

# A Framework for Measuring and Reducing Nonresponse in Surveys

MICHAEL A. HIDIROGLOU, J. DOUGLAS DREW,  
and GERALD B. GRAY<sup>1</sup>

## ABSTRACT

The need for standards introduced for the gathering and reporting of information on nonresponse across surveys within a statistical agency is discussed. Standards being adopted at Statistics Canada are then described. Measures to reduce nonresponse undertaken at different stages in the design of surveys at Statistics Canada that have a bearing on nonresponse are described. These points are illustrated by examining nonresponse experiences for two major surveys at Statistics Canada.

KEY WORDS: Nonresponse rates; Incentives; Follow-ups; Data collection.

## 1. INTRODUCTION

National agencies such as Statistics Canada conduct a large number of different surveys every year. These vary in their subject matter, units of response, periodicity, sample design and collection methodologies. They also have varied experiences with respect to the nonresponse incurred. There is a need for agency-wide standards for the gathering and reporting of information on response and nonresponse. If they are sufficiently flexible to accommodate the requirements of the variety of surveys that are conducted, it is logical to have standard definitions. A distinction needs to be made though between standard definitions and standards of acceptable levels of different components of nonresponse to surveys. It is the former and not the latter that is under discussion.

There are major differences between surveys that result in different levels of nonresponse achieved; for example, longitudinal and cross-sectional surveys face somewhat different missing data problems. Standard definitions can provide a common lexicon that will help in isolating and understanding better the differences. A common lexicon helps in the ongoing analysis of trends in nonresponse. Information on survey response and nonresponse can serve multiple purposes, such as the potential for nonresponse biases, pointing to weak areas that need to be strengthened in future rounds of the survey. They provide measures of frame coverage, for developing methods to compensate for and to reduce nonresponse. They also give an important input to survey design, collection methodologies, evaluation of data quality and operations for different surveys.

Nonresponse rates can be defined differently, depending on whether they are used to diagnose sampling activities,

data collection activities or to analyze published data. For example, in the case of sampling requirements, the unit for which nonresponse is measured ought to be the sampled unit. Correspondingly, for data collection activities, the unit of measure for computing nonresponse would be based on the unit of response. It should be noted that for business surveys there is often not a one-to-one correspondence between sampled units and units of response (*e.g.*, the sampled unit may be the head office and the unit of response is its branches). For published data, the measure of nonresponse could be weighted size measures or weighted key variables to estimate the contribution of nonrespondents to the key aggregates. In business surveys, such measures can be important because of the skewed populations where a few units contribute to a disproportionately large share of the estimate.

Breakdowns of the nonresponse rates should be available at pre-determined geographical levels, industrial and size levels and combinations of it. If possible, the reasons for nonresponse also should be available *e.g.*, unable to contact, refusal *etc.* These can be used to produce diagnostics to establish causes of nonresponse. If the data are collected by using interviewers located throughout nationwide regional offices, then nonresponse rates by interviewers within each regional office and nonresponse rates aggregated by regional office can be used as measures of operational performance. Questionnaire item nonresponse rates can be used to point to questions that need to be rethought in terms of wording or data availability.

This paper deals with total nonresponse, where nonresponse occurs at the level of the unit for which data are being collected. It does not deal with partial nonresponse, where the respondent provides usable information for some items but not for others. We start with a conceptual

<sup>1</sup> Michael A. Hidiroglou, Business Survey Methods Division; J. Douglas Drew, Household Surveys Division; Gerald B. Gray, Social Survey Methods Division, Statistics Canada.

framework for the definition of response and nonresponse that is suitable for both business and social surveys. The next section is devoted to general causes of nonresponse and to means for reducing nonresponse. Finally, we look at the experiences with nonresponse for two major surveys conducted at Statistics Canada.

## 2. DEFINITIONS OF NONRESPONSE RATES

Nonresponse rates and their complements, response rates, are defined as ratios of variables that represent a given category of response/nonresponse in some domain of interest. The important variable may be a simple count or it may be weighted by some factor. It may be the sample weights of the unit or the unit's expected contribution to the estimate of some major statistic of the survey. Figure 1 represents a conceptual framework developed by Drew and Gray (1991) for classifying sampled units in a survey into responding, nonresponding and out-of-scope units. The hierarchical representation is similar to one initially proposed by Platek and Gray (1986). The framework has been evaluated for several business and social surveys at Statistics Canada. The agency has adopted these standards

for the gathering and reporting of information on nonresponse. Starting with the 1993 reference year, several major surveys will be required to report detailed nonresponse using the standard definitions. A data base of nonresponse rates will be maintained for use in agency-wide monitoring and analysis of trends in nonresponse.

We begin with the **Total number of Units** (weighted or unweighted). The total number of units consists of those that are thought to belong to the survey of interest before the survey process begins. The total (Box 1 in Figure 1) is broken down into two main categories: resolved (Box 2) and unresolved (Box 3) units. **Resolved Units** are those whose status as belonging or not belonging to the target universe is known by the cutoff date of the survey data collection. For some surveys all units can be resolved. For other surveys, it is either impossible or impractical to resolve all units. For example, in a telephone survey there are telephone numbers that ring but do not correspond to working numbers. Without checking the status of each so-called ring-no-answer case with the telephone company, there is no way to determine whether such a number represents a working number. Similarly for a survey with mail collection, without a follow-up of units not returning a questionnaire, it may not be known which units are

