 RHS	1979 CPS Subsample	1983 SCF Subsample, Deflated to 1979	
			APS	Full Sample
Income				
Less than \$5,000	32.5	30.5	23.2	22.9
\$5,000 to \$7,499	18.4	19.2	17.9	17.7
\$7,500 to \$12,499	27.0	24.6	30.2	29.9
\$12,500 to \$19,999	13.7	14.2	12.3	12.2
\$20,000 to \$29,999	4.7	6.6	6.5	6.5
\$30,000 to \$49,999	2.7	3.7	6.1	6.4
\$50,000 or more	1.0	1.2	3.7	4.4
Mean income	\$9,794	\$10,474	\$16,059	\$16,669
Median income	\$7,376	\$7,510	\$8,719	\$8,878
Net worth				
Less than \$10,000	23.0%		22.4%	22.1%
\$10,000 to \$39,999	27.3		25.5	25.2
\$40,000 to \$99,999	33.5		26.7	26.3
\$100,000 to \$249,999	12.0		15.5	15.7
\$250,000 to \$499,999	3.0		5.6	5.9
\$500,000 to \$999,999	1.0		3.0	3.4
\$1,000,000 or more	0.3		1.4	1.4
Mean net worth	\$65,823		\$112,421	\$137,606
Median net worth	\$39,282		\$42,348	\$41,697

Examining first the NLS, we find that, in general, the demographic characteristics implied by the 1981 NLS and the 1981 CPS are quite similar. The only striking difference is the much higher rate of farm ownership, farm occupation, and receipt of farm income implied by the NLS. The NLS also implies that a larger percent of the population receives income from a pension and a smaller percent receives income from Social Security. If this finding reflects real differences and not respondent misclassification of income types, it suggests that the NLS represents a somewhat more geographically stable population, since pension receipt is associated with longer tenure with an employer. In addition, the NLS implies a less educated population than either the CPS or especially the SCF. Since education is highly correlated with economic status, this is consistent with large differences in wealth and income between surveys.

In comparing the financial characteristics of the NLS to the SCF, we find that the NLS implies a generally lower income than the SCF. On net worth, the NLS implies a smaller percentage of the population in both the upper and lower tails of the net worth distribution relative to the SCF. A comparison of the relative values of the mean and median income and net worth suggests that the NLS underrepresents the upper tail of the distributions more than the lower tail.

The results of comparing the 1979 RHS, the 1979 CPS, and the SCF are similar. The demographic characteristics implied by the RHS and the CPS are generally similar. The RHS implies higher rates of farm ownership and farm occupation, but the differences are less than for the NLS. Like the NLS, the RHS

implies that a higher proportion of the population receives pension income than does the CPS. Unlike the NLS, the RHS implies that a higher proportion of the population is married and a lower proportion is widowed than the CPS. These findings also suggest that the RHS may represent a somewhat more stable population. Like the NLS, the RHS implies a less educated population than either the CPS or especially the SCF. In comparison to the SCF, the RHS implies a much lower level of income and of net worth, with the underrepresentation being especially pronounced in the upper tails of the distributions.

Very few of the differences between the CPS and the 1981 NLS or the 1979 RHS appear in the initial NLS or RHS. In Tables 3 and 4, we compare the initial population characteristics of the 1966 NLS and the 1969 RHS to the characteristics implied by the 1966 and 1969 CPSs. Generally, the match is very close, with the major difference being the higher percent of farm ownership and receipt of farm income for the NLS. In addition, the NLS implies a lower receipt of social security, while the RHS implies a higher receipt of pensions than the CPS. These findings are consistent with the 1979 and 1981 comparisons. However, unlike the later comparisons, the educational levels implied by the NLS and RHS are initially similar to the CPS, and the RHS initially implies that a *lower* proportion of the population is married than the CPS. On financial items, since the 1966 CPS has a much less extensive sequence of income questions than the NLS, we compare wages and salaries and find that the CPS and NLS distributions match closely. The RHS total income distribution seems to have somewhat more weight in the lower tail than the CPS.

In summary, the NLS appears initially to have been generally representative with respect to demographic and financial characteristics, except for over-representing farmers, and subject to problems common to area probability samples. The RHS appears initially to have been representative with respect to demographic characteristics, but to represent a slightly different income distribution than the CPS. There is evidence that the attrition process resulted in a somewhat more stable and less educated population than is implied by the CPS or the SCF. In addition, the 1981 NLS appears to undersample both tails of the wealth distribution, especially the upper tail, while the 1979 RHS has lower income and wealth overall than the SCF.

V. COMPARISON OF THE WEALTH HOLDINGS IMPLIED BY THE NLS, THE RHS, AND THE SCF

In Tables 5 and 6, we compare the ownership percentages and asset values implied by the 1981 NLS, the 1979 RHS, and the 1983 SCF (limited to a subsample comparable to the NLS or the RHS populations and deflated to 1981 or to 1979). We find that the SCF implies a population with substantially different financial characteristics than either the NLS or the RHS. The ownership percentages implied by the SCF are similar to or higher than those implied by the NLS or the RHS for widely held assets such as homes, checking and savings accounts, and cars. They are slightly to substantially higher for assets such as businesses, other real estate, and stocks, bonds, and mutual funds, whose ownership is largely concentrated among wealthy households. They are the same or lower for

TABLE 3
COMPARISON OF IMPLIED INITIAL NLS POPULATION CHARACTERISTICS

Population Characteristic	Percent of Population	
	1966 NLS	1966 CPS Subsample
Age		
45 to 49	36.6	36.8
50 to 54	34.0	33.9
55 to 59	29.4	29.2
Race		
White	90.6	90.7
Black	8.7	8.7
Other	0.7	0.6
Farm ownership	13.7	7.3
Marital status		
Married	89.3	87.0
Widowed	1.9	2.1
Divorced	2.6	2.9
Separated	1.7	2.1
Never married	4.6	6.0
Education		
7 years or less	16.8	15.1
8 or 9	25.6	24.0
10 or 11	13.7	13.4
12	25.3	27.7
13 to 15	8.7	9.4
16 or more	9.8	10.5
Receipt of income from		
Social Security	4.4	9.0
Public Assistance	2.3	3.2
Non-farm business	16.9	15.0
Farm	10.3	7.3
Income from wages and salary		
Less than \$5,000	34.1	34.8
\$5,000 to \$7,999	22.7	24.6
\$8,000 to \$11,999	24.8	24.3
\$12,000 to \$15,999	11.7	10.2
\$16,000 to \$19,999	4.2	3.5
\$20,000 to \$29,999	1.7	2.2
\$30,000 or more	0.9	0.5
Mean wage, salary income	\$7,535	\$7,273
Median wage, salary income	\$7,006	\$6,800

savings bonds which tend to be held by households with lower net worth. For consumer debt, the SCF finds twice the incidence as the NLS but lower incidence than the RHS.

