EVALUATING RESPONSE ERROR IN THE REPORTING OF THE INCOME OF THE AGED: BENEFIT INCOME

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It is commonplace of survey research that if anything can possibly go wrong, it will. The collection of data in large scale interview surveys is filtered through a series of intermediaries; the phenomena studied are rarely observed directly. The ultimate source of information, the respondent, is for most purposes only another intermediary, with his own flaws and inadequacies in his ability to transmit accurate reports of the traits, characteristics, events or conditions about which the total stranger we have sent to his door is inquiring, generally for some reason which to the respondent is remote, abstract or irrelevant. He is asked to respond to questions out of context to their real life situation, concerning matters about which good friends, and sometimes even wives, are usually not expected to inquire. After completing the interview, or possibly that night, after putting the children to bed and washing the dishes, the interviewer reviews the questionnaire, to see that each space is appropriately filled in.

At survey headquarters, the one-hundred or so answers on the questionnaire are transferred to a record and manipulated to reduce them to the five, ten, twenty, or fifty dimensions which constitute the data of the survey. The data are then further manipulated to produce a set of tables and numbers which presumably have some bearing on the problem which prompted the study. Considering the multiple possibilities of error, it is reasonable and necessary to ask how good are the data we have collected.

Up to the point at which the interviewer knocked at the door, we had a precise estimate of the range of error expected from sampling, assuming an acceptable probability sampling design consistent with the objectives of the survey. At the respondent's door, however, errors attributable to the interviewer, the respondent or the interviewer-respondent interaction enter into the measurement. Regardless of the precision expected from the sample design, we have not accounted for the accuracy of the measurement until we have some notion of the kind and extent of the response errors entering into the estimates.

In this paper we will present data on the magnitude and type of response error and response bias in the reporting of social security benefit income and we will examine some of the characteristics associated with response bias. The data are based on a national area probability sample of all persons aged 62 and over, the 1963 Survey of the Aged, conducted by the Social Security Administration, in cooperation with the Bureau of the Census. Validation of the benefit income was obtained from a complete matching of the survey interviews with the benefit income data from Social Security record files.

The concern with response validity predates the sample survey by many years, as illustrated by the laws of perjury, rules of evidence and trial cross-examination procedures. Only in recent years has a systematic body of data and of theory on response error begun to develop.1/ Unlike sampling error, however, there is little existing theory as yet on which a priori judgments or estimates of response error may be based.

One of the difficulties in the study of response error is the limited availability of criterion data for assessment of the survey data. In many cases, the available criteria contain similar response errors, or a different but equally unknown set of estimation errors. In some areas of measurement, such as personality and attitudes, the existence of an external reality against which the data can be measured may itself be in question.

Most of the things with which we are concerned in survey research, however, do have an external reality or may be represented by events, acts, or conditions external to the reporting unit.

The 1963 Survey of the Aged provided an unusual opportunity to study response error in income reporting through the virtually complete matching of survey data from an area probability sample with a large record system, the Social Security benefit and earnings records. The survey data were collected in two stages and included information to identify respondents with the records and information on specific income sources, including benefit income and earnings. Interviews were completed with 7,500 survey units, consisting of a person aged 62 and over and his spouse, if any. Matching record information was located for all but 2 cases per 1,000 interviewed.2/ The benefit income reporting comparison is based on the total of 4,727 beneficiary units, representing 11 million couples and aged individuals. The sample is self-weighting, but has not been adjusted for population and non-interview factors in this analysis.

The matching operation was primarily undertaken to insure accurate reporting of beneficiary status and benefit income. The methodological analysis of benefit income reporting was a by-product of the study rather than a major objective. Both benefit income amounts were kept in the data tape, but only the "true" or benefit record value was reported in the study, with the exception of a $60 range of error allowed to reduce the review and editing work load.3/

The accuracy of the respondent's income estimate was measured from the discrepancies between the amount recorded in the benefit record, the "true" value for the respondent, and the amount obtained in the interview. The mean

benefit income reported is the survey estimate of the "true population value," without response error. The differences between the Social Security benefit record and the interview data represent response error, including both variable error and bias.

In order to examine some of the possible sources of response error, the data were analyzed by age, type of unit, education, income thirds, living arrangements, and amount of OASDI benefit income. Beneficiaries who did not correctly report their beneficiary status in the interview are included in the analysis.

