Survey Research Center University of Michigan

SURVEYS OF CONSUMERS

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Sample Design

The monthly Survey of Consumers is an ongoing nationally representative survey based on approximately 500 telephone interviews with adult men and women living in households in the coterminous United States (48 States plus the District of Columbia). The sample is designed to maximize the study of change by incorporating a rotating panel sample design in an ongoing monthly survey program. For each monthly sample, an independent cross-section sample of households is drawn. The respondents chosen in this drawing are then reinterviewed six months later. A rotating panel design results, and the total sample for any one survey is normally made up of 60% new respondents, and 40% being interviewed for the second time.

The rotating panel design of the Surveys of Consumers has several distinct advantages over a simple random sample. This design provides for the regular assessment of change in attitudes and behavior both at the aggregate and at the individual level. The ability to gauge individual change expands the study of aggregate change by permitting a better assessment of the underlying causes of that change. The rotating panel design also permits a wide range of research strategies made possible by repeated measurements. In addition, the sample design supports the pooling of up to six of the independent monthly samples to achieve larger samples, or to screen for rare populations or events.

The List-Assisted RDD Sampling Frame

The method used to draw the monthly national probability sample is generally know as random digit dialing (RDD) telephone sampling. The specific RDD procedure used at the Survey Research Center (SRC) is a one-stage list-assisted design. The list-assisted sampling frame, which is available commercially, consists of all hundred series[1] which have at least one listed household number. The frame is produced by aggregating all directory-listed household telephone numbers to the hundred series level. These "listed hundred series" form a subset of approximately 40 percent of the total possible hundred series which can be formed from all Area Code/Exchanges in the Bellcore system.

Each hundred series is associated with 100 possible phone numbers -- which can be listed household, unlisted household, nonresidential, non-working or unassigned. Because of the way telephone numbers are assigned, a hundred series which has at least one listed household number is more likely to have other residential telephone numbers. Business numbers are often segregated in reserved hundred series and other hundred series are not used. While the incidence of working household numbers is about 22 percent in the set of all possible hundred series from the Bellcore Area Code/Exchanges, the incidence of working household numbers is about 50 percent in the set of listed hundred series.

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[1]The term "hundred series" refers to the first eight digits of a phone number -- the area code, exchange, and the first two digits of the remaining four numbers. One hundred possible phone numbers can be formed from each hundred series by adding the set of numbers "00" to "99" to create 10-digit phone numbers.

Connor and Heeringa (1992)[2] found that the coverage of a current (up to six months old) list-assisted frame is very high, approximately 96.5 percent. Noncoverage results from the addition of new hundred series after the creation of the frame and from hundred series which contain only unlisted household numbers. Investigations by Connor and Heeringa (1992) and Brick, Waksberg, Kulp, and Starer (1995)[3] of the characteristics of households not covered by the national listed hundred series frame shows that they do not differ significantly from the covered households.

List-Assisted Sample Stratification

The monthly Survey of Consumers sample, which are selected from a list-assisted RDD frame using the GENESYS Sampling System[4], are stratified, one-stage, equal probability samples of telephone households in the contiguous United States (48 states and the District of Columbia). GENESYS uses the Donnelly Quality Index Database (100% Phone File) as the basis for its RDD sampling frame along with auxiliary files including the Bellcore file of valid area codes and exchanges.

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[2]Connor, J. & Heeringa, S. (1992). Evaluation of two cost efficient RDD designs. Paper presented at the annual meeting of the American Association for Public Opinion Research (AAPOR), St. Petersburg, FL, May 18-20.

[3]Brick, J. M., Kulp, D. W., Starer, A., & Waksberg, J. (1995). Bias in list-assisted telephone samples. Public Opinion Quarterly, 59, 219-235.

[4]The GENESYS In-House Sampling System is a product of Marketing Systems Group, Fort Washington, PA. The GENESYS Sampling System is widely used throughout the academic and governmental survey research community.

The GENESYS list-assisted frame is stratified by geography and urbanicity. Explicit strata are formed by crossing Census Division by MSA/non-MSA status. Within each MSA stratum, there is an ordering by size of MSA and within MSA by exchanges serving the county containing the central city, followed by those serving remaining non-central city counties; within non-MSA strata, exchanges are ordered geographically in a serpentine fashion within each Census Division. Stratification by these criteria assures the appropriate sample representation of different region, state, and metropolitan size categories. The GENESYS sampling frame is updated twice yearly. Area code changes are incorporated as needed between the semi-annual updates.

List-assisted RDD sample designs for telephone surveys differ from those for personal interview surveys in that selection probabilities are assigned on the basis of the number of possible phone numbers which can be formed from the set of listed hundred series in a defined group of area codes/ exchange codes rather than on population totals for geographic areas such as counties, cities, and blocks.

The list-assisted RDD design provides for an equal probability sample of all telephone households; within each household, probability methods are also used to select one adult as the designated respondent. At the time of the initial contact with the household, a listing is taken of all household members that are 18 or older. From this list of eligible respondents, a specific member of the household is selected by the interviewer using the "respondent selection table" assigned to that household's coversheet. These selection tables are assigned to households so that each adult has a known selection probability, across households of all sizes, as well as differences in age and sex composition. Giving each selected respondent a weight equal to the number of adults in the household would then transform the sample of households to a sample of the adult population.

