The Lifecycle of Response Propensities in Fertility and Family Demography Surveys

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Abstract

With declining response rates to sample surveys throughout the Western world, demographers collecting survey data are increasingly using postsurvey adjustments via response propensity models. These models assume each sample element has a nonzero probability of participating in the survey, conditional on a fixed design, and correctly estimated through a multivariate model. However, not all sample persons in fertility surveys receive the same recruitment protocol. Using data from the Wisconsin Divorce Study and National Survey of Family Growth, we find evidence that response propensities of individuals vary systematically over the course of the data collection period. We find that mode switches and altered incentives move those propensities in expected directions. We find that those altered propensisites are connected to reduce nonresponse bias in key family demography variable statistics.

I. Introduction

Family demography depends on sample surveys for much of its data, but surveys in the Western world are increasingly threatened by low response rates (deLeeuw and deHeer, 2002). Because response rates have been used as an indicator of survey quality, there are fears reduced response rates will increase bias in fertility and other demographic survey estimates. There have been two reactions to this trend: a) increased efforts to improve response rates, through repeated callbacks and "refusal conversion" efforts, b) increased attention to the design and use of postsurvey adjustments. The first reaction has been challenged as a method to improve survey quality in several replicated studies and meta-analyses that fail to find a clear link between response rates and nonresponse error in some estimates (Keeter, Miller, Kohut, Groves, and Presser, 2000; Groves and Peytcheva, 2008; Blohm and Koch, 2008). This reaction has renewed focus on the fact that the nonresponse bias of the respondent-based estimates is a function of the correlation between a response propensity and the survey measure in question (Bethlehem, 2002). Thus, nonresponse bias will vary over different estimates in the same fertility survey; nonresponse rates by themselves are poor indicators of nonresponse bias.

A key postsurvey adjustment tool in fertility surveys are propensity models, that estimate the probability that a sample case participates in the survey (Little and Rubin, 2002). The assumption underlying that approach is that we can identify a set of characteristics that when modeled (usually using a logistic regression framework) will produce unbiased estimates of a fixed propensity to participate for a given sample unit. In this paper, we argue that each sample case might exhibit a lifecycle of response propensities during the data collection. Each begins the data collection period in a "base" response propensity, determined by the attributes of the case (e.g., life experiences, residential setting, age, race, and gender). Each action that the survey organization subsequently takes might change that base propensity – raising it or lowering it. The importance of this perspective of dynamic response propensities is that how the sample cases' propensities evolve over the course of the data collection is not fully under the control of the survey design or fully determined by fixed respondent characteristics.

This paper asks some simple questions motivated by the above perspective:

1. Is there any evidence that response propensities of individuals vary over the course of the

data collection?
2. Is there any evidence that propensities are influenced by specific actions taken by the survey recruitment protocol?
3. Does the change in propensities coincide with changes in the nature of nonresponse bias impacts on key survey estimates?

We argue that answers to these three questions yield a fundamental change in the paradigm for postsurvey adjustment in family and fertility surveys. This viewpoint incorporates response propensity change over time that explicitly flows from data collection protocols, provides a much more realistic model of the nonresponse bias. Thus the dynamic approach we advocate offers a valuable new tool for widespread use in the analysis of demographic survey data.

II. Data Resources

We examine two surveys - the National Survey of Family Growth (NSFG), conducted by the University of Michigan for the National Center for Health Statistics, and the Wisconsin Divorce Study (WDS), conducted by the University of Wisconsin-Madison. Each used an explicit protocol change at the end of the survey field period.

The NSFG is a survey of US household members 15-44 years of age about sexual and fertility experiences, partnering, and family formation events. Every 12 weeks, or 84 days, a new sample is released for data collection. The 84-day period is divided into Phase 1 (first 70 days) and Phase 2 (last 14 days), continuing data collection effort on a probability subsample of cases that have not been interviewed in Phase 1. In Phase 1 all sample persons are given $40 in cash upon agreeing with the interview; in Phase 2, all those persons are mailed $40 and then offered an additional $40 if they complete the main interview.

The WDS is a survey about marital satisfaction and marital history of divorced persons aged 18 and older in four counties in Wisconsin, sampled from divorce records with information available on both respondents and nonrespondents. The first recruitment requests were delivered by telephone (Phase 1); all telephone nonrespondents were followed up by a mailed questionnaire after the telephone field period ended (Phase 2).

III. Hypotheses

- The largest change in individual response propensities to participate at the next recruitment request occurs when a new recruitment protocol component is immediately applied.

- After the experience of the component, the application loses its effectiveness over time, either because the respondent no longer considers this new component in his or her decision or the persons for whom the component was attractive are culled out.

