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First Wave Effects in the U.S. Consumer Expenditure Interview Survey

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ABSTRACT

Panel responses to the U.S. Consumer Expenditure Interview Survey are compared, to assess the magnitude of telescoping in the unbounded first wave. Analysis of selected expense categories confirms other studies' findings that telescoping can be considerable in unbounded interviews and tends to vary by type of expense. In addition, estimates from the first wave are found to be greater than estimates derived from subsequent waves, even after telescoping effects are deducted, and much of these effects can be attributed to the shorter recall period in the first wave of this survey.

KEY WORDS: Bounding; Telescoping; Recall Bias; Conditioning.

1. INTRODUCTION

Respondents to retrospective surveys are asked to recall details of events within a specific time interval, or reference period, and this task of identifying the correct time in which events occurred may be as difficult as remembering the events. Misdating, or "telescoping", is widely recognized as a source of error in surveys, although it is rarely studied directly (Neter and Waksberg 1965). Respondents tend to include in the report events that occurred outside the reference period (external telescoping), *e.g.*, when events are recalled as more recent than they actually are (forward telescoping). Data that can be validated with independent records show that both forward and backward misdating errors are made by respondents (Mathiowetz 1985). This could be "due to the respondent's wish to perform the task required.... When in doubt, the respondent prefers to give too much information rather than too little" (Sudman and Bradburn 1974, p. 69). The net effect of telescoping is generally forward. Bounding methods are designed to create boundaries around the reference period of the survey report, and, in so doing, avoid misdating errors by respondents. A method for bounding the starting point of the reference period, best applied during the interview, involves comparing events reported in a prior interview and deleting duplicate reports. Extending the reference period up to the interview day is a method commonly used to bound the end of the reference period. "Unbounded" reports result by necessity from one-time surveys, and for questions asked only once or for the first time in panel surveys, since no prior data exist to check for erroneous inclusions. These effects can be reduced by including "anchoring" techniques during the interview, *e.g.* constructing a time line (Mingay 1987, p. 132).

This paper is concerned with reporting levels experienced by first time respondents of panel surveys, and provides a comparative analysis of first and subsequent interview waves. The study investigates potential telescoping, conditioning, and recall length effects in estimates of household expenditures, based on data reported in the U.S. Consumer Expenditure (CE) Interview Survey for the year 1984. This survey is one of two independent components designed to collect national data on household expenditures, the other component being the Diary Survey.

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The survey is conducted by the Census Bureau under contract to the Bureau of Labor Statistics. The first wave of the CE Interview Survey is used to establish cooperation, collect initial inventory data on household possessions, and bound the second wave. There are four subsequent waves of interviews three months apart, collecting data for the previous three calendar months up to the interview day. The bounding method is as follows. Expenses reported for the portion of the calendar month in which the interview takes place (or "current month") are later transcribed onto the next wave questionnaire; this information is available to the interviewer to check for duplicate reports, but is not read to respondents. Data collected during the first wave pertain to expenditures for the current month and for one previous calendar month; these latter expenditures are excluded entirely from the estimates, while current month expenditures become part of the second wave. More details on collection and estimation methods can be found in the 1984 Bulletin (U.S. Bureau of Labor Statistics 1986), and are discussed by Silberstein and Jacobs (1989).

The findings underscore the need for bounding methods in retrospective data collection, since sizable telescoping effects may be present in unbounded recall. In addition, the analysis points out that first time responses may yield higher estimates even after telescoping effects are deducted. These first wave effects may be a direct result of the shorter recall in this wave of the CE Interview Survey, although other factors are not excluded. A discussion of the analysis used to identify telescoping effects is included in section 2, and estimates of telescoping and first wave effects are included in section 3. Conclusions can be found in section 4.