Sampling Errors

The equal probability sample design of the monthly Surveys of Consumers permits the computation of sampling errors for statistics estimated from the survey data. In general, sampling errors for survey based estimates are a function of both the statistical characteristics of the estimator in question, and the number of sample cases on which the estimate is based. In a complex sample such as that used for the Survey of Consumers, "design effects" due to the stratification and weighting of sample elements may also affect the sampling error of a particular survey statistic. Since the one-stage list-assisted RDD sample design is unclustered, there is no design effect due to clustering.

The Sampling Section has developed a package of computer programs which calculate sampling errors for survey statistics using either pseudo replication techniques (REPERR), Balanced Repeated Replication (BRR) and Jackknife Repeated Replication (JRR) or Taylor approximation methods (PSALMS) of estimation. By specifying appropriate options for these programs, staff may calculate sampling errors for ratio means, regression coefficients, simple or multiple correlation coefficients (standardized and unstandardized), and partial correlation coefficients. In a single run, these programs can calculate estimates for the total population, its subclasses and domains. Each sampling error program is designed to deal automatically with weighted estimates including post-stratification adjustments. The PSALMS and REPERR programs are available in the OSIRIS.IV statistical analysis and data management software system.

Without conducting actual computations, it is impossible to provide the exact extent of sampling error for each survey statistic that might be of interest. However, there is a generalized technique which does yield approximate levels of sampling error for survey statistics that are either estimates of percentages or statistics which are equal to the difference in percentage estimates for population subgroups. Based on this generalized sampling error method, Table 1 provides approximate values of recommended sampling error allowances for percentage estimates derived from the monthly surveys.

The approximate sampling error values given in Table 1 were computed using the following formula:

$$\textit{Sampling error} = 1.96\sqrt{p(1-p)(1/(n-1))DEFF}$$

The term p is defined as the observed sample percentage. For large samples, p is assumed to follow a normal distribution about the true population percentage, P. In the formula, the expression "p(1-p)/(n-1)," is the estimated variance of the sample percentage, p, for data collected under a simple random sampling design. The 1.96 multiplier at the beginning of the sampling error expression serves to transform the estimated standard error of p to a recommended sampling error allowance that is equal to the 95% confidence interval for the estimated statistic.

The *DEFF* term in the sampling error expression represents the design effect, a factor which introduces the effects of stratification and clustering into the simple random sampling variance formula. Given a particular complex sample design, it is common to find that values of the design effect will vary depending on the estimate of interest and the size and distribution of the population subclasses being considered. However, based on past experience, an average design effect of 1.3 was used to develop the entries in Table 1.

To use Table 1, both the value of the estimated proportion, p, and the base sample size, n, must be known. Knowing these two values, simply cross reference the margin entries in Table 1 to find the recommended sampling error allowance. Table 1 tabulates sampling error approximations only for selected values of *p* and *n*. Interpolation between categories given in Table 1 (and subsequent tables) can be used to obtain the sampling error approximation for values of *p* or *n* that were not tabulated.

TABLE 1
RECOMMENDED ALLOWANCE FOR SAMPLING ERROR OF A PERCENTAGE

For Estimated Percentage Near	Sampling Error Allowance in Percentage Points[a]											
	100	200	300	400	500	750	1000	1250	1500	2000	2500	3000
1% or 99%	2.2	1.6	1.3	1.1	1.0	0.8	0.7	0.6	0.6	0.5	0.4	0.4
5% or 95%	4.9	3.5	2.8	2.4	2.2	1.8	1.5	1.4	1.3	1.1	1.0	0.9
10% or 90%	6.7	4.8	3.9	3.4	3.0	2.4	2.1	1.9	1.7	1.5	1.3	1.2
20% or 80%	9.0	6.3	5.2	4.5	4.0	3.3	2.8	2.5	2.3	2.0	1.8	1.6
30% or 70%	10.3	7.3	5.9	5.1	4.6	3.7	3.2	2.9	2.6	2.3	2.0	1.9
40% or 60%	11.0	7.8	6.3	5.5	4.9	4.0	3.5	3.1	2.8	2.4	2.2	2.0
50%	11.2	7.9	6.5	5.6	5.0	4.1	3.5	3.2	2.9	2.5	2.2	2.0

[a]The figures in this table represent two standard errors. Hence, the chances are 95 in 100 that the true percentage lies within a range equal to the observed percentage, plus or minus the sampling error.

The estimates of standard errors given in Table 1 imply that the confidence intervals are symmetric around the estimated sample proportion. Such symmetry is only observed when the estimated proportion is close to 50%. The greater the divergence from the midpoint, the greater the skew in the confidence interval about the observed sample proportion. Separate estimates of the lower and the upper limits of the confidence intervals can be obtained. The formulas used to estimate the lower limit (LL) and the upper limit (UL) of the confidence intervals are:[5]

$$LL = p - \frac{2(n/DEFF)p + 1.96^2 - 1.96\sqrt{4(n/DEFF)p(1-p) + 1.96^2}}{2((n/DEFF) + 1.96^2)}$$

$$UL = \frac{2(n/DEFF)p + 1.96^2 + 1.96\sqrt{4(n/DEFF)p(1-p) + 1.96^2}}{2((n/DEFF) + 1.96^2)} - p$$

The estimates of the lower and upper limits of the confidence intervals using this method are given in Table 2.