- Since the largest introduction of recruitment protocol components is at the beginning and end of most field survey periods, a decline in within-person response propensities over the course of a data collection period after the introduction of a new component will be observed.

- The package of recruitment protocol components experienced by the respondent prior to

the introduction of the new protocol component may modify or enhance its effectiveness.

- If response propensity changes over the field period, then the correlation between propensity and the survey variables also must change for survey variables related to the cause of survey participation.

IV. Findings

- In Figure 1, we clearly see that individual probabilities of obtaining an interview change over the course of the data collection. The early days of the data collection contains a set of active cases that have higher probabilities of interview. They exit the active sample base over the early days of the survey. The cases remaining at the end of the Phase 1 data collection are those with very low probabilities.

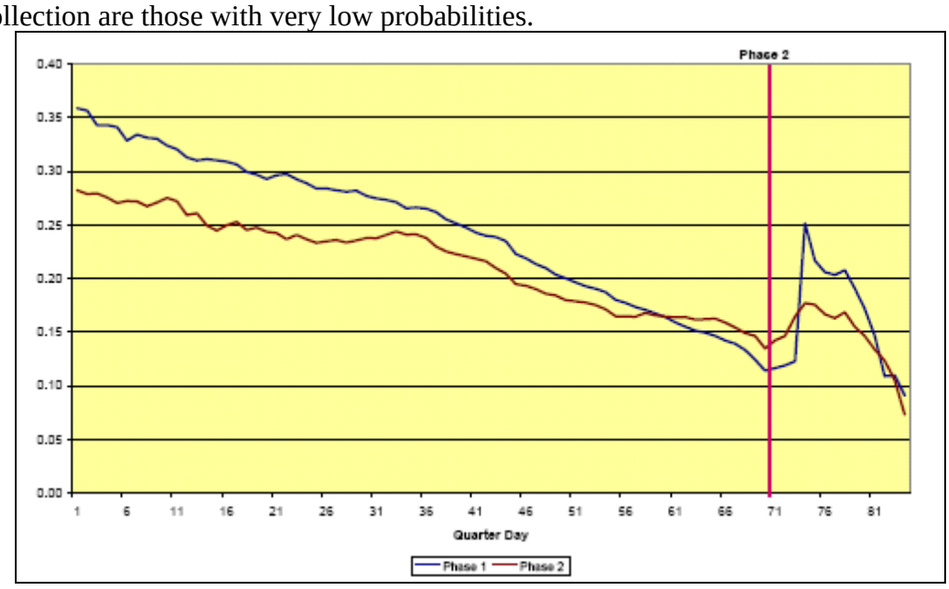

Figure 1: Mean Response Propensity over Quarter Day, Phase 1 and Phase 2 cases, National Survey of Family Growth

- In both studies, the Phase 2 protocol has a net effect of increasing the estimated propensities of cases that exhibited very low propensities by the end of Phase 1. (Note in Figure 1 above how the blue Phase 2 case propensities jump up after the beginning of Phase 2, when they are exposed to the higher incentive). For the NSFG, The mean probability that the next call will generate a main interview on the 70th day of Phase 1 is .134 among those still active on day 70; the mean for the last active days of Phase 2 is .157, for an increase in mean propensity of .022 (ste=0.0059, p<.001). Similarly, in the Divorce study, the mean estimated probability that an interview occurs on the last active day of the telephone field period is 0.08 (ste=0.0039), rising to 0.46 (ste=0.0062) for the mail survey, an increase in mean propensity of 0.38 (ste=0.095, p<.0001).
- In the NSFG, Phase 2 propensities experience the largest increase over the first five days of Phase 2, likely reflecting the time required to receive the priority mailing of the new

incentive offer. After this point, the remaining cases are less receptive to benefits of the higher incentive and refusal conversion efforts proceed, resulting in declines of Phase 2 propensities. As expected, Phase 2 ends with a case base with mean propensities that are even lower than those they exhibited at the end of Phase 1.

- In the Divorce Study, the effectiveness of the mode switch was greatest for those with the shortest amount of time elapsed between the two contact attempts and greater among cases who received fewer calls prior to the mode switch. Neither of these field decisions was randomly assigned.
- At the end of the Divorce phone survey, older persons, women, persons with higher levels of education, persons with children, and those who lived in Wisconsin at the time of the field period were significantly more likely to be respondents than other persons. With the addition of the mail survey, response rates for men and women, older and younger persons, and persons with more or less education were equalized.