The mean asset values for asset owners are similar across surveys for broadly distributed assets such as homes, checking and savings accounts, and cars. For farms and concentrated assets (businesses, other real estate, and stocks, bonds, and mutual funds), the mean asset values implied by the SCF are nearly two to

TABLE 4
COMPARISON OF IMPLIED INITIAL RHS POPULATION CHARACTERISTICS

Population Characteristic	Percent of Population	
	1979 RHS	1979 CPS Subsample
Age		
58 to 59	35.0	35.1
60 to 61	32.9	33.1
62 to 63	32.1	31.8
Race		
White	90.0	90.5
Black	9.4	8.7
Other	0.5	0.8
Male-headed family	71.2	74.5
Marital status		
Married	61.5	66.6
Widowed	21.5	20.3
Divorced	5.8	5.4
Separated	2.9	1.8
Never married	8.1	5.9
Education		
7 years or less	22.2	21.9
8 or 9	27.0	25.8
10 or 11	12.4	11.9
12	22.3	23.3
13 to 15	7.9	8.3
16 or more	8.3	8.8
Receipt of income from		
Social Security	19.7	19.3
Pension	10.3	7.0
Public Assistance	2.6	4.4
Income		
Less than \$4,000	30.6	26.5
\$5,000 to \$7,999	28.0	29.0
\$8,000 to \$11,999	20.2	21.2
\$12,000 to \$15,999	9.3	11.5
\$16,000 to \$19,999	4.4	5.8
\$20,000 to \$34,999	5.3	4.9
\$35,000 or more	2.1	1.1
Mean income	\$8,825	\$8,614
Median income	\$6,700	\$7,191

three times those implied by the NLS or the RHS. For U.S. savings bonds, the mean value implied by the SCF is lower than that implied by the NLS or the RHS⁵. For consumer debt, the SCF area probability sample implies a lower mean value than the NLS or the RHS, while the full SCF sample implies a higher value. In general, these comparisons hold for both the full SCF sample and the

⁵It is possible that for the NLS and the RHS, other types of bonds were included with savings bonds.

TABLE 5
COMPARISON OF NLS ASSET OWNERSHIP RATES AND MEAN AND MEDIAN ASSET VALUES FOR OWNERS

	1983 SCF Subsample, Deflated to 1981								
	1981 NLS			Area Probability Sample			Full Sample		
	Ownership Percent	Mean Value	Median Value	Ownership Percent	Mean Value	Median Value	Ownership Percent	Mean Value	Median Value
Home equity	83.5	\$63,459	\$50,000	84.7	\$60,119	\$46,458	84.9	\$68,042	\$46,458
Farm equity	11.7	97,525	85,000	4.6	265,602	215,408	4.3	244,346	161,556
Business equity	9.5	98,934	70,000	12.2	202,507	47,465	13.3	315,027	52,773
Real estate equity	25.3	55,521	32,000	27.9	89,149	35,255	28.4	124,960	37,111
Stocks, bonds, etc.	27.6	38,433	23,000	29.7	76,002	9,328	31.1	138,728	13,215
Savings bonds	19.7	5,369	3,331	19.7	2,751	954	19.6	3,148	954
Loan assets	11.9	30,221	15,000	9.2	37,576	19,417	9.1	48,256	20,711
Savings accounts	83.6	23,564	18,000	90.9	25,553	8,217	91.0	29,387	8,258
Car equity	91.2	4,002	3,882	93.9	4,295	3,189	94.0	4,476	3,212
Consumer debt	15.7	4,772	900	33.3	1,801	680	33.8	6,279	680
Net worth		125,747	80,283		165,834	67,075		222,486	67,394
1980 income		20,266	16,260		28,686	16,937		29,657	17,179
Sample size		2,832			480			640	
Population (millions)		11.2			11.2			11.3	

TABLE 6
COMPARISON OF RHS ASSET OWNERSHIP RATES AND MEAN ASSET VALUES FOR OWNERS

	1983 SCF Subsample, Deflated to 1979								
	1979 RHS			Area Probability Sample			Full Sample		
	Ownership Percent	Mean Value	Median Value	Ownership Percent	Mean Value	Median Value	Ownership Percent	Mean Value	Median Value
Home equity	73.2	\$42,374	\$35,000	78.2	\$44,403	\$31,866	79.0	\$47,431	\$31,866
Farm equity	5.8	76,610	20,000	5.3	200,684	149,367	5.1	168,404	149,367
Business equity	4.4	72,010	48,116	9.0	127,686	27,238	9.6	160,261	37,674
Real estate equity	13.9	39,042	20,000	21.2	62,807	31,804	21.6	122,040	31,804
Stocks, bonds, etc.	18.0	34,137	10,000	27.6	82,035	7,401	28.4	99,965	8,326
Savings bonds	14.7	5,317	1,800	10.6	1,693	670	11.0	3,566	715
Loan assets	9.5	22,078	7,000	9.0	35,790	22,123	9.2	37,368	22,123
Checking accounts	73.2	1,405	600	81.7	2,190	731	81.8	2,128	731
Savings accounts	70.6	17,149	9,790	71.4	20,502	7,519	71.7	23,792	8,161
Consumer debt	26.0	1,471	400	21.7	1,262	360	22.0	4,450	360
Net worth		65,823	39,282		112,421	41,697		137,606	42,348
1978 income		9,794	7,376		14,803	8,719		15,365	8,878
Sample size		6,700			250			306	
Population (millions)		4.1			5.8			5.8	

area probability sample (appropriately weighted), although the differences, as expected, are more striking for the full sample.

These patterns of asset ownership and mean values produce mean net worth figures for the SCF that are considerably higher than those of the NLS or the RHS. The SCF area probability sample implies that mean net worth is 32 percent higher than implied by the NLS and 71 percent higher than the RHS. The full SCF sample implies that mean net worth is 77 percent higher than the mean net worth implied by the NLS and over twice that implied by the RHS. These differences are similar to the differences between the SIPP and the SCF reported in Curtin, Juster, and Morgan (1989). They presumably have nontrivial consequences for the analysis of saving.

As expected, the median values for asset owners are lower than the mean values, especially for the SCF. In fact, for businesses, stocks, bonds, and mutual funds, housing, and savings accounts, the SCF median values are below the NLS and the RHS medians. This leads to median SCF net worth figures that are less than the NLS median net worth and only slightly more than the RHS median net worth. On income, the SCF median is somewhat higher than the NLS or the RHS medians. Imputation procedures could account for some of these relatively small differences.

The results in Tables 5 and 6 are consistent with the SCF sample having a longer upper tail of the wealth distribution than the NLS and the RHS and a fatter lower quartile than the NLS. A longer upper tail would account for the higher means which are strongly influenced by the density and length of the upper tail of the skewed net worth distribution. A fatter lower end of the distribution, which implies a larger portion of the population with very limited net worth, combined with the imputation differences, could account for the lower medians.

The net worth percentiles in Table 7 support this hypothesis, especially for the NLS. Compared to the NLS, the SCF has more weight in both tails with the upper tail being much longer and thus containing more wealth, and with the lower part of the distribution containing more households, since the SCF median is below the NLS median. Compared to the RHS, the SCF percentiles are all higher, especially in the upper tail.