In addition to confidence interval for point estimates of percentages, confidence intervals for estimates of differences in percentages between two population subclasses are also frequently needed. Table 3 provides approximate values of the recommended sampling error

[5]See Hays, William L., Statistics, New York: Holt, Rinehart, & Winston, 1981, and Johnston, Lloyd, Bachman, Jerald, and O'Malley, P., Monitoring the Future: 1983 Questionnaire Responses, Ann Arbor: Institute for Social Research, University of Michigan, 1984.

allowance for percentage differences computed from the monthly surveys. The approximate sampling error allowances were computed using the following formula:[6]

$$Sampling\ error = 1.96\sqrt{p'(1-p')(1/n_1+1/n_2)DEFF}$$

In this expression, p' is the observed percentage in the combined subsamples:

$$p' = (n_1p_1 + n_2p_2) / (n_1 + n_2)$$

As in Table 1, an average design effect of 1.3 was used in constructing Table 3.

Values tabulated in Table 3 represent the recommended sampling error allowance for estimated differences between two independent subclass percentages. To use Table 3, first locate the subtable which best corresponds to the range of the two percentage estimates that are being compared. Note that the sub tables are organized according to the approximate value of the two independent subclass percentages, not according to the value of the difference of percentages. Having located the appropriate part of the table, the recommended sampling error allowance is obtained by cross-referencing the sample size values (n_1 and n_2) for the two percentage estimates that are being compared.

[6]See Stuart, Alan, Standard Errors for Percentages. Applied Statistics, Vol. XII, No. 2, 1963, pp.87-101.

TABLE 2
CONFIDENCE INTERVALS FOR ESTIMATED PERCENTAGES[a]

PERCENT NEAR		SAMPLE SIZE 100	200	300	400	500	750	1000	1250	1500	2000	2500	3000
1%	-	0.9	0.8	0.7	0.7	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.3
	+	5.5	3.2	2.3	1.9	1.6	1.2	1.0	0.9	0.8	0.6	0.6	0.5
5%	-	3.1	2.5	2.1	1.9	1.8	1.5	1.3	1.2	1.1	1.0	0.9	0.8
	+	7.4	4.7	3.6	3.0	2.7	2.1	1.8	1.6	1.4	1.2	1.1	1.0
10%	-	4.9	3.8	3.2	2.9	2.6	2.2	1.9	1.7	1.6	1.4	1.3	1.2
	+	8.7	5.8	4.5	3.9	3.4	2.7	2.3	2.1	1.9	1.6	1.4	1.3
20%	-	7.4	5.6	4.7	4.1	3.7	3.1	2.7	2.4	2.2	1.9	1.7	1.6
	+	10.3	7.0	5.6	4.8	4.3	3.5	3.0	2.6	2.4	2.1	1.8	1.7
30%	-	9.1	6.7	5.5	4.8	4.4	3.6	3.1	2.8	2.6	2.2	2.0	1.8
	+	11.0	7.7	6.2	5.3	4.8	3.9	3.3	3.0	2.7	2.3	2.1	1.9
40%	-	10.2	7.4	6.1	5.3	4.8	3.9	3.4	3.1	2.8	2.4	2.2	2.0
	+	11.2	7.9	6.4	5.6	5.0	4.1	3.5	3.1	2.9	2.5	2.2	2.0
50%	-	10.9	7.8	6.4	5.6	5.0	4.1	3.5	3.2	2.9	2.5	2.2	2.0
	+	10.9	7.8	6.4	5.6	5.0	4.1	3.5	3.2	2.9	2.5	2.2	2.0
60%	-	11.2	7.9	6.4	5.6	5.0	4.1	3.5	3.1	2.9	2.5	2.2	2.0
	+	10.2	7.4	6.1	5.3	4.8	3.9	3.4	3.1	2.8	2.4	2.2	2.0
70%	-	11.0	7.7	6.2	5.3	4.8	3.9	3.3	3.0	2.7	2.3	2.1	1.9
	+	9.1	6.7	5.5	4.8	4.4	3.6	3.1	2.8	2.6	2.2	2.0	1.8
80%	-	10.3	7.0	5.6	4.8	4.3	3.5	3.0	2.6	2.4	2.1	1.8	1.7
	+	7.4	5.6	4.7	4.1	3.7	3.1	2.7	2.4	2.2	1.9	1.7	1.6
90%	-	8.7	5.8	4.5	3.9	3.4	2.7	2.3	2.1	1.9	1.6	1.4	1.3
	+	4.9	3.8	3.2	2.9	2.6	2.2	1.9	1.7	1.6	1.4	1.3	1.2
95%	-	7.4	4.7	3.6	3.0	2.7	2.1	1.8	1.6	1.4	1.2	1.1	1.0
	+	3.1	2.5	2.1	1.9	1.8	1.5	1.3	1.2	1.1	1.0	0.9	0.8
99%	-	5.5	3.2	2.3	1.9	1.6	1.2	1.0	0.9	0.8	0.6	0.6	0.5
	+	0.9	0.8	0.7	0.7	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.3

[a]The figures in this table, when subtracted from or added to the observed percentage, form the 95 percent confidence interval.