Data from the record match

1. Response error and bias

Table 1 shows the distribution of reporting differences between the SSA benefit record and the interview for all beneficiary units, couples and the nonmarried. Almost half of the beneficiary income reports matched exactly with the benefit record and more than three-fourths of the beneficiaries were within a range of plus or minus $60. About one-fourth of the responses were distributed among over and underestimates of more than $60, but the proportion with underestimates was 8 percent higher. Most of the net differences in under and over reporting were large amounts in excess of $300.

The net income understatement or bias was $61, about 6 percent of the Mean Total Benefit Income (TBI) of $1,052, with a standard error of approximately $5. As table 2 indicates, almost all of the bias was attributable to the small proportion of units with large under reports: four-fifths of the bias was from errors in excess of $500. Response errors of less than $301 were almost entirely random variation and made little or no contribution to the bias.

Considering that more than half of the aged received less than $1,000 in benefits and only one in 20 received more than $2,000, errors in excess of $300 are quite sizable for this group and would seem to be more than simple inability to recall or work out an approximate total. Faulty reporting of beneficiary status may account for as much as a third of this; about two percent of the beneficiaries did not report their beneficiary status, but the variation in the proportion not reporting did not show any direct relationship to the proportion with large under-reporting errors.

Other factors related to the particular conditions of benefit payments and to the questionnaire method may also have resulted in the omission of income amounts. Large back payments for delayed benefit awards, benefit terminations and suspensions may result in unusual or irregular payments. The questionnaire was set up primarily to obtain accurate totals on regular income and may thus have led to some understatement of irregular payments. Our data do not examine this possibility directly, but there is some support for this in the differences in the size and error rate of the bias by age groups.

2. Matching reports under $61

We were also interested in the effect on the income distribution and mean of the editing procedure allowing differences of up to $60 to be accepted as matching amounts. This was done in order to reduce the edit rejection rate and to eliminate extensive clerical checking for small differences.

As shown in tables 1 and 2, the $60 allowance was an effective procedure for reducing editing at little or no cost in bias. Reporting differences under $61 were randomly distributed between under and over reporting; 31 percent of the respondents had reporting errors under $61, but only 2 percent more under reported than over reported income. The net effect on the total benefit income was negligible, an average understatement of $1.

From an examination of the distribution, it would seem that our allowance was overly conservative and that we could have accepted all matching differences up to three hundred without affecting the mean Total Benefit Income (TBI) or introducing a serious distortion of the income distribution.

3. Sources of selective bias

The several variables selected for analysis were chosen on the basis of experience with or assumptions about their relationship to response validity. Differences between the Current Population Survey and Office of Business Economics estimates of the number of low-income families have been attributed, in part, to transfer income, including social security benefits.4/ Socio-economic factors such as education and income have frequently been found to be positively associated with accuracy of reporting.5/ Age, as an indicator of mental and physiological responsiveness should be negatively associated with validity, while living arrangements, as a measure of independent functioning, should have a positive relationship.

The results of this examination are summarized in table 3, for total beneficiary units. The relationship of these variables to response validity is examined further in tables 4 and 5, with marital status, sex and age held constant.

With the exception of living arrangements, none of the assumptions on the relationship between income reporting and characteristics were supported by the data on total beneficiaries. The younger beneficiaries have a greater net error than the beneficiaries aged 73 and over; the upper-income, larger benefit and higher education groups have greater net error rates than the lower income and education groups. The absolute

differences, however, were relatively small and are not statistically significant for the Education and Income characteristics. Respondents with "no answer" on income, however, do have a significantly larger response bias.

The response error rates for beneficiary unit types, in table 4.are generally consistent with those for all beneficiary units, and provide little evidence of selective bias in the reporting of benefit income. Only in living arrangements and age are the percent bias relationships consistent and substantial.

In table 5, age appears to account for most of the bias variation in the benefit income groups, with the 62-64 year age group having biases two to three times that of the older age groups. This is also the age group most likely to have irregular payments because of recent benefit awards and interruptions in payments.

Respondents whose total income was unreported also tended to have among the highest rates of bias, even when age and marital status were controlled.