2. IDENTIFYING TELESCOPING EFFECTS

2.1 Method of Analysis

One approach for identifying telescoping errors, discussed by Kalton *et al.* (1989, p. 257), is to examine whether there are duplicates in individual responses to consecutive waves. This micro-level approach is not necessarily accurate, as the respondent for a given household may change from one wave to the next. The method is also impractical, since independent records, needed to reconcile discrepancies on dates, may not be readily available. Duplicate responses may not be recorded as such in an ongoing survey, even when they are identified during the interview, as in the CE Interview Survey. More commonly, telescoping effects are evaluated at the aggregate level, by comparing estimates of unbounded and bounded responses, with certain precautions. Tracking the experience of several panels is advisable in order to overcome seasonal incomparabilities, since bounded responses are reported subsequently to unbounded responses and, therefore, do not refer to the same time interval. Another factor to account for in the comparisons is panel conditioning, a phenomenon that refers to changes in respondent behavior as a result of being part of a panel, or to changes in the quality of reports. The assumptions made and the method of estimation used in this study are discussed in section 3, whereas the preliminary testing procedure is described here.

The first step in the analysis is to ascertain whether symptoms of external telescoping can be detected from the survey data. A level of reporting in the first wave that is higher than expected is an indication of telescoping. Unbounded interviews are known to yield higher estimates than bounded interviews, as documented in several studies that compared unbounded and bounded responses (Neter and Waksberg 1964 and 1965; Murphy and Cowan 1976; Cantor 1985). Another indication is the presence of differential effects across separate types of the collected data. Major sources of differences in the way events are retrieved and stated by respondents are recall bias and telescoping. The relationship of these factors suggests that

smaller expenses are forgotten as time increases, but larger more salient expenses, that tend to be remembered better, are more often telescoped.

Telescoping errors can also occur in bounded responses, causing the forward shifting of data within the reference period (internal telescoping). While overall estimates do not change as a result of these effects, the distribution for the three recall months is affected. Reports of apparel and home furnishing and equipment expenses were selected for the study, because characteristics of these expenses were helpful in the analysis. These commodities include expenditures of various degree of salience, and were grouped accordingly. They also tend to differ by degree of underreporting. Many apparel estimates are 40% below the estimates from the National Accounts (NA), and several estimates for home furnishings and equipment are also lower than NA estimates. Estimates for furniture and selected equipment categories, on the other hand, are only 7% below the independent estimates (Gieseman 1987, p. 11), and higher reports in the first wave can be interpreted as the result of external telescoping.

The hypothesis evaluated is whether the first recall month of bounded waves, *i.e.*, the month prior to the interview, is reported similarly to the past month in the first wave. The Hotelling T^2 was used to test differences in eight expenditure groups within each of the two commodities. Given two vectors of means in a repeated-measures design, a two-tailed .05-level test of H_0: $C\mu = 0$ (equality of means) versus H_1: $C\mu \neq 0$ was applied. H_0 was rejected if:

$$[(C\bar{x})'(CSC')^{-1}C\bar{x}]/[np/(n-(p-1))] > F_{p,n-p+1}(.05), \qquad (1)$$

where $\bar{x}$ is a vector of sample means within each commodity (ordered as shown in the tables), S is the covariance matrix computed with the method of balanced repeated replication ($n = 20$ replicates), C is the contrast matrix shown below, and p is the number of contrasts in C.

$$\underset{(px2p)}{C} = \left[\begin{array}{cccc|cccc} 1 & 0 & .. & 0 & -1 & 0 & .. & 0 \\ 0 & 1 & .. & 0 & 0 & -1 & .. & 0 \\ . & . & .. & . & . & . & .. & . \\ . & . & .. & . & . & . & .. & . \\ 0 & 0 & .. & 1 & 0 & 0 & .. & -1 \end{array}\right].$$

Simultaneous confidence intervals for individual comparisons by group were derived using the Bonferroni method (Johnson and Wichern 1988), with percentile $t_n(.05/2p)$. Expenditure means were computed using a log transformation of individual expenses reported in the first recall month. Sample weights included adjustments for nonresponse and subsampling, but excluded final weight factors for population controls, which were not available for the first wave. Note that weight adjustments for the first wave were computed only as part of this research, since they are not needed in the ongoing estimation process.