TABLE 3
RECOMMENDED ALLOWANCE FOR SAMPLING ERROR OF DIFFERENCES

	n_2											
n_1	100	200	300	400	500	750	1000	1250	1500	2000	2500	3000
	a. For comparing percentage estimates near 1% or 99%											
100	3.1											
200	2.7	2.2										
300	2.6	2.0	1.8									
400	2.5	1.9	1.7	1.6								
500	2.4	1.9	1.6	1.5	1.4							
750	2.4	1.8	1.5	1.4	1.3	1.1						
1000	2.3	1.7	1.5	1.3	1.2	1.1	1.0					
1250	2.3	1.7	1.4	1.3	1.2	1.0	0.9	0.9				
1500	2.3	1.7	1.4	1.3	1.1	1.0	0.9	0.9	0.8			
2000	2.3	1.6	1.4	1.2	1.1	1.0	0.9	0.8	0.8	0.7		
2500	2.3	1.6	1.4	1.2	1.1	0.9	0.8	0.8	0.7	0.7	0.6	
3000	2.3	1.6	1.3	1.2	1.1	0.9	0.8	0.7	0.7	0.6	0.6	0.6
	b. For comparing percentage estimates near 5% or 95%											
100	6.9											
200	6.0	4.9										
300	5.6	4.4	4.0									
400	5.4	4.2	3.7	3.4								
500	5.3	4.1	3.6	3.3	3.1							
750	5.2	3.9	3.3	3.0	2.8	2.5						
1000	5.1	3.8	3.2	2.9	2.7	2.4	2.2					
1250	5.1	3.7	3.1	2.8	2.6	2.2	2.1	1.9				
1500	5.0	3.7	3.1	2.7	2.5	2.2	2.0	1.9	1.8			
2000	5.0	3.6	3.0	2.7	2.4	2.1	1.9	1.8	1.7	1.5		
2500	5.0	3.6	3.0	2.6	2.4	2.0	1.8	1.7	1.6	1.5	1.4	
3000	5.0	3.6	2.9	2.6	2.4	2.0	1.8	1.6	1.5	1.4	1.3	1.3
	c. For comparing percentage estimates near 10% or 90%											
100	9.5											
200	8.2	6.7										
300	7.7	6.1	5.5									
400	7.5	5.8	5.1	4.7								
500	7.3	5.6	4.9	4.5	4.2							
750	7.1	5.3	4.6	4.2	3.9	3.5						
1000	7.0	5.2	4.4	4.0	3.7	3.2	3.0					
1250	7.0	5.1	4.3	3.9	3.5	3.1	2.8	2.7				
1500	6.9	5.0	4.2	3.8	3.5	3.0	2.7	2.6	2.4			
2000	6.9	5.0	4.2	3.7	3.4	2.9	2.6	2.4	2.3	2.1		
2500	6.8	4.9	4.1	3.6	3.3	2.8	2.5	2.3	2.2	2.0	1.9	
3000	6.8	4.9	4.1	3.6	3.2	2.7	2.4	2.3	2.1	1.9	1.8	1.7

TABLE 3
RECOMMENDED ALLOWANCE FOR SAMPLING ERROR OF DIFFERENCES

	n_2											
n_1	100	200	300	400	500	750	1000	1250	1500	2000	2500	3000
d. For comparing percentage estimates near 15% or 85%												
100	11.3											
200	9.8	8.0										
300	9.2	7.3	6.5									
400	8.9	6.9	6.1	5.6								
500	8.7	6.7	5.8	5.4	5.0							
750	8.5	6.4	5.5	4.9	4.6	4.1						
1000	8.4	6.2	5.3	4.7	4.4	3.9	3.6					
1250	8.3	6.1	5.1	4.6	4.2	3.7	3.4	3.2				
1500	8.2	6.0	5.0	4.5	4.1	3.6	3.3	3.1	2.9			
2000	8.2	5.9	4.9	4.4	4.0	3.4	3.1	2.9	2.7	2.5		
2500	8.1	5.9	4.9	4.3	3.9	3.3	3.0	2.8	2.6	2.4	2.3	
3000	8.1	5.8	4.8	4.2	3.9	3.3	2.9	2.7	2.5	2.3	2.2	2.1
e. For comparing percentage estimates near 20% or 80%												
100	12.6											
200	10.9	8.9										
300	10.3	8.2	7.3									
400	10.0	7.7	6.8	6.3								
500	9.8	7.5	6.5	6.0	5.7							
750	9.5	7.1	6.1	5.5	5.2	4.6						
1000	9.4	6.9	5.9	5.3	4.9	4.3	4.0					
1250	9.3	6.8	5.7	5.1	4.7	4.1	3.8	3.6				
1500	9.2	6.7	5.7	5.0	4.6	4.0	3.6	3.4	3.3			
2000	9.2	6.6	5.5	4.9	4.5	3.8	3.5	3.2	3.1	2.8		
2500	9.1	6.6	5.5	4.8	4.4	3.7	3.3	3.1	2.9	2.7	2.5	
3000	9.1	6.5	5.4	4.8	4.3	3.6	3.3	3.0	2.8	2.6	2.4	2.3
f. For comparing percentage estimates near 25% or 75%												
100	13.7											
200	11.9	9.7										
300	11.2	8.8	7.9									
400	10.8	8.4	7.4	6.8								
500	10.6	8.1	7.1	6.5	6.1							
750	10.3	7.7	6.6	6.0	5.6	5.0						
1000	10.1	7.5	6.4	5.7	5.3	4.7	4.3					
1250	10.1	7.4	6.2	5.6	5.1	4.5	4.1	3.9				
1500	10.0	7.3	6.1	5.4	5.0	4.3	4.0	3.7	3.5			
2000	9.9	7.2	6.0	5.3	4.8	4.1	3.7	3.5	3.3	3.1		
2500	9.9	7.1	5.9	5.2	4.7	4.0	3.6	3.4	3.2	2.9	2.7	
3000	9.8	7.1	5.9	5.2	4.7	4.0	3.5	3.3	3.1	2.8	2.6	2.5