4. Effect of response error on the standard error

The survey estimate of the standard error of the mean, $41, includes sampling variability, but no response variability. Without the adjustment for bias, from the benefit record, the apparent standard error would have been approximately the same or slightly smaller than the standard error of the record data mean. The mean square error, or "true standard error," however, would have been almost twice that of the apparent standard error if there had been no correction for bias:

Survey estimate of standard error of mean corrected for bias.....	$\sigma_{\bar{x}}$	$41
Standard error of bias.....	$\sigma_{\bar{e}}$	5
True standard error of reported mean (mean square error).....	$\sqrt{MSE}$	74*

$(MSE = \sigma_{\bar{x}} + \sigma_{\bar{e}} + 2r\,\sigma_{\bar{x}}\,\sigma_{\bar{e}} + (Bias)^2)$

* Assuming the coefficient of correlation, $r \leq \pm .5$

DISCUSSION

On the basis of these data, we can say with reasonable confidence that the reporting of Social Security benefit income is relatively accurate in surveys of the aged. With few exceptions, respondents reported benefit income with great accuracy. The bias, or net error was small and was confined to understatements by 5 to 7 percent of the reporting units, rather than to constant error or consistent under-reporting. The bias, moreover, was relatively consistent among education and income groups and was selectively distributed to a marked degree only by age.

The extent of understatement of benefit income was also consistent with the findings of a variety of other income studies. The 1950 Census underestimated the National Income accounts by 9 percent.6/ As Guthrie reported last year, the 1960 Consumer Expenditures study underestimated income by 6 percent and the Michigan Consumer Finance Surveys ranged from 3 percent to 13 percent in income underestimates during 1947-1955.7/

Aside from the immediate purposes of the Aged Survey, the data also have some general implications for methods of controlling response bias. The data strongly suggest that income reporting is not a problem of the sensitivity of the instrument. There was little tendency towards "yard-stick" error or consistent individual under-reporting of benefit income. The bias was due almost entirely to a small proportion of cases with gross under-statements. It was also associated with incomplete reporting in other financial areas. A good part of this would be accounted for by people who did not report beneficiary status, probably because of suspended payments and other changes in their beneficiary status. Others may have omitted lump-sum and retroactive payments.

As Ferber concluded from his study of time deposits, it is doubtful that methods designed to increase the accuracy of response overall would be effective for those income reports. Most respondents are already providing adequate answers. The deviant case is the one which presents the problem.

One possibility would be the use of questions directed specifically towards recall of unusual or one-time payments. A good part of the net error came from those respondents who did not answer other income questions, however, and it is doubtful that much more could be obtained from them through the refinement of questioning techniques.

Adjustment procedures which take into account not only the demographic characteristics of non-respondents, but also non-response as an attribute may provide more effective means of accounting for response bias. This will, of course, require more knowledge of the special

attributes of non-responders and more validation research. Non-responders on total income, for example, had a mean benefit income equal to the high and middle income thirds. Adjustments for non-response which take this into account as an attribute should, therefore, produce better estimates.

The extent to which these findings may be generalized to other questions and other population can, of course, only be determined by further study. Our research plans include a variety of validation studies related to Social Security record data. We are, for example, preparing a similar analysis for earnings from the 1963 Aged Survey. Data on earnings and benefit income reporting will be available for the under age 65 disabled population, from the 1966 Survey of Disabled Adults. Comparison data on the reliability of diagnostic information will also be developed. The proposed Longitudinal Survey Retirement should provide data on the temporal nature of response error.

The developing computer technology and access to large-scale data systems are extending the possibilities for validation studies and much more research may now be done on response error. It is to be hoped that the growing body of research will lead to a more standard treatment of response estimation procedures and that in the future these procedures will be made available in at least as much detail as is now published for sampling procedures.

References

1/ See, for example, William G. Madow, "On Some Aspects of Response Error Measurement," 1965 Proceedings of the Social Statistics Section, American Statistical Association, Washington, D.C. pp. 182-192, 1965; John B. Lansing, Gerald P. Ginsburg and Kaisa Braaten, An Investigation of Response Error, Studies in Consumer Savings No. 2, 1961, pp. 188-204; and William G. Cochran, Sampling Techniques, 2nd ed., John Wiley and Sons, New York, 1963, pp. 374-389.

2/ The procedures for record matching are described by Lawrence D. Haber, "Methodological Analyses in the 1963 Survey of the Aged," paper presented at the Gerontological Society meeting, October 1964, Minneopolis, Minnesota; the sample design is summarized in "Technical Note on Source and Reliability of the Estimates for the 1963 Survey of the Aged," Social Security Bulletin, July 1964, pp. 26-28.

3/ The benefit income reported in the study also included minor editing adjustments to resolve differences arising from exclusion of children's benefits and changes in marital status.

4/ Selma F. Goldsmith, "Low-Income Families and Measures of Income Inequality," Review of Social Economy, 20:1 (March 1962), pp. 1-19; and "The Relation of Census Income Distribution Statistics to Other Income Data," An Appraisal of the 1950 Census Income Data, vol. 13, Studies in Income and Wealth, National Bureau of Economic Research, Princeton, 1958, pp. 70-83.

