

Issues in design and implementation of large-scale repeated social surveys.

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Abstract: The paper highlights main features of the temporal structure of repeated, large-scale social surveys. Technical issues concerning sampling over time, including rotation patterns and follow-up rules in longitudinal or panel surveys are discussed.

Keywords: sampling over time, longitudinal follow-up, survey round

Introduction

We may distinguish more or less regular *continuing surveys* from one-time or occasional *ad hoc surveys*. In this paper we address some issues in the design and implementation of the former type of surveys. Specifically, our reference is to relatively large-scale, generally national in scope, social surveys. Social surveys means those concerning the general (human) population or particular subgroups of it. Perhaps the largest and the most common and well-established of such surveys are the national labour force surveys (LFS's). We will use the LFS's of EU countries to illustrate the following discussion (Husmanns et al 1990; Verma et al 2009).

The following sections discuss issues relating to: (1) temporal structure of the survey; (2) sampling over time; and (3) longitudinal follow-up ('tracing') of the sample.

1 Temporal structure of a repeated survey

In terms of periodicity of the survey, we may distinguish between *infrequent*, say decennial like a census, 5-yearly or biennial surveys on the one hand, and *frequent* such as annual, quarterly or monthly surveys on the other. Data needs are the main consideration determining the frequency of the survey. Labour force surveys, for instance, are conducted monthly in some countries, quarterly in all EU countries, annually in many developing countries, but less frequently when the objective is obtain structural information of longer-term interest or when frequent surveys are unaffordable.

In some surveys fieldwork for the collection of data is *concentrated* over a short period, one time during each application (*round*) of the survey. At the other end there are many surveys with *continuous* fieldwork. In most European LFS's for instance, fieldwork is not only continuous but is also distributed quite uniformly over the 52 weeks of the year. In-between we have surveys with several periods of concentrated fieldwork within each application of the survey, such as over a few days during each month of a quarterly survey. More strictly, it is the distribution of the *reference period* to which the information collected relates, and not the data collection period as such, which is controlled in the survey design. The main factors favouring continuous over intermittent

fieldwork include the operational convenience, economy, and possibly also improved quality of the resulting data. More importantly perhaps, with well-distributed fieldwork, the survey results are better able to represent variations over time, such as seasonal variations in employment. The ideal is to make the sample representative simultaneous in space and in time.

Often survey rounds are divided into *subrounds*, such as monthly subrounds in a quarterly survey. This is possible when fieldwork is distributed, i.e. is continuous or at least is conducted over several periods in each round. Division into subrounds enhances the operational and substantive advantages of distributed fieldwork. Conceptually the difference between a round and a subround is that mainly the former, but not the latter, is large enough to yield results with the required precision. Nevertheless, the feature distinguishing a subround from any arbitrary partition of the fieldwork period of a round is that, like the round, each subround is also designed to be *representative of the whole target population*.

2 Sampling over time

Samples of different survey rounds are usually made to overlap for introducing positive correlations to permit more precise estimation of changes over time. The range of possibilities varies from entirely independent samples, to panels in which the same units are followed up repeatedly from one round to the next. The choice of the rotation pattern depends on the survey objectives – or more correctly on the desired compromise between different objectives since the objectives are always multiple. A survey may be designed to meet several objectives simultaneously, to provide estimates or measures of various types each with its own statistical requirements. A labour force survey for instance may be required to provide estimates of current levels for individual periods like quarters; estimates of net differences between periods e.g. from one quarter to the next; aggregates over several periods and moving averages; seasonal variation; geographical breakdown; and estimates of gross differences, changes and flows over time at the micro level.

We may briefly note several common and useful practical aspects of sample rotation patterns.

- (1) Obviously, the degree of overlap between samples in a repeated survey can have a major impact on respondent burden, response rates achieved, and data quality and cost.
- (2) In statistical terms, the measurement of net change is served best by overlapping samples; averaging over time is served best by independent samples; estimates of current levels are essentially independent of the degree of overlap.
- (3) Often other types of conflicting requirements also exist. For instance, the desirability of large overlaps across but small overlaps within years to estimate annual changes; but of small overlaps across but large ones within years to estimate seasonal patterns.
- (4) For a given design, the estimate of change can be made more precise by giving more weight to the overlapping part; the estimate of averages can be made more precise by giving more weight to the non-overlapping part.
- (5) Much of the gain in estimating net change is captured with only modest overlaps, while large overlaps can damage the efficiency in estimating averages. The actual

effect depends of course on the magnitude of the correlation between overlapping samples.