TABLE 3
RECOMMENDED ALLOWANCE FOR SAMPLING ERROR OF DIFFERENCES

	n_2											
n_1	100	200	300	400	500	750	1000	1250	1500	2000	2500	3000
	g. For comparing percentage estimates near 30% or 70%											
100	14.5											
200	12.5	10.2										
300	11.8	9.3	8.4									
400	11.4	8.9	7.8	7.2								
500	11.2	8.6	7.5	6.9	6.5							
750	10.9	8.1	7.0	6.3	5.9	5.3						
1000	10.7	7.9	6.7	6.1	5.6	4.9	4.6					
1250	10.6	7.8	6.6	5.9	5.4	4.7	4.3	4.1				
1500	10.6	7.7	6.5	5.8	5.3	4.6	4.2	3.9	3.7			
2000	10.5	7.6	6.3	5.6	5.1	4.4	4.0	3.7	3.5	3.2		
2500	10.4	7.5	6.3	5.5	5.0	4.3	3.8	3.5	3.3	3.1	2.9	
3000	10.4	7.5	6.2	5.5	4.9	4.2	3.7	3.4	3.2	3.0	2.8	2.6
	h. For comparing percentage estimates near 35% or 65%											
100	15.1											
200	13.1	10.7										
300	12.3	9.7	8.7									
400	11.9	9.2	8.1	7.5								
500	11.7	8.9	7.8	7.2	6.7							
750	11.3	8.5	7.3	6.6	6.2	5.5						
1000	11.2	8.3	7.0	6.3	5.8	5.1	4.8					
1250	11.1	8.1	6.9	6.1	5.6	4.9	4.5	4.3				
1500	11.0	8.0	6.7	6.0	5.5	4.8	4.4	4.1	3.9			
2000	10.9	7.9	6.6	5.8	5.3	4.6	4.1	3.8	3.6	3.4		
2500	10.9	7.8	6.5	5.7	5.2	4.4	4.0	3.7	3.5	3.2	3.0	
3000	10.8	7.8	6.5	5.7	5.1	4.4	3.9	3.6	3.4	3.1	2.9	2.8
	i. For comparing percentage estimates near 40% or 60%											
100	15.5											
200	13.4	10.9										
300	12.6	10.0	8.9									
400	12.2	9.5	8.4	7.7								
500	12.0	9.2	8.0	7.3	6.9							
750	11.7	8.7	7.5	6.8	6.3	5.7						
1000	11.5	8.5	7.2	6.5	6.0	5.3	4.9					
1250	11.4	8.3	7.0	6.3	5.8	5.1	4.6	4.4				
1500	11.3	8.2	6.9	6.2	5.7	4.9	4.5	4.2	4.0			
2000	11.2	8.1	6.8	6.0	5.5	4.7	4.2	3.9	3.7	3.5		
2500	11.2	8.0	6.7	5.9	5.4	4.6	4.1	3.8	3.6	3.3	3.1	
3000	11.1	8.0	6.6	5.8	5.3	4.5	4.0	3.7	3.5	3.2	3.0	2.8

TABLE 3
RECOMMENDED ALLOWANCE FOR SAMPLING ERROR OF DIFFERENCES

	n_2											
n_1	100	200	300	400	500	750	1000	1250	1500	2000	2500	3000
j. For comparing percentage estimates near 45% or 55%												
100	15.7											
200	13.6	11.1										
300	12.8	10.1	9.1									
400	12.4	9.6	8.5	7.9								
500	12.2	9.3	8.1	7.5	7.0							
750	11.8	8.8	7.6	6.9	6.4	5.7						
1000	11.7	8.6	7.3	6.6	6.1	5.4	5.0					
1250	11.6	8.5	7.1	6.4	5.9	5.1	4.7	4.4				
1500	11.5	8.4	7.0	6.3	5.7	5.0	4.5	4.3	4.1			
2000	11.4	8.2	6.9	6.1	5.6	4.8	4.3	4.0	3.8	3.5		
2500	11.3	8.2	6.8	6.0	5.4	4.6	4.2	3.9	3.6	3.3	3.1	
3000	11.3	8.1	6.7	5.9	5.4	4.5	4.1	3.7	3.5	3.2	3.0	2.9
k. For comparing percentage estimates near 50%												
100	15.8											
200	13.7	11.2										
300	12.9	10.2	9.1									
400	12.5	9.7	8.5	7.9								
500	12.2	9.3	8.2	7.5	7.1							
750	11.9	8.9	7.6	6.9	6.5	5.8						
1000	11.7	8.7	7.4	6.6	6.1	5.4	5.0					
1250	11.6	8.5	7.2	6.4	5.9	5.2	4.7	4.5				
1500	11.5	8.4	7.1	6.3	5.8	5.0	4.6	4.3	4.1			
2000	11.4	8.3	6.9	6.1	5.6	4.8	4.3	4.0	3.8	3.5		
2500	11.4	8.2	6.8	6.0	5.5	4.7	4.2	3.9	3.6	3.4	3.2	
3000	11.4	8.2	6.8	5.9	5.4	4.6	4.1	3.8	3.5	3.2	3.0	2.9

[a]The figures in this table, when subtracted from or added to the observed difference in the percentages, form the 95 percent confidence interval around that difference.