A direct implication of the results in Tables 5 through 7 is that the degree of inequality in wealth implied by the SCF is much greater than that implied by the RHS or especially the NLS. The Gini coefficient for the NLS is 0.55. For the SCF subsamples comparable to the NLS, it is 0.67 and 0.75 for the area probability and the full samples respectively. The Gini coefficient for the RHS is 0.61, and for the comparable SCF area probability and full subsamples, it is 0.69 and 0.74 respectively. Comparing the implied percent of wealth held by the wealthiest several percentiles of the population confirms these results.

The differences between the surveys described above can occur either because of (1) representation of different income distributions possibly due to sample design, weighting, or attrition, or (2) differential reporting of net worth variables given the same income distribution, possibly due to differences in questionnaire design or interviewer training. To distinguish between these sources of difference, we want to make the NLS and the RHS approximate the SCF income distribution

TABLE 7
COMPARISON OF NET WORTH PERCENTILES

Percentile	1981 NLS	1983 SCF Subsample, Deflated to 1981	
		Area Probability Sample	Full Sample
99th	\$1,009,814	\$1,555,961	\$2,339,358
95th	393,712	657,123	844,797
90th	259,650	388,960	427,479
75th	148,000	170,505	172,357
50th	80,283	67,075	67,394
25th	37,015	26,742	27,187
10th	7,850	6,432	6,432

Percentile	1979 RHS	1983 SCF Subsample, Deflated to 1979	
		Area Probability Sample	Full Sample
99th	\$554,000	\$1,476,065	\$1,056,050
95th	222,200	485,811	494,394
90th	140,000	242,300	257,783
75th	73,600	101,545	111,160
50th	39,282	41,697	42,348
25th	11,255	12,046	12,046
10th	175	668	668

and then compare the reported assets and net worth. Finding similar net worth would be evidence in favor of the first alternative. However, neither the NLS or the RHS have any representation in the upper tail of the income distribution of either the SCF area probability sample or full sample. If the NLS and the RHS were drawn from the same population as the SCF, it would be highly unlikely, given the smaller sample size of the SCF, that the SCF full sample would have 142 respondents and the area probability sample seven respondents with wealth greater than the wealthiest NLS respondent. A similar argument can be made with regard to the RHS. Therefore, to compare similar populations, we limit the SCF sample to the income range of the NLS or the RHS sample respectively. Then we modify the NLS and the RHS weights to approximate the income distribution of the remaining subsample of the SCF full sample. We reimpute the missing financial values and recalculate the ownership rates and mean values. The results are given in Tables 8 and 9.

Comparing Tables 8 and 9 to Tables 5 and 6, we see that for all the assets and liabilities, the reweighting causes the ownership rates to increase slightly for the NLS and somewhat more for the RHS. The mean net worth values also increased by 10 percent for the NLS and by 40 percent for the RHS. For the most part, the reweighted NLS and RHS look much more like the SCF subsamples. However, for the concentrated assets, the ownership rates and mean values are still lower for the NLS and the RHS than for the SCF. The most dramatic change is the reduction in the SCF mean values, which drop up to 50 percent when the SCF sample is limited to the income range of the NLS or the RHS. Of the original difference between the mean net worth figures for the NLS and the SCF area

TABLE 8
COMPARISON OF NLS ASSET OWNERSHIP RATES AND MEAN ASSET VALUES FOR OWNERS
WEIGHTED TO APPROXIMATE THE SCF INCOME DISTRIBUTION

	1983 SCF Subsample, Deflated to 1981					
	1981 NLS		Area Probability Sample		Full Sample	
	Ownership Percent	Mean Value	Ownership Percent	Mean Value	Ownership Percent	Mean Value
Net home equity	83.7	\$65,053	84.4	\$57,703	84.5	\$59,544
Net farm equity	11.6	100,738	4.5	257,689	4.3	218,304
New business equity	10.8	112,576	11.4	119,954	11.8	131,342
Net other real estate equity	26.3	60,538	27.4	84,399	27.3	94,471
Stocks, bonds, mutual funds	28.9	49,171	29.0	76,002	29.4	64,028
U.S. savings bonds	20.0	5,793	19.8	2,787	19.8	2,925
Personal loan assets	12.6	33,649	9.0	37,278	8.9	39,365
Savings accounts	84.5	25,534	90.7	22,549	90.7	23,957
Net equity in cars	91.4	4,155	94.1	4,153	94.1	4,172
Other consumer debt	15.7	5,425	33.6	1,639	33.9	2,845
Net worth		138,510		140,844		148,597
1980 income		23,265		23,146		23,074
Sample size		2,832		473		498
Population (millions)		11.2		11.0		11.0

TABLE 9
COMPARISON OF ASSET OWNERSHIP RATES AND MEAN ASSET VALUES FOR OWNERS
WEIGHTED TO APPROXIMATE THE SCF INCOME DISTRIBUTION

	1983 SCF Subsample, Deflated to 1979					
	1979 RHS		Area Probability Sample		Full Sample	
	Ownership Percent	Mean Value	Ownership Percent	Mean Value	Ownership Percent	Mean Value
Net home equity	76.3	\$47,836	78.0	\$42,764	78.8	\$45,323
Net farm equity	6.9	112,664	4.9	184,216	5.1	166,423
Net business equity	6.2	107,556	8.7	69,358	9.1	103,411
Net other real estate equity	17.0	50,865	20.8	58,100	21.4	81,637
Stocks, bonds, mutual funds	23.1	49,650	26.8	60,474	27.6	69,671
U.S. savings bonds	17.2	6,127	10.7	1,693	11.1	3,563
Personal loan assets	11.4	29,160	9.1	35,790	9.2	35,203
Checking accounts	77.7	1,835	81.5	1,746	81.7	1,896
Savings accounts	75.4	22,038	71.1	19,851	71.5	21,205
Other consumer debt	25.6	1,945	21.9	1,262	22.1	4,050
Net worth		92,993		95,514		109,662
1978 income		13,186		12,860		13,748
Sample size		6,700		248		268
Population (millions)		4.1		5.7		5.8

probability sample, 62 percent of the difference is eliminated by limiting the SCF to the NLS income range, 32 percent by reweighting the NLS to approximate the remaining SCF income distribution, leaving only 6 percent that can be attributed to differential reporting of assets given similar income distributions. The comparable percentages for the RHS are 36 percent, 58 percent, and 5 percent respectively. Since only a small number of SCF area probability sample respondents are eliminated by limiting the SCF to the income ranges of the NLS or the RHS, it is not surprising that, for the SCF full sample comparison, much larger portions of the differences in mean net worth are attributable to limiting the SCF to the other surveys' income ranges.

These results imply that most of the differences between the surveys are due to differences in the income distributions of the population represented by the samples, especially the upper tail of the distributions.⁶ In the next section, we examine reasons that may explain why the NLS and the RHS fail to represent not only the SCF full sample but also the SCF area probability sample. Note, however, that even after the NLS and the RHS are reweighted to approximate the income distribution of the SCF, differences remain for assets whose ownership is highly concentrated. These differences are especially pronounced for the upper tail of the income distribution, and they may be due to differential reporting of these assets.

