Does a Panel Operation Increase the Reliability of Survey Data: The Case of Consumer Savings

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The effect of a panel operation on the reliability of survey data has long been a subject of conjecture in sampling circles. Virtually all past work on the subject has focused on measuring these effects indirectly, for as a rule it is only such evidence that can be brought to bear on the question. Hence, the approach in these past studies has been to evaluate panel effects in terms of changes in one or more of these basic forces, namely, changes in population composition, panel mortality and panel conditioning effects.

With regard to estimates of population parameters--usually means or aggregates--the effect of the first two of these factors is likely to be in the direction of reducing the reliability of panel data over time. Thus, changes in population composition (which usually are not paralleled by changes in the composition of the panel), and continuing panel mortality, tend to widen any differences that may exist between the composition of the panel and the composition of the population; and this in turn presumably brings about increased differences between the parameter estimate obtained from the sample and the true value of that parameter.

Moreover, panel mortality, if not offset by new families, tends to reduce sample size. For the same sample design, this serves to increase sampling variances and bring about greater instability in the parameter estimates.

On the other hand, it is well recognized that panel conditioning may have positive or negative effects. In some instances, the repeated interviewing of the panel, with repetition of the same questions, serves as a learning process to educate the respondents in better reporting techniques. In other instances, the repeated interviewing may make respondents less interested or perhaps less inclined to give accurate information, with the result that the reliability of the survey data declines over time.

No attempt is made here to evaluate the various studies exploring these effects, once consideration is given to the different circumstances under which the studies were carried out. Rather, the present paper presents the results of a direct analysis of the problem, with reference to the subject of consumer savings, made possible by the availability of data throughout the course of a panel operation which provided, unknown to the field force and the respondents, true values of some of the variables being requested in the interviews.

This panel operation, and several other panels as well, were carried out as part of the Consumer Savings Project of the Inter-University Committee for Research on Consumer Behavior, with financial assistance from the Ford Foundation. The present paper focuses on the effect of one of these panel operations on the accuracy of time deposits reported by panel members over the period of a year.

The panel operation which served as the source of data for this analysis was designed specifically to study response and nonresponse errors in individuals' reports of time deposits. Sample members were selected by random probability chunk selection from the files of savings institutions in a large metropolitan area. All accounts of individuals selected in the sample were listed separately. A stratification procedure by account size was also used, so that at the time of sample selection equal numbers of sample members had accounts under $100, $100-999, $1,000-4,999, $5,000 or more. (For multiple account owners, the largest account size was used in each case.)

Five waves of interviews were scheduled with the sample members, the interviewing interval being roughly three to four months. The questionnaires used in these interviews were general in scope, covering the entire range of consumer assets and debts. In meetings with the interviewers and in contacts with the respondents, the asset-management aspects of the study were stressed; neither the interviewers nor the respondents were informed of the source of sample selection.

The validation of account balances was carried out after each wave of interviews, data being obtained each time for nonrespondents as well as respondents. Because of the panel nature of the operation, various safeguards could be incorporated against mismatching, which is therefore probably negligible in the present study.

As with other operations of this Project, certain controlled experiments were incorporated into this panel operation, mostly in the first wave. Only one such experiment is relevant for present purposes. This experiment consisted of asking half of the panel for dollar holdings as of the date of the interview and the other half of the panel for changes that had taken place in each holding since the time of the last interview. This distinction was maintained only for the first two waves of interviews; after the second wave all panel members were asked for holdings, and on the fourth wave they were asked in addition for changes since the last interview. This modification made possible comparison of accuracy of reported change against the accuracy of change computed as the difference between two holdings reports. It should be noted that dollar balances were requested as of the date of the interview on all waves and the use of records was stressed, so that memory errors would be minimized.