5/ See, for example, Robert Ferber, "The Reliability of Consumer Surveys of Financial Holdings: Time Deposits," J. American Statistical Association, 60:309 (March 1965), pp. 148-163; and Lansing, op.cit., pp.180-181.

6/ Herman P. Miller, Income of the American People, John Wiley & Sons, New York, 1955, p. 15.

7/ Harold W. Guthrie, "Some Methodological Issues in Validation Studies," 1965 Proceeding, op. cit., pp. 193-196.

Table 1.-- Distribution of response errors for OASDI benefit income by type of beneficiary unit: Percent of beneficiary units aged 62 and over

Reporting difference (SSA - Interview)	Beneficiary units			
	Total	Married couples	Nonmarried	
			Men	Women
Sample N.....	4,727	2,137	713	1,877
Percent.....	100	100	100	100
Under-reporting				
$500 or more.....	6	8	4	6
301-500.....	3	3	2	3
101-300.....	4	5	3	4
61-100.....	2	2	2	2
Matching report (±$60)....	77	73	82	79
Exact.....	46	39	74	44
±1-60.....	31	34	8	35
Over-reporting				
61-100.....	2	2	2	2
101-300.....	4	6	4	2
301-500.....	1	1	1	1
501 or more.....	1	1	1	1
Percent of units Net response error (NRE) ($61 or more).....	8	8	3	9
Mean (dollars)				
Total benefit income (TBI).....	$1,052	$1,351	$911	$764
Net under-reported..	$61	$82	$29	$50
Percent of TBI.....	5.8	6.1	3.2	6.6

Table 2.--Percent distribution of response errors: Units and aggregate dollars

Reporting difference (SSA-Interview)	Total beneficiary units 62 and over			
	Percent of units		Net under-reported dollars	
	Total (Under plus over-reporting)	Net under-reporting (Under minus over-reporting)	Percent of mean TBI	Percent of bias
Base.....	4,727	4,727	$1,052	$61
Percent.....	100	100	100	100
Size of difference				
$501+	7	5	4.8	82
301-500.....	4	2	0.8	14
101-300.....	8	1	0.2	2
61-100.....	4	*	0.0	*
1-60.....	31	2	0.1	2
None.....	46	---	---	---

* Less than one-half of one percent.

Table 3.--Mean Total Benefit Income and Response Bias: Total Beneficiary Units

Selected Characteristics	Number of Units	Mean Total Benefit Income	Net Under-report	
			Mean Bias	Percent of TBI
Total (62 & over).....	4,727	$1,052	$61	5.8
Age				
62-64.....	449	834	99	11.9
65-72.....	2,309	1,095	71	6.5
73 & over.....	1,969	1,050	41	3.9
Living Arrangements				
In household-no relatives.....	2,969	1,099	47	4.3
In household-with relatives.....	1,702	1,980	82	8.4
Institutionalized.....	56	717	194	27.0
Education				
Less than 9 years.....	2,884	1,049	58	5.6
9-11 years.....	556	1,060	47	4.5
12 years or more.....	979	1,106	73	6.6
NA.....	308	892	79	8.8
OASDI Benefit Income				
$0-499.....	755	416	2	0.5
500-999.....	1,752	765	35	4.6
1,000-1,499.....	1,364	1,220	68	5.5
1,500-1,999.....	568	1,769	96	5.4
2,000-2,499.....	244	2,133	163	7.7
2,500 & over.....	44	2,885	916	31.7
Income Terciles a/(65 & over)	4,278	$1,075	$57	5.3
Lowest.....	1,072	898	29	3.2
Middle.....	1,401	1,135	46	4.0
Highest.....	1,323	1,132	54	4.7
NA.....	480	1,136	165	14.5

a/ Terciles were defined for each array of unit types separately and represent the position of the unit among couples, non-married men and non-married women.

