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Non-sampling Errors: Some Approaches Adopted in Major Government Surveys in Britain

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The problems and sources of non-sampling errors are well known. They can occur at every stage in the survey process from the original formulation and definition of research objectives, through each part of the technical operation including inadequacies in the sampling frame and sampling procedures, questionnaire design and fieldwork, coding and data processing and finally in the analysis, interpretation, and reporting of results. Most non-sampling errors can cause large distortions of the true values which the survey seeks to measure. Many of the causes of non-sampling errors are inherent in the survey process and as such are virtually impossible to eliminate entirely. There is no coherent, established theory that deals with non-sampling errors and the biases that result are usually difficult to measure and to control.

This article describes: the general approach adopted in Britain to control non-sampling error in the major government surveys, some new methods introduced in recent years to reduce those errors, and some work done to measure the extent of certain kinds of non-sampling errors.

Perhaps the most important factor in the general approach is a recognition that non-sampling errors are best treated by minimising them at their source rather than relying on compensating methods after they have occurred. This means the creation and maintenance of an organisational climate aimed at thoroughness in methods and high standards in procedures. This is greatly helped by the fact that nearly all major government surveys in Britain are carried out, or are controlled, by a single organisation – the Social Survey Division (SSD) of the Office of Population Censuses and Surveys – whose primary responsibility is to undertake quality survey research for government. This quality approach is apparent both in the research design and the operational procedures used. For example, strong emphasis is placed on the following points: involving and collaborating with survey clients to ensure that the underlying research problems and priorities are adequately addressed by the survey design; thorough pilot or feasibility trials before embarking on the main survey stages; the maintenance of as high response rates as possible; the thorough training and motivation of survey interviewers both before and during field work phases; and the general principle that wherever possible those responsible for designing the survey and co-ordinating the operational phases, should be responsible for the analysis, interpretation and presentation of the results.

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These claims of high standards are not just proud boasts designed for presentational purposes but deliberate policy in an attempt to reduce non-sampling errors. Improvement in quality is a goal which often conflicts with those of reducing costs and increasing timeliness. However a few new techniques manage to achieve all these goals simultaneously and some of these are described later.

Inadequately constructed questions and questionnaires are an important source of non-sampling error. For example, post enumeration surveys of recent population censuses in Britain have shown that answers to some questions were wrong on substantial proportions of census forms (Britton and Birch (1985)). In Britain, as in many other countries, self-completion methods are used in the census whereas in most sample surveys trained interviewers administer the questionnaires. But the important point is that it is only through intensive interview checks, carefully designed to assess the accuracy of the informant's response, that errors can be measured. For sample surveys carried out by SSD, the standard technique is to test questionnaires (and other survey procedures) thoroughly through pilot tests or series of pilot tests. This will not always ensure that a questionnaire is perfect; there probably is no scientific means of guaranteeing total success. It does, however, help to reveal major problems sufficiently early for corrective measures to be taken before the main fieldwork takes place.

Sometimes the policies of maintaining an ethos of quality in the organisation and of prior testing has resulted in a survey not being carried out at all because it was judged that the survey could not be conducted to an acceptable standard. For example, in 1975 SSD was commissioned to carry out a survey of wealth holdings in Britain. Feasibility studies suggested that such a survey would produce response rates too low and response errors too high to justify proceeding to a main inquiry and the attempt was abandoned (Knight (1980)).

In recent years SSD has introduced a number of innovations to improve methods and procedures to reduce non-sampling errors in British government surveys. One such innovation was the switch to a machine readable file of British post codes, the Postcode Address File (PAF), as the sampling frame for most of the major household surveys. One of the purposes of this measure was to reduce costs through the automation of sample selection procedures. Studies (Wilson and Elliot (1987) and Dodd (1987)) were carried out which demonstrated that the PAF is more complete than the previous frame in general use, i.e., the electoral register. The electoral register was shown to be some four per cent deficient in recording all addresses in the country and the shortfall was concentrated in certain types of addresses, such as those occupied by ethnic minority groups and those recently vacated. The overall deficiency of the PAF is estimated to be about one or two per cent.