Data from waves 2 to 5 were combined, since differences between these waves were very small. Responses by participants in all five waves (3200 respondents) were selected to assure comparability between the waves and bounding of waves 2 to 5. Unbounded interviews are experienced by new panel respondents, *e.g.* new occupants at a sample address, and by respondents who do not participate in one or more wave during the panel. In 1984, 89% of the interviews in waves 2 to 5 were bounded, 8% were unbounded because respondents were new to the panel and 3% were unbounded resulting from a previous refusal or other noncooperation (Silberstein 1988). Estimates are affected by unbounded responses, as pointed out by Biderman and Cantor (1984), but this aspect is not treated directly in this study.

2.2 Test Results

Comparisons between means are shown in Table 1 in the original scale, *i.e.*, without the log transformation used in the statistical tests. The first wave displays higher means in nearly all expense groups, and the overall test is significant. The tests for the individual groups reveal that significant differences are found only for large expenditures, such as coats and jackets in apparel and appliances and furniture in home furnishings and equipment. The groups with significant differences are more represented in wave 1 than in other waves, not surprisingly: they account for 19% of total apparel and 72% of total home furnishings in the first wave, compared to 16% and 67%, respectively, in the first recall month of other waves, as shown in Table 2 (columns 1 and 2). A greater number of expenses are also reported in wave 1 for these groups of expenses (Table 2, columns 3 and 4). In addition, the average dollar value of reported expenses in wave 1 tends to be different from the other waves for big-ticket items (*e.g.*, major appliances), but very similar for smaller items (Table 2, columns 5 and 6).

Table 1

Percent Difference in Expenditure Means

	Wave 1 Versus First Recall Month of Waves 2 to 5	
	% Difference (a)	*s*
APPAREL: (b)	**14.5***	**4.9**
Coats, jackets, furs, suits	39.6*	12.9
Trousers, slacks, jeans	13.6	9.5
Shirts, blouses, tops	9.7	5.6
Sweaters, dresses, skirts	16.4	4.7
Undergarments, hosiery	6.9	5.4
Miscellaneous and combined clothing	−2.5	7.3
Footwear	2.1	6.1
Other apparel items and services	27.4	25.4
Overall test value: 4.16*		
HOME FURNISHINGS AND EQUIPMENT: (b)	**48.6***	**8.4**
Major appliances	76.1*	27.5
Other appliances	56.3*	17.0
Furniture	111.0*	24.8
Large household and entertainment equipment	34.2*	16.0
Other household and entertainment equipment	19.1*	7.1
Home furnishing repair and services	7.0	14.6
Dishes, decorative items, linens	14.0	16.0
Floor and window coverings	52.5	24.3
Overall test value: 13.86*		

(a) Positive values indicate first wave mean is greater. Base of percentages is mean of first recall month in waves 2 to 5.
(b) Commodity totals not included in overall test.
s Standard error of percent difference.
* Significant ($\alpha = .05$).

Table 2

Comparisons of First Wave and First Recall Month of Subsequent Waves

	Percent of Total Expenses		Percent of Total Number of Expenses		Average Dollar Value of Expenses	
	Wave 1	Waves 2 to 5	Wave 1	Waves 2 to 5	Wave 1	Waves 2 to 5
	(1)	(2)	(3)	(4)	(5)	(6)
APPAREL:	**100.0**	**100.0**	**100.0**	**100.0**	**$ 35**	**$ 33**
Coats, jackets, furs, suits	19.2	15.7	9.3	8.6	71	59
Trousers, slacks, jeans	10.7	10.8	10.6	9.8	36	35
Shirts, blouses, tops	10.0	10.4	12.0	12.2	31	29
Sweaters, dresses, skirts	14.3	14.0	13.0	12.4	38	37
Undergarments, hosiery	5.2	5.6	16.8	16.7	11	11
Miscellaneous and combined clothing	15.5	18.2	15.4	16.4	36	38
Footwear	11.7	13.1	12.8	13.6	33	31
Other items and services	13.5	12.2	10.1	10.4	45	40
HOME FURNISHINGS AND EQUIPMENT:	**100.0**	**100.0**	**100.0**	**100.0**	**$123**	**$ 92**
Major appliances	11.4	9.6	4.2	3.4	370	277
Other appliances	2.3	2.2	9.2	7.1	29	30
Furniture	28.3	19.9	8.9	7.5	385	251
Large household and entertainment equipment	19.7	21.8	8.8	7.6	262	266
Other household and entertainment equipment	10.7	13.4	22.7	22.8	58	56
Home furnishing repair and services	4.7	6.6	8.4	9.5	67	65
Dishes, decorative items, linens	12.9	16.8	33.1	37.5	46	39
Floor and window coverings	10.0	9.8	4.6	4.5	294	172