Table 4 --Mean total benefit income and response bias by type of beneficiary unit

Specified characteristics	Number of units			Mean total benefit income(TBI)			Mean net under-reported			Percent of TBI under-reported		
	Married couples	Nonmarried		Married couples	Nonmarried		Married couples	Nonmarried		Married couples	Nonmarried	
		Men	Women		Men	Women		Men	Women		Men	Women
Total (62 and over).....	2,137	713	1,877	$1,351	$911	$764	$82	$29	$50	6.1	3.2	6.6
Age												
62-64.....	204	42	203	991	**	696	166	**	42	16.8	**	6.1
65-72.....	1,114	296	899	1,357	978	809	95	44	51	7.0	4.5	6.4
73 and over.....	819	375	775	1,433	878	729	43	15	51	3.0	1.7	7.0
Living arrangements												
In household-no relatives.	1,559	401	1,009	1,355	921	775	61	17	37	4.5	1.8	4.7
In household-with relatives	575	292	835	1,346	909	753	137	39	60	10.2	4.3	7.9
In institution.....	3	20	33	**	**	**	**	**	**	**	**	**
Education												
less than 9th grade.....	1,383	465	1,036	1,333	894	739	73	21	56	5.5	2.3	7.5
9-11th grade.....	248	71	237	1,343	980	788	70	36	27	5.2	3.7	3.4
12th grade or more.....	417	104	458	1,453	991	816	126	20	37	8.6	2.0	4.5
NA.....	89	73	146	1,193	842	734	54	85	91	4.5	10.1	12.4
OASDI Benefit income												
$0-499.....	154	129	472	351	431	433	-31	17	8	-9.0	3.9	2.0
500-999.....	467	290	995	764	784	760	38	17	39	5.0	2.2	5.1
1,000-1,499.....	676	286	402	1,264	1,230	1,139	56	34	112	4.4	2.7	9.8
1,500-1,999.....	557	6	5	1,771	**	**	86	**	**	4.9	**	**
2,000-2,499.....	240	1	3	2,133	**	**	157	**	**	7.3	**	**
2,500 or more.....	43	1	---	**	**	---	**	**	---	**	**	---
Income terciles (Total 65 and over).....	1,933	671	1,674	1,390	922	772	73	28	51	5.3	3.0	6.6
Lowest.....	568	168	336	1,165	678	555	28	22	34	2.4	3.2	6.1
Middle.....	615	241	545	1,528	938	780	68	20	32	4.5	2.2	4.1
Highest.....	509	213	603	1,465	1,088	866	75	24	46	5.2	2.2	5.3
NA.....	241	49	190	1,406	**	837	186	**	153	13.2	**	18.3

** Mean and percents not computed for bases of less than 50 cases.

Table 5.--Mean total benefit income and response bias by selected characteristics and age of head of beneficiary unit

Specified characteristics	Number of units			Mean total benefit income(TBI)			Mean net under-reported			Percent of TBI under-reported		
	Age of head			Age of head			Age of head			Age of head		
	62-64	65-72	73 and over	62-64	65-72	73 and over	62-64	65-72	73 and over	62-64	65-72	73 and over
Total (62 and over).....	449	2,306	1,969	$834	$1,095	$1,050	$99	$71	$41	11.9	6.5	3.9
Living arrangements												
In household-no relatives.	274	1,460	1,235	800	1,133	1,125	65	56	31	8.1	5.0	2.8
In household-with relatives	173	834	695	887	1,035	937	154	94	50	17.4	9.1	5.3
In institution.....	2	15	39	**	**	**	**	**	**	**	**	**
Education												
Less than 9th grade.....	268	1,415	1,201	836	1,103	1,032	90	71	36	10.8	6.4	3.5
9-11th grade.....	68	302	186	877	1,096	1,069	109	51	19	12.4	4.6	1.8
12th grade or more.....	90	474	415	835	1,100	1,171	157	69	59	18.7	6.2	5.1
NA.....	23	118	167	**	983	858	**	143	51	**	14.5	6.0
OASDI Benefit income												
$0-499.....	137	314	304	324	402	472	-23	7	8	-7.1	1.8	1.6
500-999.....	166	801	785	749	767	767	70	29	34	9.3	3.8	4.4
1,000-1,499.....	110	748	506	1,180	1,223	1,225	113	79	41	9.6	6.4	3.4
1,500-1,999.....	25	276	267	**	1,771	1,766	**	118	46	**	6.7	2.6
2,000-2,499.....	6	137	101	**	2,132	2,130	**	189	125	**	8.9	5.9
2,500 or more.....	5	33	6	**	**	**	**	**	**	**	**	**
Income terciles												
Lowest.....	---	449	623	---	911	888	---	49	14	---	5.3	1.6
Middle.....	---	756	645	---	1,181	1,082	---	51	40	---	4.3	3.7
Highest.....	---	840	485	---	1,106	1,176	---	75	16	---	6.8	1.4
NA.....	---	264	216	---	1,130	1,142	---	158	173	---	14.0	15.1

** Mean and percent not computed for bases of less than 50 cases.