Sample Coverage and Non Response Errors

In addition to sampling errors, all surveys are subject to other sources of errors, including: population coverage, nonresponse, reporting, and processing errors. Household telephone samples fail to include the approximately 6% of U.S. households that are not telephone subscribers, although the percentage of nonsubscribers is declining over time. Past analysis suggests that nonsubscribers are disproportionately poor, live in the rural areas, and are more likely to rent and live alone than the rest of the population. Current studies of the bias which results from the exclusion of non telephone subscribers indicate that it is not severe and probably is within the accuracy requirements for most, but not all, survey research projects.[7]

Since not all selected respondents agree to participate in the survey, nonresponse errors are also present. In addition, factors such as question wording and the ability of respondents to recall factual details and articulate answers and opinions also affect the accuracy of survey finding. There are no standard measures of these effects, but their presence should be acknowledged when using these and other survey data. While measurement effects are present in all surveys, a noted advantage of the rotating panel design of the ongoing monthly surveys is that the non sampling influences remain relatively constant across samples.

Sample Weights

Two different sets of weights are available for use with the monthly surveys depending on the preferred unit of analysis: households or adults. The household weights are designed to yield a representative sample of all U.S. households; the adult weights are designed to yield a representative sample of all adults living in private households. The choice between these weights depends solely on the objectives of the research. This choice is not equivalent to the difference between the measurement of household characteristics (e.g. size, location, income, wealth), and characteristics of individuals (e.g. attitudes, expectations, education, employment, wages). Rather, the choice of weights depends

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[7]Groves, Robert M., and Kahn, Robert L., Surveys by Telephone: A National Comparison with Personal Interviews, New York: Academic Press, 1979.

on the preferred unit of analysis or "population" which the sample results are intended to represent. For example, studies of population attitudes often used the "adult" weights to examine the prevalence and dynamics of attitude change among individuals; studies of economic behavior often use the "household" weights, reflecting an interest in the household as the appropriate decision making unit for analysis.

For a representative sample of U.S. telephone households, differential case weighting is needed to take account of multiple phone-line ownership so as to equalize the probability with which each household was selected. For a representative sample of the U.S. adult population, each household must be weighted by the number of eligible respondents living in each household. This correction to the selection probabilities is needed since only one respondent per household was interviewed, and the probability of being selected as the respondent was inversely proportional to the number of eligible household members.

Corrections for non telephone ownership, survey nonresponse, and panel attrition are introduced through post stratification by selected demographic characteristic. Data from the Current Population Surveys conducted by the Census are used to adjust for variations in the age and income distributions observed in the monthly samples. In practice, the post stratification weights do not yield "weighted" response distributions that differ significantly from the "unweighted" results--that is, the differences are within the margin of the expected sampling error.

The RDD and reinterview portions of the sample are post stratified separately. This permits the construction of weights designed for analyses based solely on cases in either portion of the sample, and allows the pooling of cases when the analyses are based on the full sample. The separate post stratification also explicitly recognizes the underlying differences between initial refusals and panel attrition. The potential non response bias in the RDD portion of the sample relate to several factors: a) establishing contact with the selected households--for example, some phones may never be answered as the occupants are away for an extended period of time, or because answering machines are used to screen and avoid calls; b) establishing contact with the selected respondent--interviews are conducted only with the designated respondent, no substitutions are allowed even if the designated respondent is unavailable for the entire study period due to work schedules, travel, and so forth; and c) the willingness of the selected respondent to be interviewed. For the reinterview portion of the sample, there are additional sources of non response bias related to our ability to recontact respondents that have moved, changed phone numbers, or discontinued phone service. Willingness to be interviewed a second time may reflect different considerations on the part of the respondent, especially given their knowledge about the content of the interview.

Before the weights for the RDD and the reinterview portions of the sample are integrated one further adjustment is made, based on the strengths of the rotating panel design of the monthly surveys. The rotating panel design offers important statistical advantages for the measurement of change over time. The statistical advantage stems from the reduction in the standard errors of the observed differences in observed means between two overlapping samples as compared with two independent samples. The variances of the estimated differences over time are reduced to the extent that the repeated measures in the reinterview portion of the sample are positively correlated. Due to the correlation, each case in the reinterview portion of the sample contributes less to the variance (by one minus the correlation coefficient) than cases from the RDD sample. To take advantage of this variance reduction feature, the weights given to the RDD cases are decreased relative to the reinterview cases so as to achieve estimates of differences with minimum variance.[8] The weight factor used is based on the

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[8]See Kish, Leslie, Survey Sampling, New York: John Wiley & Sons, 1965, Section 12.4, and Kish, Leslie, Statistical Design for Research, New York: John Wiley & Sons, 1987, Section 6.2.

average correlation among the five questionnaire items used to construct the Index of Consumer Sentiment. When the correlation is zero, each portion of the sample is given equal weight; as the correlation increases, the relative weight given to the RDD portion of the sample decreases.

An additional weight factor is also used especially for the analysis of the economic status of households. This weight is motivated by the concern with "proxy" reports on the financial status and decision making in households. The procedures assume that for households containing married couples that either spouse would be an appropriate reporter, but other "proxy" reporters living in these household, such as adult children, would not have all of the available information needed to respond to the detailed questions on household financial matters. To avoid this source of potential bias in household reports, weights are introduced to adjust the original selection probabilities to exclude these "proxy" reporters.

Questionnaire Development

The science of survey sampling is so advanced that discussions of errors often deal with fractions of percentage points, but the principles of questionnaire design and interviewing are much less precise. A large body of evidence gathered from carefully designed experiments on a wide variety of topics suggest that the potential range of error involved in some questions may be twenty or thirty rather than two or three percentage points. This suggests that, in surveys based on probability samples, there will be more room for improvement in the questionnaire than in the sample. SRC has developed a set of conventions and standards for the design of questionnaires. These guidelines use structural and visual techniques to produce questionnaires that are clear, reliable and easy for interviewers to use accurately.