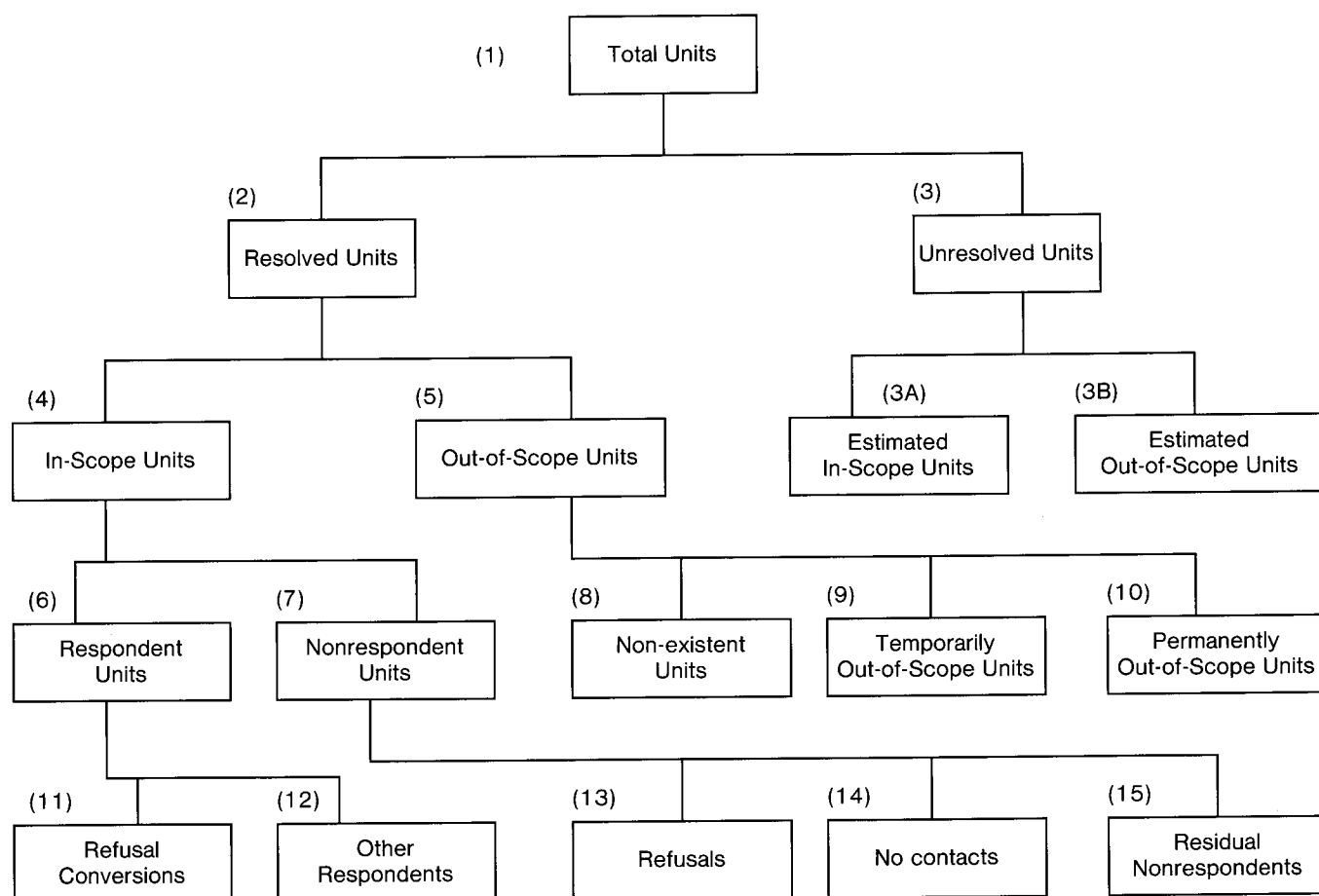


Figure 1. Respondent/Nonrespondent Components at the Data Collection Phase

out-of-scope (*e.g.*, the unit no longer exists, or it exists but it is out-of-scope), versus those that are in-scope and should have responded. **Unresolved Units** are units whose status cannot be determined by the end of data collection for the survey. The number of Unresolved Units may be broken down into **Estimated In-Scope Units** and **Estimated Out-of-Scope Units** by apportioning the number in the same ratio as for the Resolved Units for example. A **Resolved Rate** may then be defined as the *ratio of the number of Resolved Units to the Total number of Units*. The two components of the Resolved Units, *i.e.* In-Scope (Box 4) and Out-of-Scope (Box 5), lead to two complementary rates: the **In-Scope Rate**, defined as the *ratio of the number of In-Scope Units to the number of Resolved Units* and its complement, the **Out-of-Scope Rate**.

The Out-of-Scope Units (Box 5) may be split up into as many as three categories, some of which may not be applicable to a particular survey. These include Non-existent (Box 8), Temporarily Out-of-Scope (Box 9) and Permanently Out-of-Scope (Box 10) Units. The **Non-existent Units** include business deaths, that is, companies that have gone out of business, and dwellings that have been demolished. For recurring surveys, once it is determined that a unit is non-existent, it is excluded from data collection on future survey occasions. The **Temporarily Out-of-Scope Units** are units that were Out-of-Scope at the time of the survey, but which might be in-scope later. Hence, units can be temporarily Out-of-Scope even for single occasion surveys. For recurring surveys, it is necessary to recontact temporarily out of scope cases periodically in case their status has changed. Examples include businesses that are inactive due to seasonal factors, seasonal dwellings whose occupants have a usual place of residence elsewhere, and vacant dwellings. The **Permanently Out-of-Scope Units** result from improper classification on the frame because of changes in the classification since the frame was last updated. These cases may be screened out during the first stage of response. The Out-of-Scope Rate may be split up into three component rates: the **Non-existent Rate**, defined as the ratio of the number of Non-existent Units to the number of Resolved Units. The **Temporarily Out-of-Scope Rate** and **Permanently Out-of-Scope Rates** rates are similarly defined.