These differences can be interpreted in several ways, *e.g.*, they may indicate that more expensive purchases are reported in the first wave, or that purchases reported in the first wave are remembered as more expensive. Another interpretation is that a period of time longer than a month may be covered by respondents when the recall is unbounded, especially for large, easily remembered, expenses. In Table 3, comparisons by wave are extended to include the three recall months of subsequent waves. The findings are consistent with the previous tests, but tend to narrow in on the issue of telescoping effects. These comparisons are made on the basis of reporting rates according to the dollar value of the expense. The reporting rate is defined as the percentage of respondents reporting one or more expense of a given type. Note that individual expenses are generally entered on the questionnaire, with the exception of expenses for the same item, month and person in the family, which are usually reported as combined totals and counted as one "expense".

Table 3

Monthly Reporting Rates by Expense Size

	Wave 1	Waves 2 to 5 by Recall Month		
		First	Second	Third
		Percent of respondents		
	(1)	(2)	(3)	(4)
APPAREL:				
No Apparel Expenses (a)	28.8	29.3	38.2	45.5
Less than $10	38.4	37.7	27.9	25.4
$ 10 to $ 40	57.9	55.2	45.3	41.0
$ 40 to $100	35.1*	31.0	26.5	21.0
$100 and over	17.0*	13.7	11.5	8.8
Wave 1 vs 1st recall month of waves 2 to 5 **Overall test value: 29.1***				
HOME FURNISHINGS AND EQUIPMENT:				
No Home Furnishing Expenses (a)	48.1*	51.2	58.5	62.4
Less than $10	12.3	12.5	7.5	7.5
$ 10 to $ 40	30.9	30.0	25.0	22.1
$ 40 to $100	21.3*	18.4	14.9	12.8
$100 to $400	18.7*	13.8	12.1	10.3
$400 and over	8.6*	5.6	5.1	4.6
Wave 1 vs 1st recall month of waves 2 to 5 **Overall test value: 17.0***				

(a) Category included in overall test.
* Significant ($\alpha = .05$).

Consistent with the previous comparisons, the overall test is significant and the individual comparisons show that significantly more respondents report expenses of $100 or more in the first wave; reporting rates for smaller expenses are not significantly different, instead. When the three recall months are examined, the reporting rates for the first recall month appear to be closer to the first wave than to the other two months. The three recall months in waves 2 to 5 show a familiar pattern of decreased reporting, and noteworthy is the increase in the percent of respondents reporting "no expenses". This pattern is evident in each panel wave, as documented by Silberstein and Jacobs (1989) and further studied by Silberstein (1989), and is more likely due to recall effects than telescoping. When reporting rates are recomputed to include only respondents that report the commodity, it is found there are more similarities among the three recall months in subsequent waves than with the first wave. (The rates can be derived from Table 3, by using the percentage of reporters with expenses as the base.) These reporting rates for home furnishing items of $100 and over are 53% in the first wave and 40%, 41%, and 40%, respectively, in the three recall months of other waves. For apparel items of $100 and over the rates are 24% in the first wave and 19%, 19%, and 16%, respectively, in the three recall months of other waves. These differences are believed to be symptomatic of external telescoping in the unbounded recall.

