THE THREE CARD METHOD:
Estimating Sensitive Survey Items—With Permanent Anonymity of Response

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Traditional approaches to reducing question threat (Bradburn and Sudman, 1979) include, e.g., the self-administered questionnaire (or "secret ballot") and, more recently, audio CASI (Turner et al., 1996; 1998). These approaches protect respondent privacy vis-à-vis the interviewer and others in the immediate environment of the interview.

Various other techniques developed from the 1960s through the early 1990s are designed to provide **permanent anonymity of response** to sensitive questions. Included here are randomized response (Warner, 1965; Greenberg, et al., 1969), aggregated response (Warner, 1971; Boruch and Cecil, 1979), item-count (Droitcour et al., 1991), and respondent reports concerning other (anonymous) persons (Sirken, 1975; Sudman et al., 1977; Miller, 1985).[2] Such techniques promise that no one (including the principal investigator, the database administrator, outside "hackers," etc.) would **ever** be able to discover a respondent's status with respect to the sensitive question. They may also help reduce question threat. Yet, these techniques involve unusual lines of questioning and--for a variety of reasons--none have proved completely satisfactory. (For example, randomized response requires respondents to perform complex randomization tasks for which interviewers must provide seemingly "mind-boggling" explanations; the result can be respondent suspicion, confusion, and uncertainty as to the level of disclosure that a truthful answer entails.[3] Another limitation of randomized response is the inability to check respondent answers through further questions.)

Finding a satisfactory way to ensure permanent anonymity of response is, in our view, important because (1) information is needed for policy areas that involve sensitive topics and (2) concerns about respondent privacy extend beyond the point of data collection. (For example, privacy concerns extend to the storage and usage of data, data-sharing for record

linkage, disclosing data to researchers and others, and potential "re-identification" of data subjects in "deidentified" datasets; see, e.g., GAO, 2001.) Thus, there is a need to develop and use a workable technique that not only reduces question threat but also—and perhaps more importantly—can provide permanent anonymity of response.

A new technique (devised in the late 1990s) builds on the previous anonymity techniques described above and demographic methods of residual estimation (Shryock and Siegel, 1980; Warren and Passel, 1987). This technique is known as the "three card method" (GAO, 1998). It was originally designed to survey foreign-born persons about their immigration status (including illegal or undocumented status); however, it potentially can be applied in a variety of other sensitive question areas (GAO, 1999).

The present paper discusses the three card method in terms of (1) basic logic, (2) special features, (3) preliminary testing and results, and (4) variance costs and ways to reduce them. A final section shows how an immigration group that is currently of special concern—"visa overstays"—might be estimated using a version of the method.

The Three Card Method
The three card method is applicable for questions that ask the respondent to choose one of several mutually exclusive answers--only one of which is highly threatening. (The most threatening answer category will be referred to as the sensitive answer category; the other answer categories will be referred to as less sensitive.) The three card method involves:
- a three-box answer format;
- three independent samples, each of which is (1) selected to be representative of the population of interest, (2) composed of completely different persons, and (3) asked the same potentially threatening question;
- three slightly different (8-1/2" X 11" three-box) answer cards, one for each sample.

As described below using the example of immigration status, slightly different answer cards are designed so that each sample provides a different piece of less sensitive information—a different "piece of the puzzle." The outlines of the missing sensitive piece are apparent when all other pieces are in place. No respondent is ever asked directly

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[1]This paper does not necessarily reflect the views or position of the U.S. General Accounting Office.
[2]Related methods transform data after reporting so as to ensure anonymity in future (Spruill and Gastwirth, 1982.)
[3] Greenberg et al., 1969; Wiseman et al., 1975-76; Shimizu and Bonham, 1978; Tracy and Fox, 1981.

whether he or she is in the sensitive answer category. Information for the sensitive answer category is estimated indirectly for the entire population of interest, or for major subgroups.

The three-box answer format groups various answer categories in three boxes (Box A, Box B, and Box C). The respondent answers by picking one of the boxes. The mutually exclusive answer categories are arranged in the boxes so that the sensitive category appears in a box that also includes several less sensitive answer categories. For example, if the potentially sensitive question concerns a foreign-born respondent's current legal status, the sensitive category--illegal or "undocumented" immigration status—would be appear in the same box as other less sensitive categories (refugee or asylee,[4] naturalized citizen, etc.).