The In-scope Units (Box 4) may be broken down into Respondent (Box 6) and Nonrespondent Units (Box 7). The **Respondent Units** include in-scope units that have responded by the cutoff date for the data collection and have provided "usable information". The notion of "usable information" applies to respondents who provide only partial information. A threshold is needed in terms of level of completion of the questionnaire, below which units are considered nonrespondents. The **Response Rate** may be defined in different ways, depending upon the intended analysis. We prefer to define it as ratio of the

*number of Respondent Units to the number of In-Scope and Unresolved Units*. This ratio is a conservative measure of the quality of the frame and the data collection procedures, since some Unresolved Units may be Out-of-Scope. An alternative definition would include only the number of In-Scope Units in the denominator. That rate, a conditional response rate given the known status of the units in the sample, measures the efficiency of the data collection procedure alone. The **Nonrespondent Units** (Box 7) are the remainder of the In-Scope Units. The **Nonresponse Rate** is defined as the complement of the Response Rate. It is the *ratio of the number of Nonrespondent and Unresolved Units to the number of In-Scope and Unresolved Units*. Alternative definitions omit the Unresolved Units in the numerator and denominator or apportion the Unresolved Units between estimated numbers of In-scope and out-of-scope units.

To determine the effort needed to convert Refusals to Respondents at the data collection stage, the Respondent Units are divided between Refusal Conversions (Box 11) and Other Respondents (Box 12). The **Refusal Conversions** are those who refuse initially in the current or previous collection period, and are successfully converted to be respondents because of follow-up interviews. The **Refusal Conversion Rate** is a measure of the success in converting refusals to respondents. Instead of being merely a component of the Response Rate with the same denominator, the **Refusal Conversion Rate** is defined as the *ratio of the number of Refusal Conversions to the number of Refusals and Refusal Conversions*. For completeness, we label respondents who were not refusal conversions as **Other Respondents**.

Finally, the Nonrespondent Units (Box 7) may be broken down into three components; *viz.* Refusals (Box 13), No Contacts (Box 14) and all remaining categories, that is, the Residual Nonrespondents (Box 15). The **Refusals** are nonresponding units that have been contacted but refuse to participate in the survey. The **Refusal Rate** is defined as the *ratio of the number of Refusals to the number of In-Scope Units*. The **No Contacts** are in-scope units that cannot be contacted. For social surveys, these include dwellings whose occupants were temporarily absent and households where no one was at home when interviews were attempted. The occupancy status of such dwellings is determined through observation, or where applicable by speaking to building superintendents. For business surveys, these include telephone respondents who cannot be reached, and mail nonrespondents known to be in-scope, but who were not contacted as part of any nonresponse follow-up. The **No-Contact Rate** is defined as the *ratio of number of No-Contacts and Unresolved Units to the number of In-Scope and Unresolved Units*. The **Residual Nonrespondents** include units that did not respond due to special conditions (for example, language problems, or inaccessibility) as well as respondents who provided no usable information. Special conditions also include in-scope units for which interviews

were not attempted. This is to avoid unwanted overlap between samples for different surveys, as a measure to prevent undue respondent burden. While these latter units differ from other nonresponse in that interviews are not attempted, it is important that they be considered as non-respondents in deriving nonresponse adjustment factors at the estimation stage. The **Residual Nonrespondent Rate** is the ratio of the number of Residual Nonrespondents to the number of In-Scope units.

The rates defined above are at the unit level. Clearly, rates can also be defined at the item level, that is, for individual items on the questionnaire. Typically an item tends to be completed, missing, or in error as detected during editing. Hence, at an item level one can define a response rate, a missing rate, and an edit failure rate. If the missing or edit failures are imputed, one can define an imputation rate. These rates can be defined for unit respondents only, which would generally be preferable if unit nonresponse is treated by reweighting. Alternatively, unit nonrespondents can be included in both the numerators and denominators for the rates, which would be preferable in cases where unit nonresponse is treated by imputation.

We apply the definitions of nonresponse as provided above to several business and social surveys. Table 1 presents annual average nonresponse rates for several Statistics Canada surveys.

Nonresponse rates are highest for three of the social surveys and stem from: (i) the sensitivity of income as a subject matter in the case of the Survey of Consumer Finances, (ii) the respondent burden due to the length of the interview in the case of the Family Expenditure Survey, and (iii) the combination of inexperienced interviewers, telephone survey methodology and nonproxy reporting for the General Social Survey. Nonresponse is very low for the LFS because this is a long-standing flagship survey where many steps are taken to keep nonresponse low. Nonresponse rates are low for the business surveys in Table 1. Some initiatives were undertaken during the recent business survey redesign program, at reducing nonresponse.

### 3. FACTORS AFFECTING NONRESPONSE

Several survey design factors impact on response and nonresponse. In this section, we begin by briefly examining the influence of the frame and sample design. We follow with a more in depth examination of data collection, in terms of its organization, interviewer training, technology, mode of primary collection, and questionnaire design. Also, methods used for follow-up of nonresponse and edit failures, and use of administrative data to replace direct collection are considered.