3. ESTIMATING TELESCOPING AND FIRST WAVE EFFECTS

3.1 Telescoping Effects

The hypothesis of equality of means implied the response task in the first wave is similar to the one experienced for the first recall month in subsequent waves. The data did not support the hypothesis, since differential effects were found, suggesting external telescoping in the first wave. The results tend to agree with the notion, forwarded by Loftus (1986, p. 196), that internal telescoping may "arise from a different cognitive mechanism" than external telescoping. A general definition of external telescoping (β), on a monthly basis and assuming no panel conditioning, is given by the ratio of unbounded one month recall (with sample mean $\bar{x}_U$) and bounded one month recall (with sample mean $\bar{x}_B$):

$$\beta = (E\bar{x}_U/E\bar{x}_B) - 1. \tag{2}$$

This expression may be an overstatement since conditioning effects contribute to lower values for the bounded mean. Panel responses commonly display a downward trend, due to decreased reporting with increasing time-in-sample (TIS) (Bailar 1989). Conditioning effects (α) between two consecutive waves can be defined by the ratio of the two responses (with sample means $\bar{x}_i$ and $\bar{x}_{i+1}$):

$$\alpha = 1 - (E\bar{x}_{i+1}/E\bar{x}_i). \tag{3}$$

A number of assumptions were made to develop telescoping estimates from the survey data. Expenditure means of bounded one month recall, needed for comparisons with the first wave, cannot be obtained directly from the three month recall. Monthly means computed by dividing the bounded three month recall by a factor of three are not acceptable, considering the recall loss evident in the third recall month of the CE Interview Survey. As an alternative, the first and second recall months were used to estimate bounded monthly means, assuming that recall bias in the second month is moderate and telescoping into the first recall month is mostly from the second recall month. The estimating method is an adaptation of the model developed by Neter and Waksberg in analyzing the 1960 experimental study of expenditures for Residential Alterations and Repairs (Neter and Waksberg 1964 and 1965). The model implies that telescoping and conditioning effects are multiplicative and conditioning compounds with time-in-sample. Since conditioning effects are derived from relationships observed between second and third waves, two terms are necessary when estimating (2) under the assumption of conditioning. An estimate of telescoping is therefore:

$$b_C = (\bar{x}_U/\bar{x}_B)(1 - a)(1 - a/2) - 1. \tag{4}$$

The derivation of (4) is given in the appendix. The conditioning rate (a) was assumed to be constant between waves, considering the special subset of respondents in all five waves. (The Neter/Waksberg model assumed greater effects between the first and second wave.) Time-in-sample effects appear to be small in the CE Interview Survey, judging from a study that compared responses in waves 2 to 5 (Silberstein and Jacobs 1989). An explanation for this may be that declines in reporting are offset by improvements in reporting, as respondents become more knowledgeable about the reporting process. Two conditioning assumptions provided two estimates of telescoping effects, using (4): $a = 0$ (no conditioning), and $a > 0$ conditioning, equal to the rate observed between second and third waves. Four apparel groups and three home furnishing and equipment groups showed some decline from second to third waves, displayed as positive proportions in column 5 of Table 4. These ratios, while not

Table 4

Telescoping Estimates Based on Expenses

	Telescoping effects b_c				TIS effects
	If $a = 0$		If $a > 0$		a
	%	s	%	s	
	(1)	(2)	(3)	(4)	(5)
APPAREL:	**28.4**	**7.0**	-	-	**−0.02**
Coats, jackets, furs, suits	46.2	14.2	-	-	−0.01
Trousers, slacks, jeans	30.3	8.6	12.3	11.8	0.10
Shirts, blouses, tops	27.7	7.8	17.6	16.7	0.05
Sweaters, dresses, skirts	28.3	5.9	8.7	15.0	0.11
Undergarments, hosiery	22.2	6.9	7.2	12.7	0.08
Miscellaneous and combined clothing	5.2	9.5	-	-	−0.18
Footwear	18.1	7.1	-	-	−0.08
Other items and services	54.9	35.8	-	-	−0.15
HOME FURNISHINGS AND EQUIPMENT:	**63.1**	**8.9**	-	-	**−0.04**
Major appliances	95.4	30.7	-	-	−0.03
Other appliances	76.4	16.1	36.0	19.7	0.16
Furniture	113.3	25.2	-	-	−0.05
Large household and entertainment equipment	38.7	13.1	36.5	33.7	0.01
Other household and entertainment equipment	26.2	8.9	-	-	−0.11
Home furnishing repair and services	15.6	14.5	-	-	−0.29
Dishes, decorative items, linens	45.4	14.4	-	-	−0.06
Floor and window coverings	89.4	38.0	66.8	68.7	0.08

a Time-in-sample (TIS), or conditioning, effects when positive.
s Standard error of percent difference.

significant (.05 level), were applied as the conditioning loss between the first and the second wave. Net increases in reports were not considered realistic for the unknown conditioning between these two waves.