The three-box format is illustrated in Legal Status Card 1 below (shown in a reduced size; actual cards are 8-1/2" by 11"). Because this and other materials were developed in Spanish, we provide an English translation of card 1:

- **Box A**: Legal permanent resident with a valid and official green card issued to me by the U.S. government.
- **Box B**: U.S. citizen; student, work or tourist visa; undocumented (do not have my own valid official green card); and refugee or asylee (without a green card).
- **Box C**: Some other category not in Box A or Box B (specify).

Respondents are asked to report which box applies to them and are told that if it is Box B, we do not want to know which specific category applies to them.

Legal Status Card 1 is used with sample 1. The main purpose of interviews with sample 1 is to obtain a valid estimate of the percentage of foreign-born persons who have officially obtained green cards. Sample 1 data also provide correlates and other information about the "green card" population, based on other items in the questionnaire.

Legal Status Card 2 (shown on the following page) rearranges the answer categories in the same three-box format (see Legal Status Card 2, below). This time, Box A contains the status of a naturalized U.S. citizen, whereas Box B now includes the legal permanent resident or green card status, along with other immigration statuses. This answer card is shown to respondents in sample 2 (**completely different individuals than in sample 1**). Sample 2 provides a direct estimate of the percentage of foreign-born persons who are naturalized citizens. Sample 2 also provides correlates and other information about naturalized citizens.

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[4]An asylee is a person who has been granted asylum.

Legal Status Card 1

Legal Status Card 3 again rearranges the answer categories. This time, Box A features refugees and persons granted asylum as well as those here legally with temporary visas. (See Legal Status Card 3, on the following page.) This card is shown to respondents in sample 3 (**completely different individuals than those in samples 1 and 2**). Respondents choosing Box A, can be asked which specific status applies to them. But as always, respondents are told that if they are in Box B, we do not want to know which specific status applies to them. The main purpose of sample 3 data is to provide a valid estimate of the percentages of foreign-born in Box A statuses. Again, Sample 3 also provides correlates and other information about persons in Box A statuses.

As indicated above, each of the legal status categories—except for the sensitive category (illegal or undocumented status)—alternatively appears in Box A. Assuming that the legal status categories are mutually exclusive and that these categories, together with Box C ("some other category…."), represent an exhaustive set of possible legal statuses, it is possible to obtain an indirect estimate of illegal immigrants.

Legal Status Card 2

To illustrate this, we use the following hypothetical example for, e.g., foreign-born Mexican respondents: 39% of sample 1 chose Box A of Legal Status Card 1 (green card); 20% of sample 2 chose Box A of Legal Status Card 2 (naturalized U.S. citizen);[5] and 4% chose Box A of Legal Status Card 3 (refugees, asylees, and persons here legally with temporary visas). This would indicate that 63% of the foreign-born were here legally in these major statuses (39% + 20% + 4% = 63%). Suppose that 1% also picked Box C (some other category). Subtracting these hypothetical estimates from 100 yields 36% (100%-63%-1% = 36%). Thus, our indirect estimate would be that 36% of foreign-born Mexicans are here illegally.

The statistical expression of the indirect estimator of the sensitive category has been reported elsewhere (GAO, 1998; 1999).

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[5]While these are hypothetical data, we based these figures on existing data, estimates, or projections to the extent possible. Because of possible inaccurate self-reports in current surveys, there is some uncertainty regarding the percentage of Mexican residents of the U.S. who are naturalized U.S. citizens (see Passel and Clark, 1998).

Special Features of the Three-Card Method

Special features of the three-card method include "trainer cards," follow-up questions, and estimated correlates (or subgroups estimates) of the sensitive category.

Legal Status Card 3

Trainer Cards

Before showing a respondent the legal status card assigned to his or her sample, the interviewer asks questions on less sensitive topics using answer cards with three boxes.

The purpose is to train respondents in the use of the three-box format—and to familiarize them with the notion that "if you're in Box B, we don't want to know which specific category applies to you." Thus, when respondents are presented with the legal status card assigned to their sample, they will be set to understand that the interviewer is <u>not</u> going to "zero in" on the sensitive category in Box B.