**Table 1**  
Response Rate Components for Selected Surveys Data Collection Stage (Rates in %)

	COMPUTATION	FAMEX	ASM	GSS	SCF	LFS	RTS
Resolved rate	(2)/(1)	100.0	100.0	98.1	100.0	100.0	95.8
In-Scope rate	(4)/(2)	92.0	95.3	51.2	86.3	85.1	97.0
Response rate	(6)/[(3) + (4)]	72.9	92.8	75.9	73.9	94.4	94.0
Refusal Conversion rate	(11)/[(11) + (13)]	N.A.	N.A.	26.7	N.A.	N.A.	N.A.
Nonresponse rate	[(7) + (3)] / [(3) + (4)]	27.1	7.2	24.1	26.1	5.6	6.0
Refusal rate	(13)/(4)	16.2	7.2	13.2	23.7	1.5	1.7
No-Contact rate	[(14) + (3)] / [(3) + (4)]	5.1	0.0	5.9	2.3	3.6	4.3
Residual nonresponse rate	(15)/(4)	5.8	0.0	5.8	0.0	0.4	0.0
Out-of-Scope rate	(5)/(2)	8.0	4.7	48.8	13.7	14.9	3.0
Non-Existent rate	(8)/(2)	0.8	2.5	0.0	0.3	0.3	2.3
Temporarily Out-of-Scope rate	(9)/(2)	7.1	1.2	0.0	13.4	14.6	0.5
Permanently Out-of-Scope rate	(10)/(2)	0.0	1.0	48.8	0.0	0.0	0.3

FAMEX: Family Expenditure Survey (1990).  
ASM: Annual Survey of Manufactures (1989).  
GSS: General Social Survey Cycle 5 (January-March 1990).

SCF: Survey of Consumer Finances (1991).  
LFS: Labour Force Survey (1990).  
RTS: Retail Trade Survey (December 1990).

### 3.1 Frame

Duplication or overcoverage on a frame can be irritating and lead to nonresponse if there are no procedures for unduplication, or if the procedures are not always successful. For business surveys, accurate classification information is essential if the survey is industry specific or uses industry specific questionnaires. For example, if a sampled business receives a questionnaire not pertaining to its industrial activity, it is unlikely to respond. Accurate information on the coverage of complexly structured businesses is necessary to provide respondents with a good description of the required geographical and/or industrial information. Similarly, information on contact persons within the business is needed to establish good reporting arrangements with the respondent. Inaccuracies in the contact information will cause delays in getting the required data. Inaccurate coverage description will result in improper or incomplete data being provided by the respondent.

The samples for Business surveys at Statistics Canada are drawn from a file known as the Business Register. It is a list frame that contains relevant information for selecting and contacting samples of business respondents. It has recently been redesigned using a comprehensive model reflecting the real-world complexity of business respondents. The processes incorporated in the Business Register minimize the impact of the above causes for nonresponse. Duplication is kept to a minimum by continually linking the changes that are occurring to existing units on the Business Register. These changes include births, amalgamations, splits and mergers of business respondents. Several events can signal changes to the structure of large businesses, including different administrative sources and direct survey feedback. These signals trigger a "profiling" action, *i.e.* contact with the business to redefine its structure. In the absence of signals, structures are profiled on a periodic basis, at a frequency depending upon their significance and their propensity to change. The profiling exercise gathers the necessary information to update the model. More details of the required actions are provided by Colledge (1989). The source of updates is a combination of administrative updates, profile updates and direct survey feedback. Contact, coverage and questionnaire type is kept up-to-date for each sampled unit by setting up and maintaining a computerized collection system for sampled businesses for each survey of interest. The resulting collection units are automatically built and kept up-to-date using well defined rules that vary from survey to survey. The questionnaire type takes account of factors such as: the periodicity of data collection, industrial classification, any seasonal considerations for sub-annual surveys, and fiscal year ends for annual surveys. Automatic maintenance of these collection units is carried out using a wide range of updates to the Business Register. These updates encompass activity status (live, dead, seasonal), name, address and telephone changes as well as structural changes to the surveyed unit.

The adequacy of the frame plays a similar role for social surveys in reducing nonresponse. The frame in combination with the sample design and collection procedures is important: in ensuring manageable interviewer workloads, in providing information to facilitate contact of respondents by interviewers, and in preventing unwanted overlaps in the sample across surveys. The Labour Force Survey (LFS) serves as the main vehicle for the conduct of social surveys based on area sampling. Presently, most other social surveys are supplements to the LFS, that are administered through add on questions to LFS respondents. Some surveys, due to the length of the interview or sensitivity of the subject matter are not suitable as supplements. Instead, they are based on separate samples of households drawn from the LFS frame and design.

The LFS is based for the most part on an area frame, and initial contact with sampled households is generally by face-to-face interview. The efficiency of the area frame deteriorates over time; dwelling counts for the sampling units used to determine the selection probabilities of the sampling units and interval of sampling become out-of-date. This makes it harder to plan and maintain manageable interviewer workloads. The principal mechanism for keeping the area frame up-to-date is a sample redesign following each decennial census of population. Other measures have included *ad hoc* frame updating restricted to high growth areas identified by the mid-decade census. Another measure taken in the 1981 redesign was the creation of so-called buffer strata on the outskirts of large urban centres. This involved a simple design that could be readily updated without affecting the remainder of the frame in the event that growth of the urban centre reached out into the buffer zone. To prevent interviewer workloads from becoming unwieldy when units experiencing large growth enter the sample, sub-sampling is done. For cases of extreme growth, area sub-sampling is resorted to, in which the areal unit is sub-divided into new units, a sub-sample of which is selected. If the growth is not too high, the original sample unit is retained. The rate of sampling is modified to reduce the number of dwellings selected to the point where it no longer poses a problem in terms of the interviewer's workload.

Besides the area frame, a list frame of apartment buildings is used by the LFS in larger cities. This list is kept current using information on building permits. To facilitate contact with sampled dwellings in the apartment sample, telephone numbers are obtained, where possible, by matching address information to telephone company files. Supplying interviewers with telephone numbers in this fashion has proven useful since it gives them an additional means of contacting selected dwellings that are difficult to access due to security systems, or where it is difficult to find people at home. Since the introduction of this procedure, while the nonresponse rate for the apartment frame remains higher than that for the area frame, the gap has narrowed from 8.6% to 6.2%. An alternative

to the area frame used by a few social surveys is a telephone frame. Sampling is based on Random Digit Dialing of numbers within "banks" of numbers containing working residential numbers. The banks are updated using files purchased from telephone companies. To prevent undue respondent burden, telephone numbers of households currently or recently in the LFS or other surveys using the area frame are excluded from the telephone surveys.