The results give indications of the increase that would occur in the estimates in the absence of bounding. Table 4 shows estimates of telescoping effects in percentage form, excluding conditioning effects (column 1), and including them (column 3). Telescoping levels of 40% or higher are estimated for "Coats, *etc.*" and "Other items and services" (a group that includes watches and jewelry), but much lower levels are estimated for other apparel groups. High telescoping levels (63%, on average) are estimated for home furnishing and equipment expenses. Telescoping estimates decrease considerably when some conditioning effects are taken into account, and would be even lower if greater conditioning effects were assumed between wave 1 and wave 2. While these estimates are affected by sampling variability and the assumptions made, the results are consistent with findings reported in other surveys. Neter and Waksberg (1965) reported average telescoping effects of 55% with no conditioning losses and 39% with conditioning losses, for home improvement expenditures; telescoping effects were much lower for small jobs. Telescoping effects derived from the 1974/75 Crime Survey indicated telescoping effects of 44% for personal victimization incidents and 40% for property victimization (Murphy *et al.* 1976).

3.2 First Wave Effects

Differences in responses between first and subsequent waves reflect many cognitive aspects of panel interviews. This section discusses some of the factors involved, and includes a preliminary investigation of net effects. Provided that respondents participate in the whole panel, there is a progressive relationship between respondent and interviewer and more clear expectations on both sides. Quite a few interview conditions change, however. While in some panel surveys subsequent waves may be presented as follow-ups to the first wave, in the CE Interview Survey respondents are asked to report for a period of time three times as long after the first wave and detailed income information is asked in waves 2 and 5. This greater reporting load, and a resulting faster interview pace, has a negative impact on reporting levels, even for the first recall month of these waves. More expense records, *e.g.*, check books and bills, may be used in these waves compared to the first wave, making the bounded reports less likely to be affected by telescoping within the three recall months. The first wave is an easier interview, especially with regard to categories of expenses sensitive to the length of the reference period and the number of persons in the household, *e.g.* apparel expenses. The relative importance of these factors should be researched in field and laboratory studies.

Separate estimates of first wave means, net of telescoping, were developed using the two sets of telescoping effects shown in Table 4. These means ($\bar{x}_{B1}$) were derived by dividing the unbounded means by the telescoping estimates:

$$\bar{x}_{B1} = \bar{x}_U/(1 + b_C). \tag{5}$$

Results are summarized by commodity in Table 5. Both estimates of net first wave means are higher than means of waves 2 to 5 for all recall months combined, shown in column 2. The total apparel mean is 10% higher in the first wave when conditioning effects are not included, and 16% higher when they are included. The home furnishing and equipment means are also higher, but at a smaller scale: 3% without conditioning and 5% with conditioning. These estimated effects, remaining after telescoping, are interpreted as resulting from the shorter recall period and lesser reporting load in the first wave. The differences between the two commodities and the results for specific groups of expenditures imply that potential gains in reporting tend to increase for smaller expenses, but become quite marginal for big-ticket items.

Table 5

Summary Comparisons of FirstWave and Subsequent Waves
Annual Expenditure Means (Standard errors)

	Wave 1	Waves 2 to 5 All Recall Months (a)	Waves 2 to 5 First recall Month	Wave 1 Net of Telescoping	
				Assuming no TIS Effects	Assuming TIS Effects
	(1)	(2)	(3)	(4)	(5)
APPAREL	$1,663 (59.6)	$1,182 (61.7)	$1,452 (71.0)	$1,295 (66.2)	$1,370 (n.a.)
HOME FURNISHINGS AND EQUIPMENT	$1,972 (85.0)	$1,179 (59.7)	$1,327 (73.1)	$1,209 (61.5)	$1,235 (n.a.)

