Chapter 3

The Problem of Nonresponse

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3.1 INTRODUCTION

Many books about survey sampling show how the precision of survey estimates depends on the sample design; however, this assumes that data are obtained for every unit in the selected sample. This is rarely the case; most surveys experience some nonresponse. Consequently, the sample upon which the estimates are based is not the same as the sample that was originally selected. Obviously, it is smaller. But it may also be different in other important ways that affect the estimates.

It may seem rather negative to be discussing nonresponse so early in this book. We haven't yet begun to discuss how to design or implement a survey and yet we are already talking about failure—failure to collect data from all the units in our sample. But this is a fundamental aspect of survey research. If we cannot successfully collect data from a large proportion of the selected units, then it may be a waste of time carrying out a survey at all. And when the data have been collected and we want to make estimates we need to be able to make allowances for the effect of nonresponse. This requires advance planning—even before the sample has been selected. In this chapter, I try to explain how and why nonresponse occurs, why it is important, and what we can do to minimize any undesirable consequences.

3.2 WHY IS NONRESPONSE IMPORTANT?

Even the most well resourced surveys carried out by experienced survey organizations suffer from nonresponse. The level of nonresponse can vary greatly between surveys, depending on the nature of the sample units, the mode of data collection, the fieldwork procedures used and societal and cultural factors. Some of these factors vary between countries and often lead to response rates differing between countries for the same survey. But whatever the circumstances of your survey, you are almost certain to have some nonresponse.

The principles of statistical inference (see Lohr, Chapter 6) allow us to make inferences about a population of interest, provided that the sample has been selected using a known probability mechanism. In other words, we have to know the selection probability of each unit in our sample. But nonresponse
disturbs the selection probabilities. The probability of a particular unit being in our final responding sample, sometimes referred to as the inclusion probability, is the product of the original selection probability and the probability of the unit responding once selected. Assuming that we have used a probability sampling design, the first of these is known. But the second is not known. The result is that our sample may no longer be representative of the population.

Consider a simple example of a survey of literacy in a small town. Suppose we want to estimate the proportion of adults classified as low ability, based upon a test that will be administered as part of the survey interview (ignore for the moment the fact that the test may not provide a perfectly accurate measure of ability—see Hox, Chapter 20). Imagine that the population of 14,000 adults in the town consists of 8,000 who would be classified as high ability if the test were administered and 6,000 who would be classified as low ability (though of course we would not know this). The sample design is to randomly select one in every 20 adults (see Table 3.1), so we would expect to find approximately 400 high ability and 300 low ability persons in our sample. Suppose however that the low ability persons are less likely to respond to the survey, with a response probability of only 0.60, compared with 0.80 for the high ability persons. This means that we can expect to find 180 low ability persons in the responding sample of 500, so we might estimate the proportion of low ability persons in the population to be 36%, whereas in fact it is 43% (6,000 out of 14,000). But if we were carrying out this survey for real, we might not be aware that our estimate is too low. We would only observe the numbers highlighted in bold in Table 3.1. In the absence of other information, we would have no way of knowing that low ability persons had been less likely to respond to the survey and no reason to adjust our estimate of 36%.

<table>
<thead>
<tr>
<th></th>
<th>High ability</th>
<th>Low ability</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>8,000</td>
<td>6,000</td>
<td>14,000</td>
</tr>
<tr>
<td>Selection probability</td>
<td>1/20</td>
<td>1/20</td>
<td>1/20</td>
</tr>
<tr>
<td>Expected sample size</td>
<td>400</td>
<td>300</td>
<td>700</td>
</tr>
<tr>
<td>Response probability</td>
<td>0.80</td>
<td>0.60</td>
<td>0.714</td>
</tr>
<tr>
<td>Responding sample size</td>
<td>320</td>
<td>180</td>
<td>500</td>
</tr>
</tbody>
</table>

Note: Figures in bold would be known; other figures not

This error in our estimate has been caused by nonresponse. Specifically, it has been caused by the fact that the response probability is associated with the target variable (literacy ability). If nonresponse had happened completely at random, then we would still have expected to find 43% of the responding sample to be low ability. But nonresponse rarely happens completely at random. There are reasons why some units do not respond and those reasons are typically associated with at least some of the survey variables. In our example, it may be that some residents of the town were away in a different location, engaged in seasonal employment, during the survey field work period. If such
people were selected into the sample, it would not have been possible to contact them so they would have been nonrespondents. And if people with low literacy ability were more likely than those with high ability to engage in this seasonal employment, this could lead to exactly the sort of effect shown in Table 3.1.

3.3 HOW DOES NONRESPONSE ARISE?

There are several reasons why nonresponse occurs. If we are to be successful in trying to minimize the extent of nonresponse, we need to understand these reasons and to find ways of combating each of them. A summary classification of reasons for nonresponse appears in Table 3.2. These reflect the stages of the survey data collection process. Once a sample unit is selected, it is first necessary for the data collector to identify the location of that unit. This may prove impossible if, for example, the address information on the sampling frame is incomplete (a). If located successfully, the next step is to make contact with the sample unit. Sometimes, as in the example above, this proves impossible (b). Even if contact is made successfully, it may not prove possible to collect the required data. Reasons for this can be broadly classified into three types: the sample unit may be unwilling to co-operate (c), or unable to co-operate (d), or the data collector and sample unit may be unable to communicate adequately (e). Finally, it sometimes happens that data are successfully collected from the sample unit but subsequently lost—for example if questionnaires go missing in the post or computer files become corrupted (f).