Given the differences between the surveys, it is important to assess their relative reliability. Several types of external evidence suggest that the SCF data are most likely to be valid for wealth measurement. First, as noted earlier, the SCF data compare quite well to aggregates for the household sector from the Federal Reserve Board's Flow of Funds statistics. Second, the SCF income distribution, even the upper tail, is close to the Survey of Income and Program Participation (SIPP), which is generally considered to be more representative than the CPS income distribution. Third, area probability surveys tend to suffer from undersampling of wealthy households and underreporting of assets, which suggests that underrepresentation by the NLS and the RHS is more likely than overrepresentation by the SCF.

VI. REASONS FOR DIFFERENCES IN WEALTH

The preceding results indicate that the differences between the surveys are mainly due to differences in the income distribution represented by the households interviewed. In this section we discuss two possible reasons for the differences—item nonresponse and nonrandom attrition. In addition, at the end of this section we briefly discuss how questionnaire design and survey procedures may have increased the differences between the surveys. One might also have expected the SCF supplemental high income sample to be important in creating differences

⁶Alternatively, the results could imply that the households interviewed for each survey represent the same actual income distribution, but that income is underreported to the same extent as net worth, and that the underreporting on the NLS and the RHS exceeds that on the SCF. However, since the income question sequence is much more similar between surveys than the asset and liability sequence, we think it is unlikely that there would have been the same degree of underreporting of both income and assets on the NLS and the RHS relative to the SCF.

between the surveys. However, while the supplemental sample does increase the divergence between the surveys in the upper tail of the distribution, the NLS and the RHS show lower income and wealth even relative to the SCF area probability sample.

Characterization of item and survey nonresponse. For a heuristic characterization of nonresponse, let us define the following terms. P_{NR} is defined as the probability that the household will not participate in one of the interviews in the panel because of either refusal or noncontact. P_{INRj} is the probability that the household will show item nonresponse for the j th asset or debt, conditional on survey participation. P_{MD} is the probability that the household will have missing data on one or more items on the balance sheet, conditional on survey participation. NW_j is a binary variable indicating possession of the j th net worth component. V_0 and V_1 are the sets of respondent characteristics reported during either a previous or current interview respectively that are related to nonresponse (age, occupation, wealth, etc.). X is the set of changes since a previous interview in respondent characteristics that are related to nonresponse (job turnover, marital status change, geographic changes, wealth changes, etc.). Y is a set of variables related to respondent cooperation that are associated with a particular interview attempt (respondent's state of mind, schedule flexibility, other people at home, etc.). EXP is the survey resources expended on the household (number of attempted contacts, etc.). Finally, ε_1 and ε_{2j} are random variables. Then, the probability of unit and item nonresponse can be characterized as:

- (1)
$$P_{NR} = f(V_0, X, Y, EXP, \varepsilon_1)$$
- (2)
$$P_{INRj} = g_j(V_1, Y, \varepsilon_{2j})$$
- (3)
$$P_{MD} = h(V_1, Y, NW_1, \dots, NW_J, NW_1 \cdot \varepsilon_{21}, \dots, NW_J \cdot \varepsilon_{2J}).$$

Equation (1) states that the probability of survey nonresponse is a function of the household's characteristics, some of which are observed during a previous interview and some of which are unknown prior to the current survey, the circumstances associated with the interview attempt, the survey resources expended on the household, and a random element. Equation (2) states that the probability of item non-response on a particular net worth component is a function of the same household characteristics and interview circumstances, and a random element. The probability of item nonresponse varies with the characteristics of the j th net worth component, for instance, with how difficult it is for the respondent to estimate the value of the component. Equation (3) states that the probability of having missing data on one or more net worth components is a function of the same household and interview characteristics, the set of net worth components on the household's balance sheet, and the random elements. P_{MD} is an increasing function of the NW_j . Therefore, the probability of having missing data on one or more net worth components increases with the number of items on the balance sheet. Thus, there is a tendency for wealthy respondents with many assets to have a higher probability of missing net worth data, although their probabilities of nonresponse on individual items need not be higher.

The potential for bias due to item or unit nonresponse will depend on the importance of the household characteristics, V and X , in predicting nonresponse

and also in explaining the item of analysis, in this case wealth. If elements of V that are important in explaining wealth are also important in predicting non-response, then nonresponse bias is a potential problem for wealth analysis. It may be possible to correct for this source of bias by using V to form weights to correct for nonrandom attrition or to impute missing values. For unit nonresponse, a more serious situation arises if there are elements of X that are important in explaining both wealth and nonresponse. Since the elements of X are not observed for nonrespondents, we cannot use them to correct for nonresponse. We cannot even investigate the extent to which they are related to nonresponse. Therefore, even if we find that the elements of V_0 are not important in explaining both wealth and survey nonresponse, there may still be survey nonresponse bias that cannot be corrected.

Item nonresponse. The incidence of item nonresponse on the NLS and the RHS is given in Table 10. The NLS and the RHS have similar nonresponse rates on asset or liability values, except for farms, consumer debt, and income. On both debt and income, the NLS and the RHS survey questionnaires differ significantly. On consumer debt, the NLS asks about a single category of any other debt, while the RHS asks separately about five categories of debt. In addition, the RHS asks both the total amount outstanding on each category of debt and also the montly payments and number of payments remaining to be

TABLE 10
PERCENT ITEM NON-RESPONSE ON ASSET AND LIABILITY OWNERSHIP AND ON
VALUE FOR OWNERS

	1981 NLS		1979 RHS ¹	
	Ownership	Value	Ownership	Value
Home equity	0.1%	11.3%	5.1%	13.5%
Farm equity	0.4	30.1	4.3	1.9
Business equity	0.3	34.8	0.3	37.2
Other real estate	0.3	13.6	0.3	12.8
Stocks, bonds	0.6	29.6	—	28.1
Savings bonds	0.6	32.6	—	23.6
Loan assets	0.8	18.2	—	14.5
Checking accounts	0.3	25.9	—	14.2
Savings accounts			—	19.5
Cars	0.3	21.0	—	—
Consumer debt	0.3	13.5	2.6	1.1
Net worth				
(excluding cars)		34.5		33.0
(including cars)		43.8		—
Income ²		37.4		28.2
				5.3

¹ For financial assets, it was assumed that a missing value meant that the respondent had the asset but that the value was missing.

² For the RHS, the first line counts respondents as having responded only if they answered all the questions about the components of total income. The second line counts respondents as having responded if they alternatively reported which bracket their income was in.

paid. If the amount outstanding is missing, the RHS calculates the value of the debt from the payment questions. On income, the RHS asks a categorical question about the respondents' income bracket, which most respondents answered. We used the response to this question in conjunction with the responses on components of income to calculate total income. The SCF nonresponse rates tend to be lower or about the same as the NLS and the RHS.⁷

As documented in Table 10, respondents representing at least a third of the population are missing values for at least one component of net worth for the NLS and the RHS. If the incidence of missing data is nonrandom, the common practice of eliminating observations with missing data will cause the remaining sample to produce a biased representation of the population. Also, imputing missing values may also produce bias if the items with respect to which nonresponse is nonrandom are not accounted for in the imputation.