The procedure of sending advance letters has recently been introduced to improve response rates in surveys. These letters are meant to explain the purposes of the survey, vouch for its authenticity, give assurances of confidentiality and generally to ease the interviewer's task of securing cooperation. There is nothing especially original in this procedure – many countries have used the practice routinely for a long time. But in Britain until recently it was generally assumed that advance letters would at best not affect response and so would not justify the cost, or at worst would actually reduce response levels by giving some prospective informants the chance to harden their prejudices against cooperating. However recent experiments (Clarke et al. (1987)) on the General Household Survey suggested that prior notification in writing might well increase response. Prior notice both reassures the in-

formants about the credentials of the survey and the survey organisation, and increases the confidence and motivation given to interviewers whose perseverance and effectiveness in persuading informants to cooperate might be enhanced by the practice. This has been borne out by experience on the surveys themselves. For example, response on the Family Expenditure Survey and General Household Survey has been increased by four or five percentage points in most months since the advance letters were first used. In the National Food Survey the reduction in non-response has been even more marked. More recently, advance letters have been used on the Labour Force Survey and immediately there was a four or five per cent increase in response rates.

An important source of non-sampling error is the effect of coding error. There are a variety of sources of coding error, and one error source is coding judgements that are based on inadequate information. If interviewers could be trained to make better judgements the error might decrease. Interviewers are in the position to see the degree of detail required, and the interviewer is well placed to return to the informant to obtain the extra details. SSD recently conducted trials to see whether interviewers could be trained to do field-coding of common items such as occupation and industry (Dodd (1986)). The trials showed that this would be feasible and this is now standard practice in surveys carried out by SSD. Moreover this is another example of improvements in quality that are accompanied by cost savings and improved timeliness.

Interviewer coding is sometimes carried out on more specialised studies. For example highly detailed coding was required on an ad hoc survey carried out in 1986/1987 on the nutritional intakes of adults. The key to success here was the intensive and thorough training given to the interviewers.

New procedures, currently being developed, entail the use of laptop computers (LTCs) for direct data entry during the interview. The LTCs display the questions with automatic filtering and a range of built-in edit checks, in a similar way to CATI systems. Thus inconsistent responses, sequence errors, and missing items can be greatly reduced, if not virtually eliminated, in face-to-face interviews. This is another example where the new methods are expected to produce improvements in quality, as well as in costs and timing. So far a number of field trials have been carried out in connection with the Labour Force Survey and the results are encouraging. Our system owes much to the Netherlands' LFS where LTCs are already in use and the help of the Central Bureau of Statistics in the Netherlands is gratefully acknowledged.

The last example given here is the practice of re-issuing non-response on telephone interviews to face-to-face interviews. Telephone interviewing is carried out on a part of the Labour Force Survey but response rates are generally substantially lower than on that part of the sample interviewed face-to-face. The practice has been adopted to try to obtain response through a personal visit to some of the telephone non-respondents. It has been demonstrated that this increases the response rates by some nine percentage points. Moreover these personal visits reduce the non-response bias by an appreciable extent. This is a measure which incurs additional costs over initial face-to-face interviewing; the total cost of a re-issue is reckoned to be about 125 per cent of an ordinary face-to-face interview on the Labour Force Survey. However it has also been shown that for the whole sample it is cost effective to seek telephone interviews first and then to re-issue the non-response.

But no amount of concentrated attention to high technical standards will entirely eliminate non-sampling errors. The problem then is to measure the extent of the error. This is seldom easy to do, but in Britain the SSD has carried out work to investigate the size of the

bias caused by some non-sampling errors.

Non-response is relatively easy to measure but the resulting bias is much more difficult to assess. In Britain several empirical studies have been carried out to estimate the non-response bias in four major government continuing household surveys: the General Household Survey, the Family Expenditure Survey, the National Food Survey, and the Labour Force Survey. For each survey, we compared the respondents with the non-respondents according to their census characteristics. This involved matching the survey sample addresses with census addresses. The comparisons were made first at the time of the 1971 census, for all surveys but the LFS, and then again at the time of the 1981 census, this time for all four surveys.

The results have been published elsewhere (e.g., Barnes and Birch (1975)) and generally they were consistent between the two census years. However the magnitude of the biases was different for some variables in different surveys. Because of non-response the results for households containing people living alone, small families, the self-employed, and the elderly, were negatively biased and the results for households containing large families were positively biased. So far the results have been used to inform rather than to adjust because the biases could only be determined for census variables which were not necessarily the main variables of concern to the survey enquiries.

Another empirical study in connection with the LFS was carried out in 1978 to assess the effects of proxy interviewing (Martin and Butcher (1982)). Proxy interviewing is necessary on very large sample enquiries as a major factor in keeping costs within acceptable limits but it is also an important potential source of non-sampling error. For this particular study, a sample of households where proxy data had been obtained was revisited to carry out interviews with the person for whom proxy data had been collected. In fact the results for a wide range of variables were generally encouraging and confirmed the view that, for the LFS at least, the deterioration in quality of response was sufficiently small to justify the proxy procedure.

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