Table 3.2: Reasons for nonresponse

a. Failure of the data collector to locate/identify the sample unit
b. Failure to make contact with the sample unit
c. Refusal of the sample unit to participate
d. Inability of the sample unit to participate (e.g. ill health, absence, etc)
e. Inability of the data collector and sample unit to communicate (e.g. language barriers)
f. Accidental loss of the data/questionnaire

This simple classification provides a framework for considering reasons for nonresponse but it does not describe the many specific reasons that could apply on any particular survey. Often, reasons for nonresponse will be specific to the topic of the survey, to the types of units from which data are to be collected, and to the way that the survey is designed and carried out. In particular, there are important differences between surveys carried out by face-to-face interviewing, by telephone interviewing, and by self-completion methods. There are also differences between surveys of individuals and households on the one hand and businesses and other establishments on the other. In the case of individuals and households, there is also an important distinction between surveys where the data are collected in the sample member’s own home and
surveys where the sample member is responding in a different context or in a particular capacity (e.g., as a user of a particular service or as a visitor to a particular place). Let us consider some common types of survey.

3.3.1 Face-to-face Interview Surveys of Households or Individuals

Many surveys of the household population in a country, region or town are carried out using face-to-face interviews in the respondents' own home. For example, most national statistical offices carry out Labor Force Surveys and Household Budget Surveys in this way. The World Bank’s series of Living Standards Measurement Surveys (http://www.worldbank.org/lsms/) are also carried out in this way. The sample is usually selected from a list of either persons or addresses (e.g., a population register, a list of postal addresses, or a list of addresses drawn up in the field as part of the survey preparation phase) and the interviewers’ first task is to locate each selected address. They must then make contact with the residents, confirm whether any resident is eligible for the survey, possibly make a random selection of one person to interview, contact the selected person, persuade the person to be interviewed, agree a convenient time and place for the interview, administer the interview, and transmit the data to the survey office. At each stage, nonresponse could occur for each of several reasons. To illustrate this, consider the example of surveys of individuals in the United Kingdom, where a sample of addresses is selected from the Post Office list, and one person is subsequently selected for interview at each address. Surveys that use this design include the British Crime Survey, the British Social Attitudes Survey and the UK part of the European Social Survey. Similar designs can be found in several other countries. The fieldwork process is summarized in Figure 3.1. The shaded boxes indicate nonresponse outcomes.

The first stage of the process is to mail an advance letter (or prenotification letter) to each selected address. This notifies the residents that an interviewer will be visiting soon, provides some basic information about the survey, and provides contact details for the survey organization in case the recipient has queries or concerns. Having received this letter, some sample members contact the survey organization to indicate that they do not wish to participate in the survey. Where possible, the survey organization attempts to persuade these sample members to allow the interviewer to visit and to explain the survey in more detail, emphasizing that they will still have the opportunity to decline to take part at that stage if they wish. But this is not always successful; some sample members insist that they do not want an interviewer to visit. These cases are typically referred to as office refusals, as they are refusals noted in the survey office, before the interviewer has had a chance to influence the outcome.
Figure 3.1. The process for a sample of addresses. (cf. Laiho and Lynn (1999).
At all remaining sample addresses, an interviewer attempts to visit the address and make contact with the residents. In the majority of cases, the address will consist of a single dwelling (a house or a flat), in which case the interviewer’s task is to list all adult residents and make a random selection of one to interview. Some people refuse to provide the information necessary to list the residents; other people will never be at home when the interviewer visits, resulting in a noncontact. In the small minority of cases where an address contains multiple dwellings, the interviewer has the additional task of selecting one or more dwellings. Once the random selection of a person to interview has taken place, the interviewer must attempt to speak to that person. It may not be the person who provided the information to make the listing, and the selected person may not even be at home, so the interviewer may have to make subsequent visits to the address to find this person. If contact is successfully made, there are still several reasons why an interview may not be achieved. The selected person may refuse, or somebody else may refuse on their behalf (for example, a husband who does not allow the interviewer to speak to his wife, or a parent who does not allow contact with their child—a proxy refusal). The selected person may be unable to participate due to illness or incapacity or may not speak adequately the language in which interviews are being conducted. On United Kingdom surveys of this kind, it is often found that around 3% to 6% of sample addresses will result in a noncontact, between 15% and 35% will be a refusal and around 1% to 2% will be a nonresponse for some other reason.

It can be seen that the survey participation process is quite complicated and there are many stages in the process at which there is an opportunity for nonresponse to occur. In general, the more complicated and demanding the process of collecting data is, the more likely it is that nonresponse will occur.

3.3.2 Telephone Surveys of Named Persons

Many surveys are carried out by telephone. In some countries, this is a common method of carrying out surveys of the general population. This usually involves selecting a random sample of phone numbers by a method such as random digit dialling (RDD). Telephone surveys are also often used when the sample is of named persons for whom a telephone number is available, perhaps from the sampling frame or having been collecting in an earlier survey interview. With such surveys, noncontact can occur if the telephone number is incorrect or if the sample member has changed telephone number recently (for example, due to moving home). In some such cases, it will be possible to obtain the new phone number, but not always. If the phone number is correct, noncontacts will occur if the sample member is never at home when the interviewer calls, or if they do not answer the phone. It is increasingly common in some countries for people to use devices that enable them to see the phone number of the person calling them before they answer the phone. They may choose not to answer if they do not recognize the number. And even if contact is made, the sample member may refuse to carry out the interview. It is much easier to refuse on the phone than to an interviewer standing at the door, so it is a big challenge for telephone interviewers to prevent this from happening.
3.3.3 Postal Surveys

Surveys that use self-completion questionnaires administered by post (mail) may seem to be rather simple in terms of the participation process. Either you receive the completed questionnaire or you don’t. But in reality the underlying process is still quite complex. The difference is that it is hidden from the view of the survey researcher to a greater extent than with interview surveys. First, there will be some cases where the questionnaire does not reach the intended recipient, because the address is wrong, because of a failure of the postal service, or because someone else at the address intercepts it. Amongst cases where the questionnaire successfully reaches the sample member, there will be several reasons for it not being returned. In some cases this represents a refusal, in the sense that the recipient consciously decides not to complete the questionnaire (but only in a small minority of such cases will the recipient inform the survey organization of this decision), in other cases it may simply be a result of forgetting, as the recipient puts the questionnaire to one side with an intention to complete it later, but then fails to do so. There may be some cases where the respondent is unable to complete the questionnaire due to illness, illiteracy, or inability to read the language of the questionnaire. And some questionnaires may be completed but get lost in the post.