On the basis of cost and other considerations, the desired sample size was 300 completed interviews. Actually, 316 interviews were obtained on the first wave, of a total eligible initial sample

of 411. After five waves of interviews, 205 members in the area were still in the panel. In terms of accounts, which constitutes the unit for this analysis, the initial sample totaled 462. The respondents on the first wave represented 345, or 75 percent, of these accounts. After five waves, the remaining respondents represented 269, or 57 percent, of the initially validated accounts.

Framework for the Analysis

Two effects of the panel operation on the reliability of data are considered here--biases in the estimates of the same parameter from one wave to another, and changes in the variance of these estimates over time. Three parameters serve as the basis for this analysis. They are:

1. The extent to which holdings are not reported; in other words, the ratio of nonreporters to total respondents.

2. The average balance per account, first, for the sample respondents, and second, for all sample members regardless whether they are interviewed on a particular wave.

3. The aggregate amount in validated accounts --the product of the number of accounts and the average balance per account. This approximates the statistic that would be sought in estimating aggregate balances in savings accounts.

In addition, information will be provided on the accuracy of the change reports.

Results

Nonreporting of holdings

Table 1 shows that more than one-fourth of the validated accounts were not reported by respondents on the first wave. The table also shows that among those who remained in the panel nonreporting of validated accounts dropped throughout the study to less than 10 percent by the last wave. The drop was most pronounced on the second and third waves and seems to have more or less stabilized by the fourth wave.

Perhaps most significant is the fact that, in an overall sense, the improvement in the reporting of validated accounts served to offset the loss of sample members during the course of the panel. As a result, coverage of validated accounts increased, despite the substantial mortality. This phenomenon is illustrated by Table 2, which shows that on the first wave, 218, or 63 percent, of the validated accounts owned by respondents were reported; on the last wave, 192, or 79 percent, of the validated accounts were reported. In other words, the number of accounts reported per sample member rose substantially, and was much more accurate after five waves than after one wave. A far higher percentage of nonreporters than of reporters on Wave 1 had dropped out by Wave 5 (Table 2).

The manner in which the information is requested--holdings or change--clearly influences the accuracy of the coverage (Table 1). Initially, nonreporting among those asked only for changes was much higher than among those asked for holdings. However, it is interesting to note that the rate of nonreporting fell much more sharply in the former group, so that by the end of the operation nonreporting among those initially asked for change was actually less (though not significantly so) than among those asked for holdings.

Two reasons appear to be mainly responsible for this phenomenon. One reason is the tendency noted in other respects for people not to report an account if little or no change takes place in the balance. In some instances, this is due to misunderstanding and in others to a feeling that such accounts "do not matter" in the context of reporting change. Second, strong evidence exists that the "change approach" tends to retain in the sample people who are not overly cooperative but are willing to cooperate more or less on a marginal basis, and hence are more likely to be nonreporters. The switch to asking these people for holdings appears to be an irritation sufficiently strong to induce many of them to drop out altogether, thus reducing sharply the number of nonreporters who are still active sample members. In the present study, this switch was made on Wave 3, which corresponds with the striking decline in nonreporting on that wave for the "change" group (Table 1), compared with the much smaller decline in nonreporting at the same time among the "holdings" group.

The latter tendency is also brought out when we compared what had happened by Wave 5 to the respondent reporters and nonreporters on Wave 1. Among those who were initially asked for holdings, nonreporters tended to remain nonreporters throughout the study. However, among those asked initially for change, a much larger proportion dropped out during the course of the study, so that by the last wave fewer such people actually remained in the sample. In other words, the Wave 1 respondent nonreporters to the change form were basically less cooperative from the beginning and hence more likely to refuse at a later stage.

Average Balances

The average balance of validated accounts reported by the respondents initially understated the true average balance in all validated accounts owned by the respondents. However, the degree of error declined fairly uniformly throughout the operation, from roughly 10 percent on Wave 1 to virtually zero on Wave 5, as is evident from Column 2 of Table 3. This table includes those panel members interviewed initially for holdings information.