Therefore, we investigate the extent to which item nonresponse is nonrandom with respect to the variables of interest to us, wealth and income. We estimate linear probability models of the probability of response on the value of each asset, consumer debt, total net worth, and total income. In Table 11, we report the coefficient on log income or log net worth for linear probability models that include log income or log net worth and the demographic characteristics used

TABLE 11
EFFECT OF INCOME OR NET WORTH ON PROBABILITY OF ITEM RESPONSE FROM
LINEAR PROBABILITY MODELS PREDICTING ITEM RESPONSE

Variable on which Item Response Occurs	1981 NLS		1979 RHS	
	Coefficient	T-Statistic	Coefficient	T-Statistic
	Effect of Log Income			
Home equity	0.038	4.199	0.050	6.673
Farm equity	-0.008	-0.220	-0.008	-1.109
Business equity	0.003	0.052	-0.083	-2.397
Other real estate	-0.006	-0.258	0.037	1.686
U.S. savings bonds	0.082	2.042	0.065	3.142
Stocks, bonds, etc.	0.064	2.136	0.069	3.708
Personal loan assets	0.001	0.037	0.046	2.313
Checking accounts	-0.019	-1.450	0.007	0.890
Savings accounts			0.014	1.515
Car equity	-0.020	-1.806	—	—
Consumer debt	-0.029	-1.715	0.003	0.707
All components of net worth	-0.042	-3.587	-0.006	-0.689
	Effect of Log Net Worth			
All components of income	-0.040	-5.665	-0.007	-3.810

⁷While item nonresponse did occur on the SCF, it is of a different character. Due to the structure and detail of the questionnaire, it was frequently the case that unreported values could be calculated or at least bounded by other items reported by the respondent. All items on the public data tape (with the exception of attitudinal questions) that were not reported and could not be calculated have been imputed using state-of-the art techniques that preserve the first and second moments of the conditional distribution of the data.

in the imputations for this paper. In addition we estimate two other sets of linear probability models. One set replaces log income or log net worth with linear splines of log income or log net worth. The other set uses as independent variables an extensive set of demographic characteristics and asset and liability ownership, but excludes income, net worth, and asset values to avoid assessing the effect of item nonresponse using variables that have been imputed for many respondents.⁸

All three sets of models give the same result. It is usually the case that high income or variables correlated with income *increase* the probability of response on a specific asset or liability. The coefficient on income and generally the coefficients on asset ownership and/or education are positive and significant for response on home value, savings bonds, stocks, bonds, and mutual funds for both surveys, and on other real estate and personal loan assets for the RHS. There appears to be a U-shaped relationship between income and the probability of response on farm value for the NLS, and on checking and savings accounts for both surveys. There is a negative relationship between income and the probability of response on business value for the RHS and on cars and consumer debt for the NLS. The relation between net worth and the probability of response on *all* components of total income is negative for both surveys. The relation between income and the probability of response on all components of total net worth is negative for the NLS, but is an inverted U-shape for the RHS. The regression results are confirmed by univariate comparisons. For most of the items, the adjusted R^2 statistics are relatively low, especially for the first two models, while the regression F -statistics are significant. These results indicate that there is some significant relation between item nonresponse and wealth and income, but that a large part of the item nonresponse is random with respect to these variables.

These results have the following consequences for different methods of handling item non-response. First, if higher income or wealthy respondents with more assets are more likely to be missing one or more components of net worth, the common practice of excluding observations with any missing values will tend to underestimate wealth and, by eliminating respondents in the upper tail of the distribution, show a more equal distribution of wealth. In addition, mean-filling total net worth or total income, even conditioning on limited demographic information, may also underestimate wealth or income and show more equal distributions since data from higher income respondents is less likely to be available to compute the means. Second, since higher income or wealthier respondents appear to be generally less likely to have missing values on any particular individual asset, mean-filling each component of net worth or income may overestimate wealth or income and, by imputing too-high values in the lower end and middle of the distribution, also show a more equal distribution of wealth.⁹ Third, imputation techniques that take into account information that is correlated with item nonresponse and that preserve the second as well as the first moments of the conditional distribution have some hope of accurately representing the

⁸The full set of results are available from the authors.

⁹These two points imply that our estimates of mean net worth using the imputed NLS or RHS data should be higher than estimates that drop all observations with any missing values for net worth components. We find this to be the case.

amount and distribution of wealth. Finally, the amount of bias caused by item nonresponse depends on the strength of the correlation between the items of interest and nonresponse. We find that the probability of nonresponse is significantly affected by income or wealth, asset ownership, and education but that the amount of variance that is explained by observed characteristics is limited. In summary, failure to correct for item nonresponse could, in general, cause some differences between surveys. However, for the comparisons in this paper, our imputation procedure should have reduced the differences in net worth between the surveys.

These results have additional significant implications for estimation of attrition rates. They may explain the finding in Jianakoplos, Menchik, and Irvine (1987) that attrition, defined to include item nonresponse on net worth as well as survey nonresponse, is higher for wealthier households than for other households. Since wealthier respondents are more likely to be excluded when attrition includes any item nonresponse, they are more likely to be counted as attriting.

Nonrandom attrition. If attrition (due to factors other than leaving the population through death or institutionalization) is nonrandom and the weights do not correct for this, the remaining sample can give a biased picture of the population. If attrition is correlated with wealth, attrition bias may be part of the reason for the differences between the wealth characteristics of the NLS or the RHS and the SCF. If all the factors that caused attrition were observed, it might be possible to correct for attrition bias by reweighting the sample. However, if not all factors are observed, for instance, if events occur after the initial interview that affect both attrition probabilities and subsequent wealth, these unobserved factors cannot be accounted for. The analysis in this section will allow us to assess the significance of initial observed characteristics in explaining attrition, but it will not allow us to draw conclusions with respect to later or otherwise unobserved events that may influence both attrition and wealth.