- Table 2 shows the means and standard errors for the survey variables for five groups – overall, respondents and nonrespondents before the mode switch, and respondents and nonrespondents after the mode switch. It also contains the empirical correlation between estimated propensity and the survey variables before and after the mode switch. For example, the mean length of marriage for the full sample is 130.34 months. At the conclusion of the telephone survey, the mean length of marriage for respondents is 139.82 (se=5.27) and for nonrespondents is 121.43 (se=4.86), a statistically significant difference of 18.39 months between respondents and nonrespondents ($p<.01$), and an overestimate of the full sample mean of 9.48 months. The correlation between the estimated propensity and the mean length of marriage before the mode switch is 0.37 ($p<.0001$).

Table 1: Means and Standard Errors, Total Sample, Respondents and Nonrespondents after the Phone Survey, and Respondents and Nonrespondents, Phone and Mail Surveys Combined, Wisconsin Divorce Study

	Length of Marriage		Number of Marriages		Months Since Divorce		Respondent's Age	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Full Sample	130.34	3.59	1.22	0.016	49.69	0.90	39.83	0.32
Before Mode Switch								
Respondents - Phone Only	139.82	5.27	1.19	0.021	51.10	1.28	40.57	0.46
Nonrespondents	121.43	4.86	1.24	0.024	48.37	1.26	39.13	0.45
After Mode Switch								
Respondents – Mail + Phone	134.17	4.29	1.20	0.017	50.44	1.06	40.06	0.38
Nonrespondents	120.80	6.53	1.27	0.036	47.84	1.71	39.24	0.61
corr(p,Y)								

Before Mode Switch	0.37	****	0.03	0.04	0.36	****
After Mode Switch	0.32	****	-0.04	0.004	0.26	****

After the mode switch, the mean length of marriage for respondents is 134.17 months and 120.80 months for nonrespondents, a difference of 13.37 months ($p<.10$). Furthermore, the overestimate of the full sample mean has been reduced to 3.83 months and the correlation between estimated propensity and length of marriage is 0.32 ($p<.0001$), smaller than that before the mode switch.

The difference between respondents and nonrespondents is reduced after the mode switch for the mean number of months elapsed since the divorce and for the respondent age, but increases slightly for the mean number of marriages for the respondent. For the two items in which the difference between respondents and nonrespondents decreases after the mode switch, the correlation between estimated propensity and the survey variables also decreases. For the item in which the difference increases, the correlation also increases (in absolute magnitude). That is, the reduction in nonresponse bias has also been reflected in a smaller correlation between propensity and the survey variables.

V. Discussion

- Tracking the propensities and measuring the impact of field actions on those propensities is merited from the postsurvey adjustment perspective. The timing of a decision to stop survey data collection -- relative to interventions in the field -- can alter the distribution of the expected propensities to respond and thus the nature of postsurvey adjustment.
- Based on this work, we recommend building sets of informative auxiliary variables that are useful predictors of propensities and tracking them during the data collection period. This includes information about the timing and implementation of new protocol features.
- We suggest examining the covariance of estimated propensities and the survey variables as a proxy indicator of the nature of the effect of field interventions on postsurvey adjustments.
- This new approach to postsurvey adjustment will yield different, and we argue more accurate, estimates of key demographic behaviors.

References

Bethlehem, Jelke (2002) “Weighting Nonresponse Adjustments Based on Auxiliary Information,” Chapter 18 in Groves, R., Dillman, D., Eltinge, J., and Little, R. (eds.), *Survey Nonresponse*, pp. 275-288, New York: Wiley.

Blohm, Michael, and Achim Koch (2008) “Increasing response rates: The higher, the better? First results from an experimental study in the German General Social Survey (ALLBUS),” paper presented at the 19th International Workshop on Household Survey Nonresponse, Llubljana, Slovenia, September.

De Leeuw, Edith, and Wim de Heer (2002) “Trends in Household Survey Nonresponse: A Longitudinal and International Comparison,” Chapter 3 in Groves, R., Dillman, D., Eltinge, J., and Little, R.J.A., *Survey Nonresponse*, pp. 41-54, New York: Wiley.

Keeter, Scott, Carolyn Miller, Andrew Kohut, Robert Groves, and Stanley Presser (2000). “Consequences of Reducing Nonresponse in a National Telephone Survey,” *Public Opinion Quarterly*, 64, pp. 125-148.

Little, R.J.A. and Rubin, D.B. (2002), Statistical Analysis with Missing Data, Second Edition. John Wiley and Sons, New York.

Groves, Robert M., and Emilia Peytcheva (2008) “The Impact of Nonresponse Rates on Nonresponse Bias: A Meta-Analysis,” *Public Opinion Quarterly*, 72:2, pp. 167-189.