3.3.4 Web Surveys

The nature of nonresponse on web surveys depends heavily on the design of the survey. For invitation-only surveys, where a preselected sample of persons is sent (typically by email) an invitation to complete the questionnaire, noncontact can be considerable. This can be caused by incorrect or out-of-date email addresses, by the recipient’s email system judging the email to be spam and therefore not delivering it, or by the recipient judging the email to be spam and not opening it. For web surveys, levels of break-off are typically higher than with other survey modes. This is where a respondent gets a certain way through the questionnaire and then decides not to continue. There are many reasons why this happens and, although the proportion of break-offs can be reduced by good design, it is a considerable challenge. Further discussion of the sources of nonresponse and what to report can be found on the website of EFAMRO (www.efamro.org), see also de Leeuw, Chapter 7.

3.3.5 Flow Samples

Many surveys involve sampling and collecting data simultaneously from a mobile population that is defined by time and location. Examples include international passenger surveys that sample and interview at ports and airports, surveys of train or bus passengers, and surveys of visitors to a particular location or service such as a national park, a museum, or an employment agency. With this kind of survey, noncontacts are likely to consist solely of cases where the sample person could not be approached as there was no interviewer available to do so. This tends to happen during periods of high flow,
as interviewers are still occupied interviewing previously sampled person(s). The extent to which this happens depends on the frequency with which people are sampled at each sample location (determined by the population flow and the sampling interval) and the number of interviewers working at that location. The extent of refusals will largely depend on the time that sample members have available and the circumstances. If you are attempting to interview people while they are waiting in a queue you may get rather low levels of refusal as the sample members do not have many alternative ways to spend the time. But if you are sampling people who have just disembarked from a train, sample members tend to be keen to continue their journey and refusal levels will be higher.

### 3.3.6 Business Surveys

Surveys of businesses are different from surveys of households in two important ways that affect nonresponse. First, respondents are not answering on their own behalf but on behalf of the business. This raises a different set of concerns regarding confidentiality and sensitivity of responses, which could affect refusals. Second, it is often necessary for more than one person in the business to contribute to the survey answers and the survey organization rarely knows the identity of these people in advance. Consequently, a response will only be obtained if all the necessary people are identified and contacted during fieldwork. Many business surveys are conducted as self-completion surveys, so this often requires a questionnaire to be passed around the business to each relevant person. The ways in which the survey organization controls and facilitates that process are likely to influence the extent of nonresponse due to a failure to reach the relevant person(s)—a form of noncontact.

### 3.4 WHY DO PEOPLE REFUSE TO PARTICIPATE IN SURVEYS?

Refusals often constitute a large proportion of survey nonresponse. Consequently, they warrant careful attention. A conceptual framework for survey co-operation in the case of interview surveys is presented in Figure 3.2. The decision about whether or not to co-operate is an outcome of the interaction between interviewer and sample member. The behavior and performance of both the sample member and the interviewer during the interaction will be largely influenced by two sets of factors. These can be broadly labeled the social environment and the survey design. (Both actors in this interaction will of course also have their own personal characteristics and predispositions upon which these two sets of factors act.)

The social environment includes the degree of social cohesion, the legitimacy of institutions, and so on. These influence the degree of social responsibility felt by a sample person and the persuasion strategies and decision-making strategies used by interviewers and respondents respectively. Also, the immediate environment in which the survey interview is to take place...
is likely to affect a sample member's willingness to be interviewed. Relevant factors include comfort and perceived safety.

Many aspects of survey design affect response rates. These are discussed in section 3.5 later. Other, broad, aspects of survey design can be considered as constraints upon the interaction between sample member and interviewer. Mode of interview is very important. Interviewers are much more limited in the ways they can communicate with a sample member if they are talking on the telephone rather than standing in front of them face-to-face. They cannot show the sample member documents or identity cards, they cannot use body language or gestures, and so on. These limitations may contribute to the lower levels of success that interviewers seem to have in avoiding refusals on telephone surveys. How interviewers introduce the survey is also likely to be influenced by the length and content of the interview. For example, if a sample member seems generally willing but appears not to have much time available currently, then faced with a long interview an interviewer may suggest that she returns at a more convenient time ("retreat and return") rather than asking to start the interview immediately. But if the interview is short, she may be more likely to suggest starting the interview immediately. These tactics may have different implications for the survey outcome.

![Diagram](image)

Figure 3.2: A conceptual framework for survey co-operation. Adapted from Groves and Couper (1998, p. 30).

Groves, Cialdini and Couper (1992) discuss six psychological principles that apply to requests to take part in surveys: reciprocation, authority, consistency, scarcity, social validation and liking. Additionally, three types of attributes of the interviewer may have an important influence on the interaction with the sample member. The interviewer's expectations regarding the likelihood of
gaining co-operation is affected by previous experiences but can also be influenced by appropriate training. Their appearance and manner influence sample members’ impressions of the interviewer’s intentions and whether it is likely to be safe or desirable to talk to them. The more, and more diverse, previous survey experience the interviewer has had, the more likely it is that they will be able to react to particular situations in appropriate ways that will minimize their chances of getting a refusal.