TABLE 12
NATIONAL LONGITUDINAL SURVEY OF MATURE MEN LINEAR PROBABILITY MODEL
PREDICTING 1981 REINTERVIEW FOR 1966 RESPONDENTS LIVING IN 1981

Variable	Coefficient	T-Statistic	Coefficient	T-Statistic
Intercept	0.6760	4.505	0.7966	6.162
Age	0.0011	0.654	-0.0009	-0.563
Race				
Black	0.0426	1.460	0.0606	2.142
Other non-white	-0.1786	-2.098	-0.1587	-1.852
Census region				
New England	0.0024	0.067	-0.0038	-0.108
Middle Atlantic	-0.0314	-1.203	-0.0321	-1.239
E. North Central	-0.0007	-0.029	-0.0004	-0.017
W. North Central	0.0401	1.231	0.0642	2.017
South Atlantic	-0.0148	-0.527	0.0053	0.192
E. South Central	0.0263	0.698	0.0434	1.166
W. South Central	0.0184	0.580	0.0263	0.831
Mountain	-0.0742	-1.762	-0.0612	-1.445

TABLE 12—continued

Variable	Coefficient	T-Statistic	Coefficient	T-Statistic
Log income	0.0037	0.286	-0.0081	-0.741
Log net worth	0.0002	0.030	0.0159	3.234
Have income > 0	-0.0987	-0.686	-0.0072	-0.055
Have net worth > 0	0.0277	0.418	-0.0650	-1.158
Asset and liability				
Ownership				
Home	0.0083	0.369		
Farm	0.0019	0.072		
Business	0.0231	1.052		
Other real estate	0.0523	2.926		
Savings accounts	-0.0226	-1.162		
U.S. savings bonds	0.0461	2.867		
Stocks, bonds, etc.	0.0859	4.617		
Personal loans	0.0296	1.166		
Consumer debt	0.0578	3.488		
Education	-0.0020	-0.758		
Employment status				
Employed	-0.0547	-1.350		
Retired	-0.1391	-2.314		
Occupation				
Managers, officials	0.0010	0.037		
Clerical	-0.0109	-0.279		
Sales	0.0080	0.206		
Craftsmen, foremen	0.0163	0.552		
Operatives	0.0029	0.095		
Service workers	0.0510	1.291		
Farmers, farm managers	0.0852	1.881		
Laborers	0.0807	2.002		
Married	-0.0125	-0.465		
Number of household members	0.0122	2.832		
Urban-rural residence				
Urban place	0.0164	0.794		
Rural	0.0622	3.420		
Regression <i>F</i> -statistic (Significance level)		3.866 (<0.001)		2.837 (<0.001)
Adjusted <i>R</i> ²		0.0295		0.0074

We begin by examining the relationship between the initial characteristics of 1966 NLS respondents and reinterview status. In Table 12, linear probability models are reported that predict the probability of a 1981 reinterview for 1966 NLS respondents who are still in the population in 1981. The first regression includes a wide variety of initial demographic and asset ownership characteristics as well as income and net worth. The second regression includes income and net worth and a limited number of demographic characteristics such as those that might be used to adjust the weights for attrition. We find that blacks, asset or debt holders, farmers and laborers, large households, and rural residents are more likely to be reinterviewed while other nonwhite or retired persons are less

likely to be reinterviewed. Income does not have a significant effect. Net worth has a positive and significant effect only in the regression that does not include asset ownership. While the regression F -statistics are significant, the adjusted R^2 statistics are quite small, indicating that a considerable portion of the variance in reinterview status cannot be explained by observable initial characteristics. Univariate comparisons and regressions that include linear splines for log income and log net worth produce the same result. The univariate comparisons also indicate that the differences between refusers and other attriters (excluding attrition by death or institutionalization) are more substantial than the differences between respondents who were reinterviewed and those who attrited.

In Table 13, linear probability models are reported that predict 1979 reinterview for the RHS after correcting for mortality. We find that older respondents, blacks, homeowners, debt holders, employed respondents, those with less education, and nonurban residents are more likely to be reinterviewed while business owners are less likely. Unlike the NLS, net worth is not significant in either model. Income is significant and is negative only in the regression with limited demographic variables. Univariate comparisons and regressions with linear splines for log income and log net worth confirm these results and show that the negative effect of income is most pronounced for incomes of \$16,000 and over. Like the NLS, the regression F -statistics are highly significant, but the adjusted R^2 statistics are quite small.

TABLE 13
RETIREMENT HISTORY SURVEY LINEAR PROBABILITY MODEL PREDICTING
1979 REINTERVIEW FOR 1969 RESPONDENTS LIVING IN 1979

Variable	Coefficient	T-Statistic	Coefficient	T-Statistic
Intercept	0.3547	2.191	0.5709	3.605
Age	0.0049	1.948	0.0022	0.891
Race				
Black	0.0814	4.972	0.0932	5.887
Other non-white	-0.249	-0.440	-0.0059	-0.104
Male-headed household	-0.0004	-0.020	0.0568	5.376
Log income	-0.0030	-0.472	-0.0136	-2.674
Log net worth	-0.0033	-0.760	0.0016	0.510
Have income > 0	0.0480	0.684	0.1271	1.911
Have net worth > 0	0.0006	0.018	0.0062	0.199
Asset and liability				
Ownership				
Home	0.0541	3.899		
Farm	0.0169	0.945		
Business	-0.0382	-2.475		
Other real estate	-0.0093	-0.808		
U.S. savings bonds	0.0116	1.131		
Stocks, bonds, etc.	-0.0023	-0.199		
Personal loan assets	0.0085	0.599		
Checking accounts	0.0160	1.470		
Savings accounts	-0.0035	-0.328		
Consumer debt	0.0488	5.236		

TABLE 13—continued

Variable	Coefficient	T-Statistic	Coefficient	T-Statistic
Education	-0.0039	-2.557		
Occupation				
Managers, officials	-0.0259	-1.277		
Clerical	-0.0111	-0.496		
Sales workers	-0.0533	-2.026		
Craftsmen, foremen	-0.0178	-0.867		
Operatives	-0.0208	-0.983		
Service workers	-0.0145	-0.660		
Farmers, farm managers	0.0167	0.549		
Laborers	-0.0223	-0.828		
Employment status				
Employed	0.0700	3.349		
Retired	0.0264	1.204		
Marital status				
Married	0.0262	1.447		
Widowed	0.0199	1.313		
Number of household members	0.0019	0.673		
Urban-rural residence				
Urban place	0.0633	5.096		
Rural	0.0719	6.560		
Regression F-statistic		8.516		8.681
(Significance level)		(<0.001)		(<0.001)
Adjusted R ²		0.0266		0.0065

Similar patterns of attrition occur on the NLS and RHS with respect to demographic characteristics. However, the effects of financial characteristics differ. For the NLS, net worth and ownership of some assets are positively related to the reinterview probability, while for the RHS, asset ownership is less frequently significant and income is negatively related to the probability of reinterview, especially for higher income households.¹⁰

We also tried reweighting the RHS sample to correct for attrition due to mortality, using the Social Security Administration mortality data mentioned earlier. The reweighting makes virtually no difference to the measures of central tendency. This is a surprising result, given the correlation we find between mortality and economic status in both the NLS and the RHS data and that other authors have found.¹¹

¹⁰We also reestimated the attrition models correcting for heteroskedasticity. The changes in the results were negligible.

¹¹See for example, Jianakoplos, Menchik, and Irvine (1987) and Kennickell (1984). Our linear probability models predicting mortality find a number of demographic and financial variables to be highly significant, and the regression F-statistics are significant. The results are very similar between the NLS and the RHS. However, as measured by their adjusted R² statistics, the models explain little of the variance in mortality.