Two examples of three-box trainer cards (not shown here) are provided in GAO, 1999. Both trainer cards were designed with foreign-born respondents in mind. One shows categories of houses or dwellings; this card is used with questions such as "In what kind of house do you think most of the people in your home country live?" The second trainer card shows various types of transportation.

This card is used with questions such as: "If you were to travel to your home country sometime within the next 12 months, what kind of transportation do you think you would use?"

Follow-up Questions

Respondents who choose Box B on the legal status card shown to them are not asked any further questions because Box B always contains the sensitive category. However, respondents who choose Box A can be asked a set of follow-up questions about the details of their (Box A) legal status. This feature of the three card method is unique among indirect estimation techniques.

These follow-up questions might help confirm the validity of answers for respondents choosing Box A, or alternatively, provide the information needed to reclassify certain respondents in Box B or Box C. For example, suppose a person in sample 1 chooses Box A, claiming to have a green card. Follow-up questions might reveal that although the respondent has applied for green card status, he or she has not actually received that status (at least, not yet). In such a case, the respondent would simply be recoded out of Box A. (For a set of Box A follow-up questions for Legal Status Card 1, see GAO, 1999, pp.76-78.)

Estimated Correlates/Subgroup Estimates

As outlined above, the sensitive category is estimated indirectly (by subtraction). This procedure may be carried out separately for various major subgroups (as illustrated for Mexicans above). Alternatively, a formula could be used to estimate correlates.

Preliminary Testing and Results

Preliminary testing of the Legal Status Card 1 (above) was conducted with 116 foreign-born Hispanics selected to over-represent illegals. There were three phases of testing, as follows:

- 27 initial pretests conducted by four bilingual GAO staff in a variety of locations in 1997;
- 81 interviews with farmworkers conducted by a contractor in winter 1997-1998; and
- 8 cognitive interviews[6] conducted by one of the bilingual GAO pretest interviewers, after training by a cognitive-interviewing expert.

Overall, most respondents appeared to comprehend the three-box format for answering and to accept it at face value. Iterative revisions of the wording and the pictorial icons increased understanding of the legal status categories. Of the 116 persons interviewed:

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[6]See Tourangeau (1984).

- None refused to answer the legal status question (i.e., everyone "picked a box").
- About 70% (81 out of 116) picked Box B, which contained the sensitive category.[7]
- In the farmworker interviews, over three-fourths of those selecting Box A, indicated that they had obtained their green cards in the late-1980s amnesty (Immigration Reform and Control Act/Seasonal Agricultural Workers Program or a related family unity program).

Variance Costs and Ways to Reduce Them

Anonymous estimation typically carries variance costs. The variance costs associated with the three-card method are potentially high but may be reduced through efficient design or special analysis methods.

Variance costs derive, first, from the need to use three separate samples. The estimate of the less sensitive category that is featured in Box A of card 1 (legal permanent residents in figure 1) is based on Sample 1 respondents only. Obviously, the number of Sample 1 respondents is lower than the total number of respondents in all three samples. As a result, the variance of the Box A, card 1 estimate is higher than it would have been if respondents in all three samples had contributed to that estimate. The same is true of each less sensitive category estimated with data from Sample 2 only or from Sample 3 only.

The variance is further increased for the indirect or anonymous estimate of the sensitive category (which never appears in Box A). This is because the indirect estimate is obtained by a linear combination of the three direct estimates. In fact, the variance of the indirect estimate is the sum of the variances of the direct estimates.

Subgroup estimates of an immigration status (e.g., percent of foreign-born males who are here on temporary visas) have a higher variance than an estimate of that status for the total population because fewer respondents are in the subgroup. Thus, variances may be particularly high for the sensitive category within a subgroup. [8]

Basic design strategies for efficient estimation include the following:

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[7]For more detailed information on the testing and results, see GAO (1999).

[8]Still higher variances would obtain for an estimate of the percentage of those in the sensitive category who fall into a particular subgroup. Such an estimate would consist of the ratio of two indirect estimates: The numerator would be the estimate of illegals falling in the designated category (e.g., Mexican-born) and the denominator would be the estimate of total percentage of foreign-born who are here illegally.