Survey topic influences some sample members’ willingness to respond. The more relevant the survey appears, the more likely sample members will agree to be interviewed. But being interviewed can also have negative consequences, often referred to as the burden of taking part in a survey. For many people, the main component of burden is simply the amount of time that it takes. Other aspects of burden include cognitive effort, sensitivity and risk. Cognitive effort essentially relates to how difficult the questions are to answer. Sensitivity refers to embarrassment, stress or pain that may be caused by the questions. Risk acknowledges that being interviewed may (be perceived to) involve a risk to one’s personal safety by letting a stranger into one’s home, but also that answering questions that may reveal illegal or immoral behavior could result in being punished for that behavior (or at least be perceived to risk such an outcome).

Ultimately, the sample member must rapidly consider the potential benefits and potential drawbacks of agreeing to the interview and make a decision. The benefits and drawbacks will be weighed up against one another and if the drawbacks appear to weigh more heavily, the sample member will refuse. This idea is nicely encapsulated in the leverage-saliency theory of survey participation (Groves, Singer & Corning, 2000). The survey researcher should therefore, through the behavior of the interviewer and the design of survey documents and materials, emphasize to sample members the benefits of taking part and to de-emphasize the disadvantages. Of course, the various considerations will not be equally important to all sample members and that is why interviewers should be able to tailor their approaches (Groves & Couper, 1998, pp. 248-249) to react to the particular circumstances and concerns of each sample member. Various materials are available to assist in training interviewers in techniques to maximize response rates. These include a video with an accompanying trainers’ booklet (National Centre for Social Research, 1999) and an earlier book (Morton-Williams, 1993).

3.4.1 Self-completion Surveys

Tailoring is an important tool to reduce the chance of getting a refusal. However, compared with tailoring by interviewers during an introductory conversation, it is much more difficult to tailor documents such as advance letters, as typically little is known in advance about the sample members or their concerns. This is perhaps one reason why self-completion surveys, when not introduced by an interviewer, tend to achieve lower response rates than interview surveys. The framework presented in Figure 3.2 can be applied also to self-completion surveys, simply by replacing interviewer with survey organization in each box. The interaction with the sample member now
typically consists of the sample member reading written material. In the case of a postal survey, this will be a letter, a questionnaire, possibly one or more reminder letters, and possibly a survey website. In the case of a web survey, the written material comes in the form of an invitation email or letter plus instructions that accompany the questionnaire on the website. The interaction is therefore much more limited and the survey organization rarely has the opportunity to react to particular concerns or circumstances of sample members. Strategies that can be adopted to minimize refusals on self-completion surveys are discussed in Dillman (2000).

3.5 CALCULATING AND PRESENTING RESPONSE RATES

Response rate is an important indicator of the success of the survey at representing the population of interest (assuming the sample was selected by an appropriate probability method). It can also be used as an indicator of the success of the data collection operation. In fact, response rates and other kinds of outcome rates such as eligibility rates, contact rates and refusal rates provide useful information for many purposes. Consequently, the way they are calculated and presented is important (Lynn, Beerten, Laiho, & Martin, 2002).

Every survey should document the outcome rates achieved. These rates should be calculated in clearly specified ways, so that readers can understand exactly which kinds of units have been included in the numerator and which in the denominator of each rate. Ideally, the method of calculating response rate should be consistent with other similar surveys. Some guidance on how to do this appears in AAPOR (2005) and Lynn, Beerten, Laiho, and Martin (2001); for Internet surveys see EFAMRO. Published response rates are often accepted uncritically, but this is misguided as the rate can be sensitive to the method of calculation. This can make comparisons of published response rates fairly meaningless. It is good practice to publish the number of sample cases in each outcome category (e.g., the kinds of categories in Figure 3.1 mentioned earlier) so that users can calculate whichever rates they wish for themselves. We saw earlier in this chapter that there are many possible ways in which nonresponse can arise on a survey. If we want to learn how to improve response rates next time, it is essential to know how prevalent each reason for nonresponse was. A single response rate does not convey that information—a complete distribution of outcomes is needed.

Even more fundamental is the way in which the outcome categories themselves are defined. This too should be documented explicitly. The guidelines referred to earlier provide a set of standard definitions of outcome categories that can be applied to most surveys.

3.6 MINIMIZING NONRESPONSE

A consequence of the diversity of ways in which nonresponse arises is that we need a range of techniques and tactics to prevent nonresponse. No single
technique is likely to have a large impact on response rate. We need to combine many techniques, applied to different stages of the design and implementation process. The classification in Table 3.2 can serve as a useful starting point for thinking about what we should do.

3.6.1 Identifying/Locating Sample Units

Success at identifying or locating sample units largely depends on the quality of information on the sampling frame. Sometimes, it may be possible to augment sampling frame information by matching sample units to other data bases or sources of information. The researcher should consider at an early stage whether this is likely to be necessary and, if so, to set up systems in advance of field work. During field work, it may be appropriate to have systems for locating new contact details for sample members who have moved. This may require interviewers to travel to different areas. Again, such systems require advance planning.

3.6.2 Making Contact

Often, considerable efforts are needed to make contact with sample members. This is particularly true for face-to-face and telephone interview surveys. The necessary extent of the efforts, and the best way to make them, depends on the nature of the sample units and the nature of the survey task. The researcher should consider carefully how, when and where the sample members are most likely to be available to be contacted and to develop field work procedures appropriately. I outline below some techniques that have been found to work well in some common survey situations, but you must think critically about the extent to which these findings are relevant to your survey.