SRC's ongoing programs in survey methodology, which include studies of the effects of variations in question wording, question order, and interviewing techniques, contribute strongly to the development of greater precision in this area. The research conducted by Howard Schuman on question form and wording, using the monthly Surveys of Consumers, continues to make significant contributions to these developments.

Usually the sponsoring organization provides the initial draft of the questionnaire items to be included in the monthly surveys. After review by SRC and discussions with the sponsor, a pretest questionnaire is developed. The refinement of questionnaire items is then guided by rigorous and careful pretesting. A draft questionnaire is then constructed, and testing is conducted under essentially "final state" conditions--that is, pretest respondents fit all the eligibility criteria of the study, and experienced interviewers and supervisory personnel are employed. Two pretests are conducted on all new questionnaire items before each monthly survey. The overall time necessary for questionnaire development depends on the detail and depth of the particular investigation. Most questionnaire inserts can be developed and pre-tested within one month; complex questionnaire designs may need two months or more, especially if pretest results indicate significant problems.

SRC does not have a blanket policy with respect to any specific questions or content area. However, SRC will not field questions when pretesting indicates that the information being sought cannot be obtained accurately. SRC also reviews all topic areas and research procedures to determine whether they pose any risks to the respondent. If risk is present and judged to outweigh clearly demonstrable benefits, SRC will not put the subjects at risk.

Telephone Interviewing

Telephone Interviewing Facility (located within the Institute itself) is designed to make full use of the latest methodological and technical developments in telephone interviewing. Acoustically-isolated interviewing stations are arranged in clusters around glass-enclosed supervisor's booths from which interviews can be monitored to assure that questions are being asked and responses recorded according to study specifications. Samples of monitored interviews are scored objectively on such interviewer behavior as reading questions correctly, using appropriate (nondirective) probes, interacting with the respondent to reinforce accurate reporting, correctness of pace and voice inflection, and accuracy in recording answers.

The telephone facility has an interviewing staff of more than 60 persons, whose hiring, training, and supervision is conducted in Ann Arbor. Interviewers are available for evening and weekend calls as well as daytime work. People are sought who are suitable for conducting interviews on a variety of topics, and with a broad range of respondents.

Each new interviewer receives four days of basic training in interviewing, sampling, and administrative skills. A typical training agenda consists of two classroom days devoted to doorstep introductions and general interviewing techniques: question asking, clarification, probing, data recording and editing (review) of completed interviews. These skills are practiced in round robin fashion in the classroom and on a one-on-one basis with the supervisor or the training assistant playing the role of the respondent. The instructional materials, developed by SRC and published in 1983, rely on self-instructional techniques and taped (audio) information. Training Days three and four reinforce the training of the first two days and introduce new materials on other aspects of the interviewer role. These are sample update, respondent selection, refusal conversion, reporting procedures, administrative forms, and organization of field tasks. A shortened version of the actual study questionnaire, question-by-question objectives, and coversheet are used in Days three and four to model techniques learned in earlier days as well as cover study-specific issues. The basic training procedures are documented in SRC's General Interviewing Techniques which is used by each interviewer for reference.

For each monthly survey, a supplementary training document is also produced. The supplementary guide is a comprehensive study-specific reference document which includes sampling instructions, respondent selection criteria, an item-by-item discussion of the coversheet, and question-by-question objectives. In addition to their training purposes, these documents can be referenced when difficulties are encountered in the interview situation.

For each monthly survey, all interviewers study the questionnaire instructions and complete a practice interview before the interviewing begins. A quality control team reviews the practice interviews to see that the interviewer is employing proper question-asking and probing techniques and is conducting the interview in a professional manner and gives prompt feedback to interviewers. Experience has shown that actual practice and feedback on performance is the most effective form of training. General problems are noted and instructions are clarified. Additional practice interviews may be assigned. If serious problems with an interviewer's work are discovered, the interviewer will receive special follow-up training. If this does not solve the problem, or if the problem is judged too serious to be solved by training, the interviewer will not be used for production interviewing.

Interviewer training does not stop when production interviewing starts. The training function continues when supervisors review, evaluate, and provide feedback to each interviewer throughout the study. Incoming interviews are reviewed for acceptability at each step. If interviewer error results in an unacceptable interview, the material is returned, and appropriate supervisory action is taken. If there is missing information which can be obtained, the interview will be routed to the appropriate interviewer for completion.

Sample administration is controlled through computerized logging systems which store the history of contacts, the final disposition of each sample unit, interview length, control sample ID, respondent characteristics, reasons for noninterviews, etc. The resulting control files are used to generate a variety of reports to track the progress of studies and the quality of performance of individual interviewers. The performance scores are combined with other quality scores obtained from the review of interviews by supervisors to generate objective interviewer evaluation rankings for performance feedback.

Although strenuous efforts are made to interview the hard-to-contact, the efforts made to win over the reluctant are low-pressured and reasonable. This is consistent with the voluntary nature of the interview which respondents are informed of when we obtain their consent. Past experience indicates that there may be negative outcomes to excessive pressures on truly reluctant individuals. We have found that data obtained from suspicious and reluctant respondents may be so inaccurate that the reporting error they introduce outweighs nonresponse bias. All respondents are mailed a brief report on the results of the study. For the RDD sample, the byproduct of this is to track those respondents that may have moved, as well as to motivate all respondents to participate in the reinterview.