It is interesting to note, from this table, that the average error in balances reported by respondents was mostly negligible throughout the study, registering if anything a slight trend

Table 1

Nonreported Accounts as Percent of Total Validated Accounts of Respondents, by Wave and Type of Initial Form

Wave		Holdings requested	Change requested	Total sample
1		27%	32%	30%
2		16	21	19
3		13	12	13
4		13	9	11
5		11	7	9
Base:	Wave 1	169	176	345
	Wave 5	139	124	263

Table 2

Status of Wave 1 Respondents by Wave 5

Wave 5 status	Wave 1 Status: Respondent reporter[a]	Wave 1 Status: Respondent nonreporter
Respondent reporter[a]	74%	24%
Respondent nonreporter	2	37
Nonrespondent or drop-out	24	39
Total	100%	100%
Base	218	127

[a] Includes account reported but balance refused.

Table 3

Reported and Actual Average Balance Per Validated Account of Respondents by Wave

(1)	(2)	(3)	(4)	(5)	(6)
		Average balance			
Wave	Percent understatement of respondents' average balances	Reported	Actual, for balance given	Actual, for balance refused	Actual, for nonreporters
1	9.6%	$2,391	$2,446	$3,102	$2,949
2	15.9	1,975	1,944	3,106	3,078
3	6.3	2,172	1,938	4,162	3,141
4	-4.3	2,172	2,062	1,650	2,439
5	.6	2,213	1,985	2,747	2,920

toward overestimation by Wave 5. The reason for the understatements in the average balances of the respondents is the much higher balances in accounts which were not reported or for which the balance was refused; this phenomenon is illustrated by the last three columns of Table 3.

The disparity between, on the one hand, accounts which were not reported and accounts for which balances were refused and, on the other hand, accounts for which balances were given, continued throughout the study. However, as has already been shown, the number of nonreported accounts declined substantially throughout the operation, much more so than the total number of respondents, with the result that the bias due to the omission of these accounts decreased over time.

In the case of the reports of change, the errors were far more substantial, as one might expect, because of the relatively low bases on which error percentages were calculated. Average errors of 100 percent or more in estimates of average change were common, the direction of the error being invariably toward understatement of change. Moreover, contrary to the case of holdings, no reduction in these errors over time was apparent. On the other hand, in the two instances where accuracy of computed change--the difference between successive holding reports--could be compared with the accuracy of reported change, the former approach was markedly superior, registering average errors of roughly half the size of the average errors in reported change.

Contrary to the situation with respondents' accounts, the average balance of accounts of all the panel members was understated consistently throughout the study. The degree of understatement was actually lowest on the first wave (21 percent), rose to a peak of 34 percent on the second wave, and then declined gradually to 22 percent by Wave 5.

As is evident from Table 4, the reason for this continuing understatement was initially the much higher balances in the accounts held by nonrespondents than in the accounts held by respondents. Since many of the nonrespondents later became drop-outs, the primary cause of the understatement on the later waves of the study shifts to the much higher balances of the drop-outs. In contrast, the balances of the nonrespondents are seen to fall precipitously.

Aggregate Balances

An estimate of the aggregate amount in validated accounts represents the type of statistic that would be sought in estimating aggregate holdings. Such an estimate can be obtained as the product of the average balance in validated accounts per sample member and the number of sample members. (Alternatively, this estimate could be derived as the product of the average balance per account and the number of such accounts.) Two such estimates were made in the present case, one estimate relating to the aggregate balances of the respondents on each wave, and the other estimate relating to the aggregate balances of all the members of the panel.

The error in the estimates of these two aggregate balances is shown in Table 5. Clearly, the error in both of these estimates of the aggregate balances represents a combination of the errors of each of the component parts covered in the preceding tables. For both statistics, the sample estimate is seen to understate substantially the true aggregate. The understatement is largest for the entire panel, as would be expected, the true aggregate being underestimated on the first two waves by nearly 50 percent. On the later waves of the panel, the degree of understatement falls off sharply, though even by Wave 5 the total was understated by more than 20 percent.