In some countries, particularly industrialized ones, the amount of time that people spend in their home has been decreasing in recent years. Some population subgroups—for example, young single professionals living in big cities—spend very little time at home. This presents challenges for at-home interview surveys. Interviewers can reduce noncontact rates by making more call attempts and by varying the times of day and days of the week of their call attempts. Both of these dimensions of interviewers’ calling patterns (number of calls and time/day of calls) are important. In the case of face-to-face surveys, many survey organizations stipulate that an interviewer must visit an address at least 4 (or 5) times, including at least once on a weekday evening and at least once at the weekend, before it can be classified as a noncontact. Often, considerably more attempts are made. With a clustered sample (see Lohr, Chapter 6), each time an interviewer visits the sample area, he or she can make a further call at each address where contact has not yet been made. With a more dispersed sample, the noncontact rate is likely to be higher unless special measures are taken. It is important to provide interviewers with motivation to make extra calls, especially at evenings and weekends. This can partly be achieved by good training, but financial reward will also be needed. Paying a fixed hourly rate provides no incentive for interviewers to call at times when
people are more likely to be at home rather than times when they themselves prefer to work. Paying a modest bonus for achieving a target contact rate could be effective. All these counter measures are, unfortunately, likely to increase the costs of fieldwork and the length of the data collection period.

The marginal cost of making extra call attempts is relatively low on a telephone survey so many attempts can be made. It is not uncommon for survey organizations to stipulate that a sample telephone number must be attempted at least 12 or 15 times before it can be classified as a noncontact. If sample members are being telephoned at their homes, it will be important, as with face-to-face interviewing, for interviewers to work evenings and weekends. As some people can be away from home for long periods (on holiday, on business, etc.), contact rates will be higher the longer the fieldwork period.

If contact is made with someone other than the sample member, it is important to obtain and record information about when the sample member is likely to be available, and subsequently to phone again at that time. This requires a carefully planned call scheduling system. The system should ensure that an interviewer (it may not necessarily be the same interviewer) calls back at an appropriate time if an appointment is made or if an indication is given of when the sample member is likely to be available. Even if no contact at all is made, the call scheduling system should aim to ensure that future calls are made at different times and on different days to the previous unsuccessful calls. On a modest sized survey, the interviewers may do the scheduling using paper based diary systems. On a larger survey, it may be more efficient for a supervisor (perhaps themselves a senior interviewer) to do the scheduling using a spreadsheet or other computer based system. If the work is being carried out from a telephone unit or other central office location, this is particularly likely to be the best solution. Many survey organizations use computer assisted systems for telephone surveys, and these incorporate automatic call scheduling facilities.

If self-completion questionnaires are to be posted to sample members, contact will only be made if the sample member actually receives the mailing, opens the envelope and looks at the contents. The most important determinant of noncontact rate is therefore likely to be the quality of the address information used for the mailings. Once the mailing has arrived at the correct address, the sample member must be motivated to open it. A plain envelope may be best, to avoid it looking like junk mail. The design of postal survey packages is discussed by de Leeuw in Chapter 13.

On web surveys, to make contact typically requires both that a valid email address is available for each sample member (i.e., one that relates to an account that the sample member checks regularly) and that the recipient is motivated to open the invitation email and read it. The subject line of the message and the 'ender are therefore important. For further discussion of making contact on web surveys, see Lozar-Manfreda and Vehovar (Chapter 14).

Surveys that aim to sample from a flow (as described earlier) are rather different from other surveys in terms of strategies to minimize noncontacts. The important thing is to ensure that field workers are able to deal adequately with periods of high flow. The appropriate strategy depends on the rate of flow, how well the flow can be predicted in advance, and the time taken for field workers to hand out each questionnaire or administer each interview. It may involve having
3.6.3 Obtaining Cooperation

To minimize refusals, the survey researcher should: (a) increase (and emphasize) the benefits of taking part, (b) reduce (and de-emphasize) the drawbacks, and (c) address legitimate concerns of sample members.

The survey should be introduced in a way that makes participation seem likely to be interesting and enjoyable. Emphasize the aspects of the interview that people are more likely to find interesting. Explain that the survey serves useful purposes. Provision of payment or a small gift can also help. There is considerable experimental evidence that such incentives can reduce survey refusal rates, though the extent of the reduction depends on the nature of the incentive, the study population and other features of the survey. Offering survey respondents a token of our appreciation helps to establish the *bona fide* nature of the survey and makes them feel better disposed to reciprocate by offering their co-operation in return; however, providing an incentive to each respondent raises costs and survey funders may need to be convinced that it is likely to be cost effective.

For many people, the main drawback of taking part in a survey is the amount of their time that it will take. This should be minimized by keeping questionnaires as short as possible – ask only questions that are necessary; do not ask an open ended question (which might take a minute or two) if a closed question (taking a few seconds) provides equivalent information. People might be more willing to take part at certain times than others. Be flexible and allow them to take part when it is most convenient for them. On interview surveys, the interviewer should be prepared, when it is clear that she has called at an awkward time, to call back later when it is more convenient for the sample member. Otherwise, there is a high risk that a refusal will result. Offer to make an appointment. Some sample members may think that taking part will be too difficult for them, or that the survey is not relevant to them. Tell them that the questions are not difficult and that no specialist knowledge is required. Tell them that you are interested in the views and experiences of *all* kinds of people—that the survey results must represent everyone, not just the people with strong views or expert knowledge.

