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An econometric method of correcting for unit nonresponse bias in surveys

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Abstract

Past approaches to correcting for unit nonresponse in sample surveys by re-weighting the data assume that the problem is ignorable within arbitrary subgroups of the population. Theory and evidence suggest that this assumption is unlikely to hold, and that household characteristics such as income systematically affect survey compliance. We show that this leaves a bias in the re-weighted data and we propose a method of correcting for this bias. The geographic structure of nonresponse rates allows us to identify a micro compliance function, which is then used to re-weight the unit-record data. An example is given for the US Current Population Surveys, 1998–2004. We find, and correct for, a strong household income effect on response probabilities.

JEL classification: C42; D31; D63; I3

Keywords: Sample surveys; Selective unit nonresponse bias

1. Introduction

This paper considers the potential bias that can occur when some portion of the sampled population does not respond to a sample survey. If the decision to respond is statistically dependent on the variables under investigation then the sub-sample of survey respondents will not accurately reflect the true distribution of the variables of interest in the population and this will in turn result in systematically biased sample-based inferences, even in large samples. Survey noncompliance is manifested either as "item" nonresponse—while

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participating in the survey, the respondent does not answer some question(s)—or as "unit" nonresponse, when a sampled respondent does not participate in the survey at all, either because of a failure to establish contact or explicit refusal to participate. The paper develops an ex post approach to correcting for selective unit nonresponse bias in surveys.

Well-designed surveys aim to minimize nonresponse ex ante, by various means.[1] However, in most surveys a non-negligible fraction of designated respondents still fail to provide all the requested data items or fail to respond altogether.[2] Dealing with item nonresponse is facilitated by the fact that some information about the units who did not respond to a certain question was collected in the survey.[3] However, correcting for unit nonresponse requires that some structure is imposed on the set of nonrespondents without observing a single requested variable in the survey.

One approach, sometimes termed an "identification study," aims to assess how the likelihood of response is affected by certain variables, e.g., by investigating how the response rate varies across subgroups of the sample or in relation to certain auxiliary data. However, this requires knowledge about the size of these subgroups or the distribution of the auxiliary data in the total population. Hence, identification studies are best applied when the sample is chosen from a population about which some characteristics are known; examples include employees of a given set of companies (as in Gannon et al., 1971) or students of a given set of schools (Kalsbeek et al., 1974). Implicitly, identification studies assume that within a certain subgroup, or given certain auxiliary data, the decision to respond is independent of the measured variable. Another imputation technique involves substitution of nonresponding units, which is employed when the number of observations in the sample has to be kept constant regardless of survey nonresponse (Hansen and Hurwitz, 1946). Typically, another unit from the same sampling subclass as the initially designated unit substitutes for the nonrespondent. Again, this assumes implicitly that within a subclass, the decision to respond is independent of the measured variable; see the discussion in Chapman (1983).

Alternatives to the imputation methods discussed above are found in the literature on adjustment procedures and model-based methods to correct for nonresponse. The common approach is to determine a weighting factor for each observed individual that adjusts the sample for nonresponse. Various methods for determining these weighting factors have been suggested in the literature. One proposal has been to infer the weights on the basis of the time or number of solicitation attempts required to respond (Politz and Simmons, 1949). An alternative method infers the weights from the distribution of nonrespondents across certain identifiable subgroups of the sample, called "adjustment

[1]These include carefully selecting the interview medium, personalization or organizational endorsement of the survey, reward-based incentives, training of interviewers, and monitored call-backs or follow-up requests. Moser and Kalton (1972) provide an insightful overview. On rewards and monetary incentives, see for instance Philipson (1997). And, as noted early by Deming (1953), depending on the inference variable of interest, accounting for the frequency of call-backs and follow-up requests could be equally relevant to correct for potential biases as the ultimate incidence of nonresponse.

[2]Nonresponse rates in income surveys can range from virtually zero to around 30% (Holt and Elliot, 1991; Scott and Steele, 2004). In Internet surveys, nonresponse rates are often close to 100%.

[3]The most common way of correcting for this type of nonresponse is explicit imputation, whereby an imputed value is assigned to the missing item based on the recorded values for other items. This imputed value is usually taken from another surveyed unit that has responded and that resembles the unit with missing data as closely as possible, such as determined by a score estimated on commonly observed variables. For a general discussions of this approach see Kalton and Kasprzyk (1982) and Little and Rubin (1987).