It should be noted that the sample estimates were not weighted for the differential sampling fractions used in this study nor was any effort made to allocate balances to nonrespondents and to those who refused balances on a basis other than straight allocation of means. Cursory experimentation with these refinements suggests, however, that the main results in Table 5, and in the preceding tables, would not have been affected appreciably.

Concluding Remarks

The results of this study suggest strongly that, at least in the case of consumer savings, the accuracy of data obtained from consumers improves markedly during the course of a panel operation. The principal reason for this improvement appears to be a substantial decline in nonreporting of holdings, a phenomenon which serves to more than offset any tendency for the bias in data obtained from the sample members to increase as a result of drop-outs.

One additional effect of the panel operation, sometimes overlooked, is on the variance of the estimates of the parameters. As we know from sampling theory, when nonsampling errors are present, the variance of the estimate of a parameter is the sum of the ordinary sampling variance and the square of the bias. It is readily shown that the ratio of this bias to the usual expression of the standard error of the mean measures the extent to which confidence intervals are mis-stated because of this bias. Thus, a .95 confidence interval computed in the usual manner will represent a true confidence interval of the same probability only if this ratio is zero. If the ratio should be 1.0, the probability of the usual symmetrical 95% confidence interval containing the true parameter declines to .83. The true probability declines progressively as the ratio rises--to .45 when the ratio is 2.0, to .15 when the ratio is 3.0, to .02 when the ratio is 4.0, and so on.

For the first wave of the present study, this ratio was 5.5 for the respondents and 9.6 for

Table 4

Estimated and Actual Average Balance Per Validated Account of All Panel Members by Wave

(1)	(2)	(3)	(4)	(5)	(6)
		Actual average balance			
Wave	Percent understatement: all accounts	All accounts	Respondents	Nonrespondents[a]	Drop-outs[a]
1	20.9%	$3,023	$2,446	$3,924	--
2	33.9	2,986	1,944	4,645	$3,438
3	26.5	2,955	1,938	1,419	4,148
4	23.7	2,845	2,062	3,150	3,985
5	22.0	2,839	1,985	2,181	3,650
Sample size[b]					
(W1-W5) 220		220	155-115	65-5	0-100

[a] Nonrespondents include accounts of panel members who could not be contacted on a particular wave but had not previously refused further interviews. Drop-outs for any particular wave are those who refused to grant an interview on a previous wave; the size of this category therefore cumulates over time.

[b] First figure shows sample size as of Wave 1 and second figure as of Wave 5 for each category. For the total sample (Columns 2 and 3), this figure is constant over time.

Table 5

Error in Estimate of Aggregate Balances in Validated Accounts*

Wave	Respondents only	All panel members
1	39.5%	47.1%
2	39.7	48.8
3	27.1	24.8
4	17.7	22.7
5	21.3	21.3

* All percentages are underestimates.

the total sample. In other words, the true probability that the usual .95 confidence interval would contain the actual average balance was virtually zero in each case.

As the panel operation proceeded, this ratio tended to decline. As a result, on the last wave, for the same sample size, the value of this ratio was 1.6 for the respondents and 5.3 for the total sample. Hence, at least in the former case, there is at least a moderate probability that the usual 95 percent confidence interval will include the true value, though the probability is still nowhere near .95; the actual probability is roughly .42.

It is also worth noting that the sampling variance of the mean computed in the usual manner understated substantially the total variance (mean square error) of these data, but the degree of understatement declined consistently through the course of the panel operation.

Essentially similar results were obtained from other panel operations involving time deposits, debt, and life insurance, all of which serve to increase the validity of the present findings. The principal difference between the results for time deposits and for these other holdings was the lower incidence of nonreporting of debt and of life insurance. Nevertheless, the accuracy of the data for these other assets also increased over time, and for the same reasons.

Under the circumstances, these studies would appear to provide a basis for believing that a panel operation serves to increase the reliability of survey-based data, at least in the case of consumer savings.