Sample members may be concerned that their answers should not become known to anyone else. Tell them that the survey is confidential and that nobody outside the research team will be able to link their answers to their name or address (you must, of course, have systems in place to ensure this). Explain that results will be made available only in the form of statistical summaries—no individuals will be identified. Tell them that they will not receive any direct mail as a result of taking part and that they will not be asked to take part in any further surveys (if this is true). On an in-home interview survey, sample members—especially older people—may be reluctant to invite a stranger into their home. Be sure that interviewers carry identification and that sample members are given the name and telephone number of someone who can verify that the survey is genuine. It is good practice to notify the local police station in areas where you are carrying out in-home interviews. Interviewers can tell wary respondents that
the police know about the survey and suggest that they contact the police station to check this if they wish. Interviewers should be prepared to offer to come back when there will be someone else there too, if a sample member is reluctant to let them in while they are alone.

The method of communicating all these messages to sample members depends on the survey. On interview surveys, you will be heavily dependent on the interviewers to explain the survey and answer questions. It is therefore important that interviewers are well trained in what to say to avoid getting a refusal. Depending on the nature of your sample, you may also be able to send an advance letter to sample members. If the letter has an official letterhead, that helps to establish the credibility of the survey. The letter should also provide the name and phone number of someone to whom queries can be directed. (This person, of course, must also be trained in refusal avoidance techniques and must be provided with information necessary to answer most of the sorts of queries and concerns that sample members are likely to raise). The letter should also briefly outline the nature of the survey and explain that answers will be treated confidentially. It should explain that an interviewer will be in touch shortly. It is generally best to avoid mentioning how long the interview will take in the advance letter—leave this to the interviewer to explain.

On a postal survey, the survey documents must convey all the important messages to sample members. Typically, the documents consist of a covering letter and the questionnaire itself. You may also include a leaflet containing further information about the survey or about the organization for whom the survey is being carried out. Sample members will decide, based upon their perceptions of these documents alone, whether or not to take part. Similarly, for web surveys the respondent’s perception of the information presented on screen determines whether or not they decide to proceed with the survey.

3.6.4 Minimizing Other Reasons for Nonresponse

To reduce the number of interviews that are lost due to the sample member being too ill or temporarily away, a compromise solution can be to accept a proxy interview from a spouse or other household member, answering on behalf of the sample member. This can sometimes be appropriate, depending on the nature of the survey questions. There is no point asking a proxy respondent about things that they do not know. And it is certainly not possible to ask opinions or attitudes by proxy. In general, if you choose to accept proxy interviews in certain circumstances, there is likely to be a trade-off between response rate and measurement error. Other ways of reducing the number of temporarily absent sample members include extending the field work period and offering alternative modes of response, although these may have other disadvantages.

For many surveys, people who do not speak (in the case of an interview survey) or read and write (in the case of a self-completion survey) the main language (or one of the main languages) of the country are an important subgroup. Excluding them would certainly introduce nonresponse bias. But including them is likely to be expensive. It is necessary to provide translated
materials and, in the case of an interview survey, trained interviewers who speak each language. And translation of survey materials is not a simple matter (see Harkness, Chapter 4), so the translation process must be a careful one.

3.7 NONRESPONSE ERROR

Ultimately, nonresponse is important because it affects estimates. In our earlier example, nonresponse caused us to estimate that 36% of people had low literacy ability when the true figure in the population was 43%. In general, nonresponse introduces error to our estimates if the nonrespondents differ from the respondents in terms of the things we are trying to measure (unless we can fully correct for these differences at the analysis stage—see section 3.8). Suppose we want to estimate a characteristic $Y$. This could be any kind of population parameter: a mean, a proportion, a measure of association, and so forth. We estimate $Y$ by the corresponding sample statistic $y$. But we only observe $y$ for the respondents in the sample, so the value we observe might differ from the value we would have observed if we had complete response. We can express this as follows:

$$y_r = y_n + \frac{nr}{n} (y_r - y_{nr}),$$

(3.1)

where $n$ is the (selected) sample size; there are $r$ respondents and $nr$ nonrespondents (so $r + nr = n$); $y_r$ is the value of $y$ for the respondents (observed); $y_{nr}$ is the value of $y$ for the nonrespondents (not observed); and $y_n$ is the value of $y$ for the complete sample (not observed).

The amount by which the estimate $y_r$ differs from $y_n$ is the nonresponse error. This is the product of two components. The first, $nr/n$, is the nonresponse rate. The second, $(y_r - y_{nr})$, is the difference between respondents and nonrespondents in our variable of interest. We therefore need to pay attention to both these components. The nonresponse error or bias is given by

$$y_r - y_n = \frac{nr}{n} (y_r - y_{nr}).$$

(3.2)

Note that knowledge of the response rate alone does not tell us anything about nonresponse error. It is possible to have a high response rate (small $nr/n$) but have large nonresponse error (if $(y_r - y_{nr})$ is large); it is also possible to have a low response rate (large $nr/n$) but have little or no nonresponse error (if $(y_r - y_{nr})$ is small). To estimate the extent of nonresponse error, we need to find a way to estimate $(y_r - y_{nr})$ (see section 3.7). And to minimize nonresponse error we need to minimize both $nr/n$ and $(y_r - y_{nr})$. The
previous section discussed how we can minimize $nr/n$, but minimizing $(y_r - y_{nr})$ can be more challenging. Essentially, we need to concentrate on increasing response rates amongst the sample groups who would otherwise be unlikely to respond.