The LFS is currently being redesigned. Consideration is being given to adopting an address register as a list frame in urban areas. An address register of residential dwellings was created as a coverage improvement tool in the 1991 Census, and is being updated to reflect the Census enumeration of dwellings (Swain *et al.* 1992). Ways of updating the address register on an ongoing basis using administrative records or information from the postal service, and using it as a frame for social surveys are currently under study. An address register based frame should impact positively on field operations and nonresponse. Telephone numbers will be available for up to 70% of dwellings as a tool for interviewers to facilitate contacting households. Due to its regular updating, the sample can be designed to have good control on interviewer workloads, without having to resort to measures such as sub-sampling as are required under the area frame. Additionally, for the redesign, it is planned to build in mechanisms for both area and list frames to track all dwellings that are selected for Statistics Canada surveys.

### 3.2 Sample Design

The sample size for a survey is arrived at by taking into account budgets, survey objectives and desired level of reliability for key variables for the primary domains of interest. The overall sample size and survey design strategy should also allow for follow-up of non-responding units. In Section 4, we illustrate this point for the recently redesigned Monthly Wholesale and Retail Trade Surveys at Statistics Canada.

Business and Agricultural Surveys are stratified by a number of key variables including the size of the units. Because of the highly skewed nature of the distribution of key variables in the population, the size stratification results in a take-all and a number of take-some strata. Units in the take-all stratum cannot be rotated out of the sample, unless they become smaller in size over time. Optimum sampling plans that minimize the overall sample size for given levels of reliability may require too many units in the take-all stratum. To minimize response burden, some surveys restrict the number of take-all units; for example, the National Farm Survey (Julien and Maranda, 1990). Another means under consideration to reduce the response burden among the large units is the integration of questionnaires and/or data collection for several surveys. This implies that only distinct statistical data need to be collected for the different surveys.

Response burden among the smaller units can be reduced by periodic rotation of sampled units. However, rotation of units increases the cost of the survey because of additional sample maintenance, additional training of interviewers and difficulties in grooming new units to provide data. Partial rotation of sampled units at some fixed rate is undertaken as a compromise between 100% rotation which is very expensive and gives poor estimates of change, versus no rotation at all which would result in an unacceptable distribution of response burden. The rotation schemes keep a unit in the sample for a given period of time, after which the unit would be ineligible for reselection by the same survey for a minimum period. Surveys using such a scheme include: the Survey of Employment, Payrolls and Hours (with rotation of approximately 1/12th of the take-some units of the sample every month), the Monthly Wholesale and Retail Trade Survey (with rotation of approximately 1/24th of the smaller sized units every month), and the Labour Force Survey (with rotation of 1/6th of the sample every month). Another way to reduce response burden for individual units of Business and Agricultural Surveys is to minimize the overlap between surveys. This can be accomplished using a technique known as synchronized sampling. This technique attaches a permanent random number between 0 and 1 to each unit in the population. Different surveys are then allotted subsets of the interval (0,1) and all units whose random number falls within a survey's allotted subset are selected for that survey.

One of the objectives in the redesign of the Labour Force Survey to be introduced in 1995-1996 is to achieve a general household survey vehicle. Several new recurring social surveys are scheduled to start up in the mid-1990's, including a longitudinal survey of labour and income dynamics, and a health survey. The LFS redesign will consider not only LFS requirements, but requirements of these other surveys. Elements of the general survey orientation will include a common frame and similar sample designs with general purpose stratification. It will also feature co-ordinated sampling with overlap of selected primary sampling units (PSU's) to permit common interviewers across surveys. Unduplication of samples of dwellings between surveys to avoid respondent burden will also be carried out.

### 3.3 Data Collection Procedures

While all facets of the survey design can influence the survey response rates, data collection procedures and operations have the most direct and important bearing. In this section we examine the data collection procedures for business and social surveys, and the impact that factors such as the organization, the interviewer, mode of collection, technology, follow-up strategies, and response incentives have on nonresponse.

### 3.3.1 Organization of Data Collection

Data for business surveys are collected primarily through mail surveys with telephone follow-up. Before the mid-1980's, the collection and editing of business survey data was carried out principally in the subject matter divisions of Statistics Canada at its Head Office. This resulted in over seventy percent of the staff in these divisions being assigned to the processing of survey data. For many business surveys, regional offices had the responsibility of collecting data for nonrespondents to the surveys. During the mid-1980's, it was recognized that better use of Head Office and regional office resources could be made by a shift in the organization of data collection. The shift resulted in the concentration of collection and data capture activities within one division at Head Office specializing in the collection of annual data, and the regionalization of data collection for sub-annual surveys to the regional offices. The benefits of this reorganization were as follows: (i) operational resources could be used more effectively, (ii) the division of resources between the Head Office and regional offices could be better allocated, (iii) the increasing complexity of data collection could be handled by groups specialized in this activity, and could more readily exploit technical innovations and movement towards more integrated collection procedures, (iv) regional offices could establish "warm" contacts with the potential respondents on account of their geographical proximity to them, and (v) regional offices could offer services to users that would enhance Statistics Canada's presence among the potential responding units. All this helped in reducing the nonresponse rates.