(a) Means differ from published 1984 estimates, due to special subset of respondents and missing final weight factors.

4. CONCLUSIONS

This paper provides an investigation of potential telescoping effects in unbounded interviews. These effects appear to be considerable, especially for more salient or prominent events. Results from the U.S. Consumer Expenditure Interview Survey indicate that estimates of large infrequent expenses, based on unbounded one month recall, may be between 30% and 50% overstated. Lower overstatement levels are more likely in estimates of small frequent expenses. These findings are in close agreement with other studies on the subject. The study demonstrates that external telescoping effects are much greater than internal telescoping effects within a three month recall period of subsequent waves. In addition, the first wave of the panel survey studied was found to exhibit higher means than the overall means for subsequent waves, even after estimated telescoping effects were deducted. Since the first wave in this survey has one month recall, it is concluded that considerable improvements in reporting levels can be expected from a shorter recall. The potential gains are estimated to be at least 10% for frequent expenditures, but would become marginal as the value of the expenditure increases.

Although the one month recall is viewed as the major reason for the higher estimates, other factors are not excluded. Conditioning effects, assumed constant in this study, may vary between waves. Estimates of one month recall would be even greater, if higher conditioning effects were assumed between the first and second waves. Cognitive aspects of the interview, *e.g.*, respondents cooperation and involvement, and interviewers' approach to collecting data, should be researched in order to understand panel conditioning. The issue of differential effects by type of expenditure should also be addressed within this context. Field and laboratory studies of these data collection aspects would have implications for improving panel survey methodology.

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APPENDIX

(1) Explanation of Selected Expenditure Groups

SELECTED APPAREL

Miscellaneous and combined clothing: nightwear, loungewear, accessories, uniforms, and clothing items for infants under 2.

Other apparel items and services: watches, jewelry, sewing materials for making clothes, repair and alteration services, and clothing rental or storage.

SELECTED HOME FURNISHINGS AND EQUIPMENT

Other appliances: small electric kitchen and personal care appliances.

Large household and entertainment equipment: lawn mowers, window air conditioners, televisions, sound equipment, and bicycles.

Other household and entertainment equipment: radios, tape recorders, tools, calculators, camping or sports equipment, and infants equipment.

(2) Estimates of Telescoping Effects

(Adapted from: Neter and Waksberg (1965), 33-37).

For each expenditure group

Let: $\bar{x}_U$ = unbounded one month recall sample mean;

$\bar{x}_B$ = bounded one month recall sample mean, not directly observed in the CE Interview Survey;

$\bar{x}_2, \bar{x}_3$ = one-month-average sample means from waves 2 and 3, respectively, computed using first and second recall months.

Define: Telescoping effect β, assuming no conditioning

$$\beta = (E\bar{x}_U/E\bar{x}_B) - 1. \tag{1}$$

Conditioning effect, α, between two consecutive waves

$$\alpha = 1 - (E\bar{x}_{i+1}/E\bar{x}_i). \tag{2}$$

Then, assuming telescoping compounds on conditioning,

$$\beta_C = (E\bar{x}_U/E\bar{x}_B)(1 - \alpha) - 1 \tag{3}$$

is the telescoping effect under conditioning.

Using the estimated conditioning effect between 2nd and 3rd waves, $a = 1 - (\bar{x}_3/\bar{x}_2)$, the estimated mean for bounded one month recall is:

$$\begin{aligned} \bar{x}_B &= (\bar{x}_2 + \bar{x}_3)/2 \\ &= (\bar{x}_2 + \bar{x}_2(1 - a))/2 \\ &= \bar{x}_2(1 - a/2). \end{aligned} \tag{4}$$

Assuming a constant rate of conditioning and using (3) and (4), an estimate of the telescoping effect under conditioning, b_C, is:

$$b_C = (\bar{x}_U/\bar{x}_B)(1 - a)(1 - a/2) - 1. \tag{5}$$

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