If possible, persuasion letters are sent to all but the most vehement refusals. Address information is usually available for the reinterview cases, but not for the RDD sample unless the respondent volunteers this information when initially contacted. If it seems appropriate, a different interviewer will be assigned to make the callback. Our experience is that between 25 and 35 percent of refusals are converted to interviews following these procedures. Interviewers who have high refusal rates are identified and supervisors work with them to improve their techniques. If refusals appear to be due to interviewer qualities which are not correctable through retraining, the work is reassigned.

Several special procedures are used to guard against the potential falsification of interviews and the introduction of interviewer bias into the data. SRC conducts a telephone validation check on a small subset of all completed interviews. In addition, a statistical evaluation of the detailed administrative reports provides a second effective means of detecting deviation from specified procedures. It is often easier for an interviewer to make up responses to certain questions than it is to make up a normal distribution on process measures such as calls required to obtain an interview, number of refusals, interview length, edit length, and so forth. SRC requires detailed reporting of these process measures and employs computerized analysis of these data to identify outliers whose work is then thoroughly verified.

Coding Section

The SRC Coding Section is responsible for designing and building codes, for converting the response data to machine-usable form, and for error checking. Special training sessions are conducted for each project so that the format and objectives of each study are fully understood by each coder and all coders share a uniform interpretation of each question and code and the overall structure of the study design.

Many of the traditional post-coding data cleaning steps are eliminated through the use of the Survey Research Center's Direct Data Entry (DDE) system. This set of computer software is designed to allow the data to be directly entered into a computer subject to a series of automatic checks for eligible and consistent coding patterns. This DDE software eliminates many of the incorrect codes that naturally occur as part of the coding process. Various auxiliary programs allow the supervisory staff to monitor quality of each coder's performance and to review values coded for individual variables across coded cases.

In the actual coding process, as the respondent's answers to each question are categorized, the coder also takes into account all marginal comments or general notes about the interviewing situation which the interviewer may have written, and answers given to other questions which may aid in interpreting responses that by themselves are too vague to be coded with precision. This process requires a complete review of each questionnaire, from beginning to end, by a single coder. It is at this point that defects in the collection of the data are often discovered--such as an interviewer having recorded inconsistent responses to questions or not having obtained sufficient detail to allow a response to be coded accurately. Any problems of this nature that are encountered are quickly brought to the attention of the individual interviewers.

"Check coding" is the systematic and independent re-coding of all responses from a sample of questionnaires and is performed as part of routine quality control for the coding operation. This operation is usually carried out by the coding supervisor. Its main purposes are to reduce errors and to determine the overall reliability or consistency of the coded data. Check coding also guides the continued training of coders, since it reveals any misunderstandings or differences of interpretation. For each monthly survey, ten percent of the interviews are check coded.

Newly hired coders are trained on general coding techniques and in the use of our terminals and DDE programs in advance of the training for a specific project. New hires are given time to familiarize themselves with the "mechanics" of the coding process before beginning production work on "live" data. Perhaps the most valuable part of the training program consists of practice sessions. These generally begin by having each of the participating coders independently code a copy of a "practice interview," which is usually prepared by the researchers and the coding supervisor from actual responses. This gives the coder some familiarity with the format of the project's questionnaire as well as some experience with actual responses that will illustrate important or difficult coding decisions. The results are reviewed, question by question, and feedback is given to each coder on any discrepancies found.

Initial processing includes preliminary distributions on key variables to check for possible problems in editing, coding or other data management steps. Univariate frequencies are obtained for all variables, and simple descriptive analysis is performed on some variables as an additional check for possible errors. Printed documentation contains univariate frequency distributions for all variables.

Institutional Resources

The Institute for Social Research (ISR) was established at The University of Michigan in 1946 and is now one of the largest university-based social science research institutions in the world. The Institute incorporates three individual centers:

The Survey Research Center (SRC) is the institutional unit responsible for the conducting of sampling, field, and coding, and maintains its own computing section. The Center's four major objectives and priorities are: to conduct surveys of general social importance; to conduct research on survey methodology; to foster interdisciplinary research; and to provide training in all phases of survey research.

The Survey Research Center conducts multidisciplinary studies of large populations, organizations, and special segments of society. Its interests include the properties of mass publics, social aggregates, organized and structured social units, and the behavior of individuals in various social roles and settings.

SRC also maintains the facilities and resources to carry out such large-scale research enterprises, including national and regional face-to-face surveys, national and regional telephone surveys, and surveys of rare populations. In addition the Survey Research Center has been a leader in the development and use of Computer Assisted Telephone Interviewing (CATI).

The Research Center for Group Dynamics is concerned with developing a basic scientific understanding of social psychology and the factors that influence people's behavior in groups.

The Center for Political Studies examines major problems surrounding the role of political institutions and the factors that influence individual political behaviors in the context of contemporary social, economic, and political environments.

In the supportive context of the Institute's extensive array of research services, researchers from a number of disciplines provide the expertise necessary to design and conduct a wide range of projects relevant to major public policy issues and to ensure the scientific validity of their results. The ISR senior staff currently includes 90 PhD-level research scientists, about 50 researchers at the Master's level, approximately a dozen postdoctoral trainees, several hundred research support personnel, and a nationwide field interviewing staff of more than 200 people.

The Institute is both financially and administratively an integral part of The University of Michigan. From its inception in 1946, the Institute has been responsible for securing from non-University sources funding necessary to conduct its research and support its staff. The Institute maintains a business office, including accounting and grant proposal services, personnel unit, library, duplicating services, and computer services. Other services and facilities are provided through the University including access to the University's powerful computing capabilities, as well as telephone service, staff benefits, workers' and unemployment compensation, and insurance.