Data for the social surveys are collected through a combination of face-to-face and telephone interviews. The monthly Labour Force Survey and most other social surveys conducted by Statistics Canada use a dispersed field force of approximately 1,000 interviewers across the country. The interviewers do a mixture of telephone interviewing from their homes and face-to-face interviewing. They are supervised by 100 senior interviewers. Project managers located in each of Statistics Canada's regional offices are responsible for the work of 3-4 senior interviewers. For the LFS, project managers and seniors are provided with performance reports each month for the interviewers they supervise. The reports include measures such as edit failure rates, nonresponse and costs. This continual feedback improves data collection procedures, thereby having a positive impact on response rates. For social surveys, there was no alternative to the dispersed organization before the advent of telephone survey methods. From 1985-1989 a program of research and testing of telephone survey methods was carried out (Drew 1991), in which a mixed organization was considered. Under this organization the role of local interviewers would be restricted largely to one of conducting face-to-face interviews, and

telephone interviewing would be carried out from the regional offices. The mixed organization would provide less opportunity for face-to-face follow-up of households that could not be contacted by telephone, leading to somewhat higher nonresponse. Also, the mixed organization would have higher overhead costs for extra office space and equipment in the regional offices. It would result in a much smaller field force, reducing the flexibility to carry out large scale *ad hoc* surveys requiring face-to-face interviews. Also, the pool of experienced field staff would be reduced to tap into each 5 years for the census of population. Based on these considerations, it was decided to retain the dispersed organization.

### 3.3.2 Interviewers

When new interviewers are hired for the Labour Force Survey, they are paid for 5 hours of home exercises and reading material, followed by three days of classroom training. During their first two days of interviewing in each first two months, new interviewers are observed by the senior interviewer. In addition, interviewers are routinely provided with material to read at home, and with exercises to complete dealing with different aspects of the survey taking procedures. Also, home studies are available to deal with specific problems identified in head office editing of the data. All interviewers receive an additional three days of classroom training per year. For supplements, training generally takes the form of reading material and self-study exercises to complete at home. For business surveys, the number of interviewers is much smaller, 260 in total. Training and monitoring are similar to those in the Labour Force Survey.

In a comprehensive study of nonresponse, Gower (1979) found that nonresponse rates vary greatly among interviewers. Particularly of interest, Gower found that about 15% of interviewers regularly encounter little or no nonresponse to the LFS. A focus group study is planned involving groups of superior and average interviewers. It will determine how they differ both in terms of locating respondents and in convincing them to participate in the survey. The latter will be looked at from the point of view of compliance theory, drawing on the work of Cialdini (1991). The objective will be to identify techniques being used by superior interviewers so as to teach them to other interviewers.

### 3.3.3 Mode of Collection

Statistics Canada places high priority on allowing respondents to choose the mode of reporting that best fits their circumstances, including the official language of their choice. Such flexibility helps in improving response rates.

Business surveys conducted at Statistics Canada can be classified in two main groups: annual and sub-annual surveys. For the annual surveys, most of the data collection

is via questionnaire mailout and mailback administered from Ottawa, with some respondents providing data via magnetic tapes or floppy disks. The timing for mailout of annual business surveys should be linked to the respondent's fiscal year end for tax reporting purposes. This is because the required data are readily available at this time, and ambiguity about the reference year is minimized. Bilocq and Fontaine (1988), in a study on the Annual Census of Manufactures, found that the best response rates were obtained by contacting respondents three months after their fiscal year end. This implies a staggered mailout that takes fiscal year end into account. For sub-annual business surveys, data collection is mostly by mailout from Head Office and mailback to the regional offices. Most of the non-mail units respond by telephone to the regional offices, while a few respondents provide computer readable responses directly to Ottawa. It is important to respect bookkeeping practices of respondents. Most respondents use the calendar month for bookkeeping, whereas others use four and five week cycles. In both cases, data are usually available to the survey agency one or two weeks after the end of the monthly period. Telephone interviewing is used to collect data in business surveys for a variety of reasons that range from clarification of instructions to follow-up action. The quality of response may suffer if this mode of collection is improperly used. For instance, a respondent may be forced to estimate the data due to lack of availability of records near the telephone. If telephone interviewing is used on a periodic basis, such as in monthly surveys, then a best day and time arrangement with the respondent will improve response rates as well as the quality of response.

For social surveys, such as the Labour Force Survey, the mode of collection is "warm" telephone interviewing, that is, households receive an initial face-to-face interview during their first month in the sample, with predominantly telephone interviews in later months. When the initial contact with the household is made, the interviewer presents his/her identification badge. The respondent is then provided with a description of the purposes of the survey, and given assurances of the confidentiality of the responses before proceeding with the interview. The face-to-face visit is preceded by an advance letter from the Regional Director, notifying the household of its selection in the survey and describing the purpose of the survey. Respondents are invited to call on a toll free number if they have any questions before or during the survey. In a program of research and testing of telephone survey methods from 1985-1989, the feasibility of replacing the initial face-to-face interview with a telephone interview was examined. The alternative of conducting the LFS as a central telephone survey led to a 68-75% increase in nonresponse rates. There was evidence of increased nonresponse bias stemming from differences in the labour force characteristics of respondents and the additional nonrespondents (Drew 1991). The only

recurring household survey at Statistics Canada to use telephone survey methods for all its data collection is the annual General Social Survey (GSS). It uses Random Digit Dialing (RDD) in a survey of 10,000 households. On occasion the GSS sample has been augmented with households rotated out of the LFS. For example, a sample of elderly persons who had been in the LFS was selected during one round of the survey when this age group was of special interest.

### 3.3.4 Questionnaire Design and Introductory Material

Good questionnaire design practices contribute not only to the accuracy of the data collected, but also to the response rates. The questionnaire and introductory material are particularly important in mail collection since they are the only contact with the respondent. Material sent to respondents should include a description of the purposes of the survey, the authority under which it is conducted, assurances of confidentiality of responses, and a phone number in the agency for answering any queries on the survey questionnaire.