- Using information about the population of interest (if known) to stratify that population in advance of drawing the sample; and
- Using a principle of "optimal allocation" to determine the relative sizes of the three samples, i.e., allocating the relative sizes of the samples 1, 2, and 3, based on the relative sizes of the variances (p_1q_1, p_2q_2, p_3q_3) of the (expected) Box A parameters (p_1, p_2, p_3) for legal status cards 1, 2, and 3.[9]

To give the reader a flavor of what "real world" precision might be, we conducted a simulation for the Mexican-born population, as represented in a hypothetical sample of 5,000 (the approximate number of Mexican-born persons age 15 and older in the Current Population Survey supplement, March 2000).

Assuming the distribution of legal statuses indicated earlier for Mexican-born residents of the United States (36% illegal—see second page of this paper), 1,000 samples of size 5,000 were randomly selected. For each of the 1,000 samples, the 5,000 were randomly divided into three groups, allocated to answer legal status cards as follows: 2,900 for card 1; 1,800 for card 2; and 300 for card 3. The resulting 95-percent confidence interval was 33 to 40 percent. (Figures are rounded to the nearest percentage point.)[10]

Of course, it might be possible to reduce the variance through strategies such as (1) stratification when assigning respondents to the three alternative samples; (2) poststratification adjustments given the samples actually selected (which would be aimed at "equating" the three groups); and/or (3) probabilistic imputation of legal statuses to Box B respondents. (In our view, the third strategy should be implemented using special imputation methods that avoid "targeting" any data subject as likely to be here illegally.) Further simulation efforts are planned, exploring these approaches to variance reduction.

We expect the use of variance-reduction strategies (whether singly or in combination) to be effective to the extent that legal status is related to other measured variables—country of origin, length of time residing in the U.S., marriage to a U.S.-born person, education level, and so forth. For the one legal status that has been asked about in the CPS (i.e., whether the foreign-born person is a naturalized U.S. citizen), table 1 provides sample data for those who

are Mexican-born, based on two characteristics reported in the interview (March 2000).

Table 1: Percent of Mexican-born Who Are Naturalized Citizens, by Selected Characteristics*

Characteristic (Number in Sample)	% Naturalized citizens
Hispanic origin specified as:	
Mexican-American (381)	49%
Came here:	
Prior to 1970 (80)	86%
1970 to 1985 (167)	51%
1986 to 1991 (58)	33%
1992 to 2000 (76)	13%
Mexican (4374)	19%
Came here:	
Prior to 1970 (350)	59%
1970 to 1985 (1520)	31%
1986 to 1991 (1025)	10%
1992 to 2000 (1479)	4 %
Other (127)	34%
Total Mexican-born aged 15 or older (4882)	22%

*CPS data (March 2000); percentages are based on data weighted by the Census Bureau to correct for nonresponse and under-coverage by age-sex-race groups. (Note: Census adjustments do not take account of the possibly different levels of response or coverage that may characterize naturalized citizens versus other foreign-born persons. Also, as previously noted, self-reports in current surveys may be inaccurate; see Passel and Clark, 1998.)

Estimating visa overstays

By asking one additional question, the three-card method can be used to estimate "visa overstays"—and their characteristics. (No additional cards are needed.)

As described above, Subsample 3 is shown legal-status card 3, which features temporary visas in Box A; as with the other subsamples, each respondent in subsample 3 is asked to indicate which box includes his or her legal status. To estimate overstays, respondents in subsample 3 would also be asked an additional question using the same card. This question would be: *Which Box were you in at the time you first came to the United States to stay?* Data from subsample 3 can thus provide an estimate of a key multi-category group--the numbers of persons who entered on temporary visas and are now here as U.S. citizens, legal permanent residents, or visa overstays.

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[9]Here p_1, p_2, and p_3 refer to the percentages of samples 1, 2, and 3 choosing Box A; in each case, q is the complement of p. Re: optimal allocation, see Cochran (1977, pp. 96ff).
[10]We assumed that the distribution for Mexican-born persons age 15 and older is the same as for the total Mexican-born population.

To tease out an estimate of visa overstays, it is necessary to obtain and subtract out estimates of those that entered on temporary visas but are now U.S. citizens or legal permanent residents. Estimates of these groups can be obtained from Subsamples 1 and 2—simply by asking respondents who chose Box A (on legal-status cards 1 and 2) if they entered the United States on temporary visas when they first came here to stay.

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