To illustrate the use of this expression for nonresponse error, we return to our literacy example (Table 1). We have $y_r = 180/500 = 0.36$ and $y_n = 300/700 = 0.43$; the nonresponse error $y_r - y_{nr} = -0.07$ is based on $(y_r - y_{nr}) = (0.36 - (120/200)) = -0.24$ and $nr/n = 200/700 = 0.286$, alternatively calculated as $0.286 \times (-0.24) = -0.07$.

### 3.8 ESTIMATING NONRESPONSE ERROR

Estimating $(y_r - y_{nr})$ is a big challenge as $y_{nr}$ is, by definition, not observed. But there are several possible approaches. Often, more than one of them is possible. It is a good idea to look at every available source of information about nonresponse as this helps you to build up a picture of the nature of nonresponse on your survey.

#### 3.8.1 Use sampling frame information

Many sampling frames are a useful source of auxiliary information about each unit. If we include this information on the sample file, we can use it to compare respondents and nonrespondents.

Table 3.3: Estimating nonresponse error using sampling frame data

<table>
<thead>
<tr>
<th>Highest qualification</th>
<th>Response rate</th>
<th>Selected sample %</th>
<th>Responding sample %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 5+ Higher grades</td>
<td>91.1%</td>
<td>18.0</td>
<td>21.4</td>
</tr>
<tr>
<td>2. 3-4 Higher grades</td>
<td>85.1%</td>
<td>13.0</td>
<td>14.5</td>
</tr>
<tr>
<td>3. 1-2 Higher grades</td>
<td>81.7%</td>
<td>15.0</td>
<td>16.1</td>
</tr>
<tr>
<td>4. 5+ Standard grades 1-3</td>
<td>76.4%</td>
<td>8.1</td>
<td>8.1</td>
</tr>
<tr>
<td>5. 3-4 Standard grades 1-3</td>
<td>74.1%</td>
<td>9.1</td>
<td>8.8</td>
</tr>
<tr>
<td>6. 1-2 Standard grades 1-3</td>
<td>69.1%</td>
<td>14.5</td>
<td>13.1</td>
</tr>
<tr>
<td>7. Standard grades 4-7 only</td>
<td>62.6%</td>
<td>14.4</td>
<td>11.8</td>
</tr>
<tr>
<td>8. No qualifications</td>
<td>59.6%</td>
<td>7.8</td>
<td>6.1</td>
</tr>
</tbody>
</table>

$N = 4,542$  $3,469$

Source: Lynn (1996)

Table 3.3 presents an example, using data from the Scottish School Leavers Survey, a postal self-completion survey of young people aged 16 to 18 in
Scotland. The sampling frame for this survey includes a record of examination passes achieved at school. This information has been used to derive an ordinal variable with eight categories, shown as rows in Table 3.3.

Because we know the level of qualification achieved by each sample member, whether or not they responded to the survey, we can calculate response rates separately for each group. The response rate is highest amongst the most highly qualified sample members (91.1%) and lowest amongst those who left school with no qualifications (59.6%). Thus, we can obtain a direct measure of nonresponse error in, say, the percentage of people leaving school with very low qualifications: \[ y_r - y_n = 17.9 - 22.2 = -4.3. \] However, it is not immediately helpful to know that nonresponse would cause us to underestimate this percentage by 4.3 if we used the responding sample, because we already know the percentage for the complete sample. The usefulness of the statistic lies in the fact that leaving school with very low qualifications is correlated with other parameters that we might wish to estimate using the survey data, such as labour market outcomes. We could be fairly sure that nonresponse error would cause us to underestimate the proportion of young people who are unemployed at age 20, for example, although we would not know by how much. Using sampling frame data thus has the advantage that nonresponse error can be calculated directly, but the disadvantage that this can only be done for the auxiliary variables and not for survey variables. Typically, it requires advance planning as we need to capture the auxiliary data during the process of sample selection.

3.8.2 Using Linked Data

It may be possible to link data from other sources to the sample records (see Bethlehem, Chapter 26). Only rarely is this possible for individuals, as in most contexts this requires the individuals' consent (which cannot be obtained for nonrespondents). But linkage is often possible at some higher level of aggregation. For example, in many countries a range of population statistics are published for small areas, either from a Census or from administrative data (e.g., on zip code level). The sample for a general population survey can be linked to such auxiliary data provided that suitable geographic identifiers exist on the sample file. The data can then be used in the same way as for sampling frame data.

3.8.3 Interviewer Observation

For an in-home face-to-face interview survey (and some other types of survey) it can be possible to ask interviewers to record certain characteristics of each sample unit from observation. For example, this might include the type of dwelling, the construction materials, the age of the dwelling, the nature of the surrounding area, and so on (e.g., Lynn, 2003b). The data on these characteristics can then be used in the same way as for sampling frame or linked data. A variation on interviewer observation is to collect data about nonrespondents by proxy, for example from neighbors or work colleagues. This
is rarely very satisfactory as a means of studying nonresponse, as the data are typically far from complete and it cannot be assumed that measures are comparable with those collected from the respondents themselves.

3.8.4 Comparison with External Data

Sometimes there exist aggregate data about the population under study from some external source such as a recent Census or administrative data. If these data relate to one or more of the same variables about which data have been collected by the survey, then the responding sample can be compared with the population data; however, there are two important things to note about such comparisons. First, any differences between the two sources may not be due (solely) to nonresponse. Other factors affecting the comparison include coverage error and sampling error. These factors are confounded. Second, the data themselves may not be strictly comparable. There may be differences in the time period to which they refer, in the reference population to which they relate, and in the way they have been collected. Some data items may be more sensitive than others to such differences. In consequence, some observed differences between the responding sample and the external data may not reflect any real difference at all—rather, they may simply be due to differences in the way the variables have been measured. If you are planning an external comparison, consider carefully which variables are likely to be least sensitive to differences in the way the data were collected.