Next, we used initial respondent characteristics to predict 1981 or 1979 net worth and income for nonrespondents.¹² In Table 14, we compare the actual 1981 or 1979 net worth distributions of reinterviewees with the predicted distributions of attriters, weighted with initial weights. For the NLS and the RHS, the results are similar. For both surveys, a higher percent of attriters than reinterviewees are in the lowest net worth category. For the NLS, a lower percent of attriters are in the next two net worth categories and about the same percent are in the top quartile. However, a detailed breakdown of the top quartile shows that attriters are somewhat more concentrated in the top 5 percent of the distribu-

TABLE 14
COMPARISON OF PREDICTED OR ACTUAL NET WORTH BY REINTERVIEW STATUS FOR LIVING RESPONDENTS

NLS				
Percent of Reinterview Category in Net Worth Bracket				
Predicted or Actual 1981 Net Worth	Reinterviewed	Attrition Due to:		
		Refusal	Other	Either Other Or Refusal
Under \$35,000	23.8%	32.5%	55.1%	35.8%
\$35,000 to \$79,999	25.9	23.6	16.3	22.5
\$80,000 to \$149,999	25.6	17.9	14.4	17.4
\$150,000 and over	24.7	26.0	14.2	24.3
\$150,000 to \$249,999	13.9	13.5	6.9	12.5
\$250,000 to \$399,999	5.8	5.6	2.7	5.1
\$400,000 to \$999,999	3.9	6.0	3.7	5.7
\$1,000,000 and over	1.1	1.0	1.0	1.0

RHS		
Percent of Reinterview Category in Net Worth Bracket		
Predicted or Actual 1979 Net Worth	Reinterviewed	Attrited
Under \$10,000	23.7%	29.9%
\$10,000 to \$39,999	27.3	30.2
\$40,000 to \$74,999	24.2	14.3
\$75,000 and over	24.8	25.6
\$75,000 to \$149,999	15.2	11.9
\$150,000 to \$249,999	5.3	6.0
\$250,000 to \$499,999	3.1	5.0
\$500,000 and over	1.3	2.7

¹²Random errors were added to the predicted log values so that the distributions for the attriters should have the same variances as the distributions for reinterviewed respondents. The prediction of income and net worth for nonrespondents assumes that any differences between attriters and reinterviewees do not affect their future income and net worth. If this assumption does not hold, the true unobserved income and net worth distributions of attriters may differ from those of reinterviewees even though a comparison of our predicted distributions show no differences. However, if the predicted distributions differ, it is likely that the true unobserved distributions also differ, although we cannot be sure in what way.

tion. For the RHS, about the same percent of attriters and reinterviewees are in the second net worth bracket, a lower percent of attriters are in the third quartile, and a somewhat higher percent are in the upper category. Again attriters are more concentrated in the top decile of the net worth distribution relative to reinterviewees. For the NLS, a similar pattern holds for income. For the RHS, the income distributions of reinterviewees and attriters do not differ much. For the NLS, a comparison between refusals and attrition for other reasons (excluding death and institutionalization) shows that refusal is more likely than reinterview to occur at both ends of the net worth distribution while attrition for other reasons is more likely to occur in the lower net worth category.

The results in Table 14 suggest that the heaviest attrition of respondents occurs in the lower net worth category, while the heaviest loss of dollars of wealth or income occurs in the highest net worth categories. This finding is similar to the conclusion reached by comparing the NLS and, to a lesser extent, the RHS to the SCF. That comparison indicated that the SCF has a fatter lower tail than the NLS and a longer upper tail than either the NLS or RHS. This suggests that attrition may be at least partially responsible for the differences between the surveys. It does not, however, explain the magnitude of the differences. One possible explanation is that attrition from the upper tail of the distribution is even more substantial than indicated by Table 14. This is supported by the comparison of the NLS and the RHS to the SCF that suggests that the NLS and the RHS have lost all the wealthiest respondents.¹³ Using the remaining respondents to predict net worth for attriters would tend to produce predictions within the net worth range of the remaining respondents even if attriters' true net worth was outside this range. If this pattern of attrition occurred, we would expect the predicted net worth to have the pattern shown in Table 14 while a comparison of the reinterviewed respondents to a data set without attrition would be similar to the comparison to the SCF.

The attrition results indicate that even if initial characteristics could successfully explain reinterview status, reweighting to correct for attrition might not change the mean values much since the weight in both tails of the distribution would increase. The lower tail would gain more weight than the upper tail, offsetting the disproportionate wealth in the longer upper tail. In addition, if the attriters in the upper decile of the net worth or income distribution differ systematically from the reinterviewees, it is likely that reweighting the remaining respondents will not correct for these systematic differences. Despite these potential problems, we tried three different methods of reweighting the reinterviewees to account for attrition. The three weighting schemes were based respectively on initial income, the predicted probability of reinterview, and the predicted net worth used in Table 14. As expected, none of the reweighting schemes makes much difference to the measures of central tendency or the distribution of wealth or income. For the NLS, the second and third reweighting schemes even reduce mean net worth slightly, while for the RHS the mean net worth is increased slightly. For the NLS, the third reweighting scheme increases net worth somewhat

¹³It is also supported by the experience of the PSID from which virtually all of the wealthiest respondents have attrited.

between the 75th and the 99th percentile, while increasing the percentage of respondents with little or no wealth. For the RHS, there is some increase in net worth throughout the distribution.¹⁴

To summarize our attrition results, there is some significant correlation between initial characteristics and attrition. There is some evidence that attrition occurs disproportionately in both tails of the income and net worth distributions, with the consequences of the attrition from the upper tail being more serious for wealth measurement. However, initial characteristics explain little of the variance in the probability of reinterview, and using initial characteristics to reweight to correct for attrition is ineffective.

In addition, it is also possible that unobserved changes in respondent characteristics after the initial interview or characteristics unobserved at the time of the initial interview affect the probability of attrition. There is some limited support for this theory in Tables 1 and 2, which indicate that the NLS and the RHS differ from the CPS in the rate of receipt of pensions (and inferentially, job longevity), education and, for the RHS, marital status. These characteristics could be associated with both attrition and subsequent wealth. This possibility, combined with the significant correlation between some initial characteristics and attrition from both tails of the predicted wealth distribution, suggests that some portion of attrition is systematic with respect to subsequent wealth and that this systematic component is extremely difficult to correct for.

The design and objectives of the surveys. In addition to differential representation of the income distribution, it is also possible that differences in the design and objectives of the surveys play a role in creating the differences between the surveys. The SCF is a wealth survey. The survey instrument is designed primarily to get detailed financial information, and interviewers are specifically trained to obtain financial information. By contrast, wealth is only one of many subjects covered by the NLS and the RHS.