- (6) Note that it is not essential to have sample overlaps to estimate net changes (nor to have independent samples in order to estimate measures averaged over time) – the issue is only that of statistical efficiency.
- (7) Often overlaps are designed to measure change between neighbouring periods, with the overlap declining linearly as we move further apart in time. Many surveys use this straightforward pattern of rotation. The sample consists of n subsamples; at the beginning of each survey round, one new subsample is introduced; and each subsamples remains in the survey for n consecutive periods (rounds). The overlap between rounds decreases linearly as the interval separating them increases. For two sample introduced i rounds apart the overlap is $(n-i)/n$, up to $i=(n-1)$; after that ($i \geq n$), the overlap becomes zero.
- (8) But more complex rotation patterns are also used in order to increase overlap between more distant rounds, e.g. to measure year-to-year changes in a survey with quarterly rounds.
- (9) Within a round, subround samples are usually made non-overlapping for efficient cumulation over the subrounds for the construction of estimates for the round.
- (10) The rotation patterns often differ for different levels of units in a multi-stage design: it is possible to use different patterns of rotation for different levels of units. Various possibilities exist in this connection. At the one extreme, we may keep higher-stage units unchanged over time and rotate the sample of lower stage units only within fixed higher-stage units. At the other end, units at different levels may be rotated in the same way at the same rate. In any case, it can be economical and convenient to change higher-stage units less rapidly than the ultimate units within them. Longer use of the same areas can be convenient and efficient from both practical and statistical point of view. The cost associated with changing the sample areas is reduced; furthermore, by making the rotation of lower stage units faster, repeated enumeration of the same households and persons is avoided or reduced, thus limiting respondent burden.

As noted, it is not essential to have sample overlaps to estimate net changes. By contrast, estimates of gross differences, changes and flows over time at the of individual (micro) level *require* a panel design in which the same units are followed up from one period to another. Proper longitudinal analysis is limited by the manner in which most labour force surveys implement temporal overlap between samples. The common procedure in labour force surveys of dealing with a household which has moved to another location between the time of its selection into the sample and enumeration is to take into the survey the new household (if any) which now lives at the address where the original household was selected. Hence the sample may be more appropriately described as a sample of ‘occupied addresses’ where the selected households lived at the time of selection, rather than as a sample of the specific households and persons through the selection of which the ‘occupied addresses’ came into the sample. The same concept applies in relation to overlaps in the sample over time in a rotational design. The sample overlap in the sample from one survey round to another is in terms of occupied addresses, rather than in terms of following the particular households living at those addresses. The main consequence of such designs is that movers are not represented in the longitudinal sample (though of course, they are properly represented in the cross-sectional sample for each round).

The statistics published from labour force surveys tend mostly to be of the form of cross-sectional estimates of levels and their cumulations and net differences over time. Estimates of gross differences, changes and flows over time at the of individual (micro) level are limited by the above-mentioned sampling consideration. They are also more sensitive to response errors. The simpler follow-up procedures of the above type limit the usefulness of the resulting data for longitudinal analysis, but the cost and complexity of implementing the design is considerably reduced.

3 Longitudinal follow-up

Another important aspects in the definition of the statistical units in repeat surveys with overlapping samples is the tracing of units over time. Rules are required on how units are to be followed-up from one survey round to another when overlapping samples are used. These rules can be complex when the units involved in the follow-up can split, combine or change their content or identity in other ways over time. This is why follow-up rules tend to be much more complex in *household panel surveys*, than for instance in cohort studies of individual persons (who retain their uniqueness and identity over time). For practical reasons, it is usually necessary to limit the follow-up of units. This helps to limit response burden and also the damage due to attrition of the sample over time. Limiting the duration of follow-up also reduces the cumulative effect of departures from what may be considered the ‘ideal’ rules for keeping the sample representative.

In a household panel survey the usual procedure is to follow-up each individual in the original sample. The sample of these so-called ‘sample persons’ is weighted each round in an effort to keep representing the current population. The survey each wave also covers the whole household of and all the other persons currently living with each of the original sample persons. Hence the survey contains extra ‘non-sample persons’ not directly selected into the original sample. These persons have no original sample weight, but can be brought into the analysis using a special procedure called ‘weight sharing’. The resulting sample structure is complex and requires quite sophisticated weighting procedures (Verma et al, 2007).

For a detailed example of the follow-up rules, see Verma & Betti (2006).

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