3.8.5 Using Process Data

Often, survey researchers can learn a lot from information about the process of collecting the survey data. For example, for an in-home survey, it is possible to record the number, timing, and outcome of all visits made to each sample unit before the interview was achieved; for a telephone survey you can record the number, timing, and outcome of all calls; for a postal survey you can record the number of days until the questionnaire was received or the number of reminder mailings that had to be sent to each unit. Process data of this kind, also often referred to as para data (see also Mohler et al, Chapter 21), can be available for all sample units. You can then observe how these data relate to the survey variables to obtain an indication of the likely direction and magnitude of nonresponse bias.

3.8.6 Survey of Nonrespondents

After a survey is complete, a sample of the nonrespondents can be selected for intensive follow up. This can be enlightening, but it is very hard to get a good response rate to a survey of nonrespondents. Ultimately, the follow up survey only tells us something about the relatively more accessible and less unwilling nonrespondents and we will not know how representative they are of all nonrespondents. In short, this survey too suffers from nonresponse error.
3.8.7 Panel Dropouts

In the case of panel surveys and other follow up surveys, we are in a strong position to understand the nature of nonresponse subsequent to the first wave. For the first wave, we still have to use one or more of the methods described earlier. But for subsequent waves, we can use all of the survey data collected at the first wave, and any other wave prior to the one being studied, as auxiliary data. The advantage of this is that we typically have a rich range of variables available and at least some of them are likely to be highly correlated with the survey variables of interest. Often, they are measures of exactly the same concept, relating to an earlier point in time.

### 3.9 ADJUSTMENT FOR NONRESPONSE

Understanding something about the nature of nonresponse and the likely impact of nonresponse error on survey estimates is important. But rather than simply describing it, it is better to adjust the estimates for it. This can be done quite simply using weighting. However, although it is simple to implement nonresponse weighting, it is not necessarily so easy to identify a good way of weighting amongst the possible ways that present themselves. Care is needed.

Consider again the data of Table 3.3. The response rate amongst sample members in category 1 was 91.1%. If we give each respondent in category 1 a weight of $100/91.1$ (i.e. 1.098) in our analysis, and applied a similarly constructed weight to respondents in each of the other seven categories, then the categories would be represented in their correct (selected sample) proportions in the analysis. This makes intuitive sense, as every 91.1 respondents in category are in some sense representing 100 selected sample members, so they must be given extra weight to represent the additional missing 8.9 sample members. The weights will be greater the lower the response rate: in our example the largest weight is 1.678 for respondents in category 8.

After weighting has been applied, the nonresponse error that remains in a weighted estimator can be expressed as follows:

$$ y_{rw} - y_n = \frac{1}{n} \sum_{h=1}^{H} n r_h (y_{r_h} - y_{n_r}) $$

where there are $H$ weighting classes, denoted $h = 1, \ldots, H$ ($H = 8$ in our example).

It can be seen that the error is now a weighted sum across the weighting classes of the difference in $y$ between respondents and nonrespondents. In other words, the error no longer depends on differences between the classes, as this is what the weighting has corrected. The definition of the classes is therefore important. For nonresponse weighting to be successful, four criteria should be met: (a) Response rates should vary over the classes; (b) Values of target variables ($y$) should vary over the classes; (c) Respondents and nonrespondents should be similar to one another within each class (i.e. $y_{r_h} - y_{n_r}$ should be small); (d) Class sample sizes should not be too small. When choosing between
alternative ways of creating weighting classes, these criteria should provide
guidance. Weighting is discussed in more detail by Biemer and Christ in
Chapter 17. An important point to remember at this stage is that it will not be
possible to implement effective weighting unless you have planned ahead and
collected some of the kinds of data outlined in the previous section.

3.10 CONCLUSION

Nonresponse is important and there are many different ways in which it can
arise. Equally importantly, there are many different things that we as survey
researchers can do to combat the undesirable consequences of nonresponse.
Almost every stage of the survey design and implementation process has the
potential to affect nonresponse error. Consequently, we must keep the issue of
nonresponse in mind at all times. When specifying the sample selection method,
we should consider whether there are useful data that can be captured from the
sampling frame and that will help us later with nonresponse analysis and
possibly weighting. When designing field control documents and sample
control systems, we should consider whether there are useful data that can be
collected by interviewer observation or as indicators of the difficulty of
obtaining a response from each unit. When recruiting and training interviewers,
we should place an emphasis on the kind of social skills needed to avoid
refusals and on working patterns that will minimize noncontacts. Data
collection procedures should incorporate appropriate reminders or multiple
attempts to contact sample members. Questionnaires should be attractive,
interesting, and not too demanding or intrusive. And so on. There are many
things we can do to minimize the impact of nonresponse and there are many
success stories of surveys that have successfully improved response by
reviewing their procedures and implementing a coherent set of changes.

Nonresponse will therefore be a theme throughout this book. In almost
every chapter you will find references to it. Tackling nonresponse involves
carrying out every stage of the survey in a thoughtful, careful and thorough
manner. In short, good survey practice.

GLOSSARY OF KEY CONCEPTS

Adjustment. A term applied to a number of post fieldwork procedures, such as
weighting and imputation, that can be used to reduce nonresponse error.
Noncontact. Failure to communicate with a selected sample unit and to inform
the unit of their selection for the survey.
Nonresponse. Failure to obtain useable survey data from an eligible selected
sample unit.
Nonresponse error. The difference between a survey estimate and the
equivalent estimate that would have been obtained if all selected units had
responded.
Refusal. A decision by a selected sample unit not to respond to the survey.