Questionnaires should go through a review process that is independent of the questionnaire design. This process takes the form of peer reviews by experts within the agency or focus groups of survey participants. The use of focus groups or cognitive research has resulted in several improvements aimed at respondent motivation. It has also resulted in simplification of the task of completing the questionnaires for several surveys at Statistics Canada. These include the Census of Population, the Labour Force Survey, the Census of Construction Industry and the Survey of Employment, Payrolls and Hours (Gower 1990).

### 3.3.5 Follow-up Strategies

For both business and social surveys, follow-up is an integral part of the overall survey design. It is only through intensive follow-up that low levels of no-contact nonresponse can be achieved. Since follow-up usually costs more per unit than primary collection (assuming a fixed survey cost), the amount of follow-up has a direct bearing on the sample size and therefore the variance, on the response rate and therefore the nonresponse bias. Design strategies range from a large sample with little follow-up to a smaller sample with intensive follow-up. In the redesign of the Monthly Wholesale and Retail Trade Survey during the 1980's, improving response rates was a priority, and this led to adoption of the strategy of a smaller sample with more intensive follow-up.

For business surveys, follow-up is undertaken both to obtain data from nonrespondents and to recontact respondents with edit failures. Most business surveys use mail as a primary mode of collection as it is inexpensive, and it gives businesses the opportunity to consult their records in responding. Nonresponse follow-up is often



restricted to a subsample of nonrespondents to reduce costs. The allocation and selection of the nonresponding units is usually based on the following factors: (i) a take-all stratum of units that must be followed-up to concentrate effort on the larger nonresponding units; (ii) an equalization of response rates across design strata; and (iii) rotation of the smaller sized nonresponding units targeted for follow-up. Nonresponse follow-up is generally by telephone for sub-annual surveys, as time constraints do not permit mail follow-up. For annual surveys, where timeliness of the collection is not as critical, mail has tended to be used for both primary collection and for initial attempts at nonresponse follow-up, with a telephone follow-up as the last resort. Increasingly, though, in recent years more of the follow-up has been by telephone for the annual surveys as well.

For social surveys, there is not as clear a distinction between primary collection and nonresponse follow-up. Follow-up consists for the most part of second and subsequent attempts to contact and interview households during the survey period. Some distinctions exist depending on the status of the dwelling. Newly sampled dwellings are initially visited to identify those that are out-of-scope and to attempt a face-to-face interview with occupants of in-scope dwellings. In cases where an interview cannot be obtained, the interviewer attempts to obtain information such as name, telephone number, and best time to call from a neighbour. Interviewers are instructed to make two to three additional attempts to interview. These follow-ups can be either by telephone or face-to-face. Occupants of previously sampled dwellings are generally interviewed by telephone. However, if repeated attempts at telephone contact are unsuccessful, a face-to-face visit is made, to insure the dwelling is still in-scope and to attempt an interview.

While follow-up is needed to bring nonresponse to acceptable levels, there is a point after which further follow-up yields diminishing returns for the money expended. There has been little work aimed at addressing the question of appropriate strategies for the scheduling and the number of follow-ups based on cost and total error considerations. Studying this issue would require cost studies to estimate parameters in a cost and mean squared error model. The factors would include contact attempts, outcomes, costs, and characteristics of respondents at different stages of follow-up. The increased automation of data collection in the years ahead should make it more feasible to collect and use such information to optimize data collection strategies.

### 3.3.6 Technology

Data collection for business surveys is mostly by paper and pencil. Notable exceptions are the Monthly Survey of Manufacturing where CATI is currently being used

(Coutts *et al.* 1992), and the Annual Survey of Manufacturing where CATI has been used experimentally to collect data from the smaller manufacturers. With the successful implementation of CATI for the Monthly Survey of Manufacturing, plans are under way to employ CATI for other business surveys. Experiments are also currently being carried out to test other data collection technologies for business surveys. These include: a hand-held computer for the Consumer Price Index, the Grid Pad for the Quarterly For-Hire Trucking survey, and touch tone data entry for the Survey of Employment Payrolls and Hours.

Data collection for social surveys is also based on paper and pencil technology. A decision has been taken to move to Computer Assisted Interviewing (CAI) over the next few years. The dispersed interviewing staff will be equipped with portable computers for face-to-face interviewing and for telephone interviewing from their homes. The decision was made based on positive findings from two tests of CAI on the LFS. The first test (Catlin and Ingram 1988) showed: data quality improvements such as better enumeration of persons within sampled dwellings, and fewer edit failures, with no detectable impact on survey estimates or response rates. The second test in 1991 (Coutts *et al.* 1992) demonstrated the operational viability of portable computers for CAI by interviewers in the field. Plans are to begin converting social surveys to CAI as early as 1993. These will depend on the results obtained from more extensive testing during 1992. Factors to be considered will include its impact on survey estimates, and on data quality, including response rates.

### 3.3.7 Response Incentives

Under the Statistics Act that sets out the legal framework governing Statistics Canada, participation in Statistics Canada surveys is mandatory for those businesses and individuals selected for survey unless the Chief Statistician designates the survey as voluntary. An example of a mandatory program is the Census of Population, where an outright refusal can lead to prosecution. For other programs, the agency relies on obtaining the co-operation of potential respondents via advance written material or publicity explaining the purpose of the survey and the confidentiality of the data, and "door step diplomacy" measures such as display of badges by face-to-face interviewers, and informing respondents about purpose and confidentiality.