The SCF collected more detail on every net worth item with the exception of U.S. savings bonds and, relative to the RHS, consumer debt. We have already noted that the SCF finds lower or the same ownership rates and mean values for savings bonds than the NLS or the RHS. However, this is explicable by the lower income distribution represented by the NLS and the RHS. On consumer debt, both the RHS and the SCF ask multiple questions about many different types of loans, while the NLS asks only about any other (consumer) debt. The RHS and SCF area probability sample get similar ownership rates and mean values for consumer debt while the NLS gets a lower ownership rate, but a higher mean value. This suggests that when asked a single question that includes a number of financial items, respondents tend to remember only large items. In addition, even after limiting the SCF sample to the income range of the NLS or the RHS and reweighting the NLS and the RHS to approximate the SCF income distribution, the NLS and the RHS find somewhat lower mean values on other real estate and stocks, bonds, and mutual funds than the SCF. Also the NLS finds a lower mean value of business. The SCF gathers much more detail on these assets. It is possible that the additional detail increases the amounts reported.

¹⁴The full set of results is available from the authors.

VII. IMPLICATIONS OF FINDINGS FOR RESEARCH ON SAVINGS AND WEALTH

The analysis contains a number of implications for the use of data on net worth to examine issues of wealth distribution, wealth concentration, portfolio composition, and saving.

Imputations. The NLS and the RHS do not contain systematic imputations of missing values, while the SCF does. The evidence suggests that effective imputation procedures are very important in producing a reliable estimate of wealth and, inferentially, of changes in wealth.

The common procedure of eliminating cases where any data values are missing will tend to eliminate more cases in the upper end of the wealth distribution, producing biased estimates. It appears that this is *not* because higher wealth respondents tend to be more reluctant, given their initial participation, or have less information about their wealth. Rather, they have more assets and liabilities to be reported. Hence there is a higher probability of at least one missing value than would be the case for a lower wealth respondent. Thus, the finding that attrition rates, defined to include item nonresponse, are higher among higher wealth households may no longer hold if systematic imputation procedures are adopted. In addition, we find that mean filling missing values may also produce biased estimates.

Attrition. There is evidence that attrition due to reasons other than death or institutionalization occurs disproportionately in both tails of the income and net worth distributions. It may be that some of the systematic causes of attrition are unobserved. It is also possible that the remaining respondents are not representative of those who attrited, especially in the upper tail of the distribution. Thus, reweighting by using observed characteristics may not effectively correct for attrition. In general, this finding suggests that panel surveys of wealth may fail to be representative unless special procedures are adopted to increase reinterview rates in the tails of the distribution.

Attrition due to death or institutionalization also appears to have some significant correlation with initial characteristics that are significantly related to future wealth. Thus it is important to correct for attrition due to mortality or institutionalization.

Income distribution. To examine wealth totals, wealth distribution, wealth concentration, portfolio composition, or saving behavior, it is extremely important to represent the entire income distribution, especially the upper tail which holds a disproportionate share of total wealth and saving. The evidence indicates clearly that the upper end of the income distribution will not be adequately represented by any survey that relies on conventional area probability sampling techniques. Rather, special procedures are needed in order to include and, for panels, retain a sufficient number of households with very high income and wealth. In addition, the apparent disproportionate attrition of very low income households has implications for analysis of the economic status of the very poor.

Saving. If saving is measured as the difference in net worth between two time periods, the differences between the three surveys spelled out above have serious implications for the use of the NLS and the RHS to examine saving behavior. Since both aggregate wealth and wealth held by the upper end of the

income distribution are severely underestimated by both the NLS and the RHS in comparison to the SCF, it is likely that the saving done by households in these categories will also be underestimated and estimates of total saving will be substantially affected. While proper imputation for the NLS and the RHS would enable an analyst to examine saving for the majority of the cohorts included in the samples, it would not enable the analyst to examine aggregate household saving for the entire population nor to analyze the saving behavior of the very wealthy, who do a disproportionate share of the saving.

REFERENCES

- Ando, A. K. and Kennickell, A. B., How Much (or Little) Life Cycle is There in Micro Data? The Cases of the United States and Japan, in Dornbusch, R., Fischer, S. and Bossons, J. (eds.), *Macroeconomics and Finance*, MIT Press, Cambridge, Massachusetts, 1987.
- Avery, R. B. and Elliehausen, G. E., *1983 Survey of Consumer Finances: Technical Manual and Codebook*, Federal Reserve Board, Washington, D.C., 1988.
- Avery, R. B., Elliehausen, G. E., and Gustafson, T. A., Pensions and Social Security in Household Portfolios: Evidence from the 1983 Survey of Consumer Finances, in Adams, F. G. and Wachter, S. M. (eds.), *Savings and Capital Formation: The Policy Options*, D. C. Heath and Company, Lexington, Massachusetts, 1986.
- Avery, R. B., Elliehausen, G. E., and Kennickell, A. B., Measuring Wealth with Survey Data: An Evaluation of the 1983 Survey of Consumer Finances, *Review of Income and Wealth*, 34, 339-369, 1988.
- Avery, R. E. and Kennickell, A. B., Measurement of Household Saving Obtained from First-Differencing Wealth Estimates, presented at the General Conference of the International Association for Research in Income and Wealth, Lahnstein, Federal Republic of Germany, 1989.
- Center for Human Resource Research, *The National Longitudinal Surveys Handbook*, 1983-1984, Ohio State University, 1983.
- Curtin, R. T., Juster, F. T., and Morgan, J. N., Survey Estimates of Wealth: An Assessment of Quality, in Lipsey, R. E. and Tice, H. S. (eds.), *The Measurement of Saving, Investment and Wealth*, University of Chicago Press, Chicago, Illinois, 1989.
- Darby, M., Postwar U.S. Consumption, Consumer Expenditures, and Saving, *American Economic Review*, 65, 217-222, 1975.
- Diamond, P. A. and Hausman, J. A., Individual Retirement and Savings Behavior, *Journal of Public Economics*, 23, 81-114, 1984.
- Duncan, G. J. and Hill, D. H., Assessing the Quality of Household Panel Data: The Case of the Panel Study of Income Dynamics, *Journal of Business and Economic Statistics*, 7, 441-452, 1989.
- Inter-University Consortium for Political and Social Research, *Retirement History Longitudinal Survey, 1969*, University of Michigan, Ann Arbor, Michigan, 1985.
- , *Retirement History Longitudinal Survey, 1979*, University of Michigan, Ann Arbor, Michigan, 1985.
- Jianakiplos, N. A., Menchik, P. L., and Irvine, F. O. Using Panel Data to Assess the Bias in Cross-sectional Inferences of Life-Cycle Changes in the Level and Composition of Household Wealth, presented at the Conference on Research on Income and Wealth, Baltimore, Maryland, 1987.
- Juster, F. T., Current and Prospective Financial Status of the Elderly Population, in Cagan, P. (ed), *Saving for Retirement*, 1981.
- Kennickell, A. B., *An Investigation of Life Cycle Saving Behavior in the United States*, Dissertation, University of Pennsylvania, Philadelphia, Pennsylvania, 1984.
- King, M. and Dicks-Mireaux, L., Asset Holdings and the Life Cycle, *Economic Journal*, 89, 706-732, 1981.
- Mirer, T. W., Wealth-Age Relation Among the Aged, *American Economic Review*, 69, 435-443, 1979.
- Munnell, A. H., Private Pensions and Saving: New Evidence, *Journal of Political Economy* 84, 1013-1032, 1976.