Several studies of the use of response incentives have been carried out for social surveys. The first was on the Labour Force Survey (Gower 1979). In a split sample test, the Canada Handbook was given to half the households when first contacted. The result was a marginally lower refusal rate in later months for the sample receiving the incentive. Interviewers believed that the incentive was of marginal benefit, and that existing door-step procedures

were more important in reducing nonresponse. More recently, in an incentive study in the 1990 Family Expenditure Survey three treatments were administered at the interviewer level: one in which each selected household received a clipboard with the Statistics Canada logo, a second receiving the Statistics Canada publication "A Portrait of Canada," and a control sample receiving no incentive. At the national level, there was no significant change in the response rates (Kumar and Durning 1992). A study of response incentives is also planned for an upcoming longitudinal survey of income and labour.

### 3.4 Selective Editing

Another potential cause for nonresponse is faulty editing procedures that result in several recontacts with the respondent for the same questionnaire, lessening their willingness to cooperate on future occasions. To streamline and optimize the editing process to minimize recontacts, the following three measures should be followed. First, editing at the data capture, follow-up and imputation stages should be consistent. Second, selective editing ought to be applied to numeric data especially in business and agricultural surveys. Records that have a significant impact on the estimates are identified, and follow-up is restricted to those records. The records with a small impact should be subjected to an automated edit and imputation process to ensure consistency. Third, to keep response burden to a minimum, all errors should be identified for the units to be followed-up so that most errors can be cleared up in a single contact. The use of an inter-field edit analyzer and error localizer, such as the one in the Generalized Edit and Imputation System developed at Statistics Canada, is recommended for this requirement (Kovar, MacMillan and Whitridge 1988). If too many items fail edit but prove to be correct on follow-up, the edits should be adjusted to alleviate unnecessary response burden.

Selective editing procedures for numeric data developed at Statistics Canada can be grouped in three sets: (i) statistical editing, (ii) grouping of variables and (iii) a score function. For statistical editing, Hidirolou and Berthelot (1986) have developed a transformation that allows more emphasis on detecting units that show unusual changes from occasion to occasion. It recognizes that period to period changes for small units are inherently more variable than changes for large units. The cut-off bounds for edit failures are thus funnel shaped, allowing large relative changes in small units. These bounds are calculated using medians and quartiles, and are thus robust to outlier observations in the data. This method can also be used to detect outlier ratios between two variables. However, the number of pair wise comparisons can become prohibitively large. Bilocq and Berthelot (1990) recommended a method of grouping the variables into subsets of related variables and then only cross editing

variables within the subsets. The procedure used for this partitioning is based on principal component correlation methods. The significance of the errors as measured by their influence on the estimates must be considered as well. In the case of edit failure for completed questionnaires, Latouche and Berthelot (1992) have developed a score function that assigns a relative score of error importance to each respondent based on the size of the unit, the size and number of suspicious data items on the questionnaire and the relative importance of the variables. It has been demonstrated in a simulation study using this idea, that recontacting a few units is sufficient to ensure acceptable data quality for the final estimates.

### 3.5 Administrative Data Considerations

Response burden for Business and Agricultural Surveys at Statistics Canada is being alleviated by obtaining some data for the smaller sized units from administrative sources. Such data are also used to replace illegible, inconsistent or missing survey data. For example, the data for the smaller sized nonresponding units is imputed using tax data.

### 3.6 Management System for Data Collection

A good tracking system is required to determine the status of the collection process at any time. For Business Surveys, collection status codes, whose history is kept for each surveyed unit, are used to control the collection process. These collection status codes, stored in the time sequence that the survey is being carried out, are used with other codes that reflect the activity status of the unit (active, seasonal with operating dates provided, out of business, temporarily closed, *etc.*). Examples of collection status codes are: i) mode of data collection at different time points of the data collection process, ii) contact initiation codes for units (known to be active during the reference period), and for exclusions (which include closed units, out of business, temporarily closed), and iii) expected dates for return of the information to prompt additional follow-up. The management system receives information from sources external to the survey indicating a change in the status of units, and tracks the collection status from initial data collection to follow-up until all the units are ultimately classified into one of the categories under the framework described in Section 2.

## 4. ANALYSIS OF NONRESPONSE FOR SELECTED SURVEYS

We will briefly examine nonresponse for two surveys at Statistics Canada, to illustrate some general factors impacting on nonresponse described in Section 3.

#### 4.1 The Monthly Retail Trade Survey

The Monthly Retail Trade Survey (MRTS) is a survey that collects sales from a sample of retail locations and inventories for a sub-sample of them. Estimates of the level and change are generated for these two variables. The sample design is a rotating simple random sample of companies stratified by province, industry and gross business income. The population size is approximately 165,000 companies, and the sample size is about 13,000. Data are collected by telephone for approximately 40% of the units and by mail for the remaining 60%. Preliminary estimates are published 7 weeks after the survey reference period, and final estimates, which include more respondents because of nonresponse follow-up are released a month later.

A redesign of the survey was implemented in January 1990. The new design differed in several aspects from the old one that had been in place since the early seventies. First, to increase the design efficiency, the number of industry groups was reduced from 34 to 18 and three size strata were used in place of two. Second, the levels of reliability were relaxed with the new design. These changes permitted a sample reduction of 35%, allowing intensive follow-up of nonrespondents. Third, data collection was decentralized to the regional offices. Under this strategy, data collection costs were higher on a per unit basis on account of the extra follow-up. There was, however, an overall gain in quality of survey results due to the reduction in nonresponse.

Both preliminary and revised weighted response rates, defined as the ratio of the estimate of sales contributed by the respondents to the estimate of sales for all in-scope units are provided in Figure 2 for the period 1986-1992. From this graph, both preliminary and revised response rates are substantially higher for the new survey than for the old survey. Preliminary rates have risen from 75% to 93%, while final rates have risen from 85% to 95%. It is also clear that the gap between the preliminary and revised response rates is much smaller for the new survey. It should be noted that in September, 1991 the preliminary rates were lower than expected because of a strike by the clerical staff handling the documents.

Several factors have contributed to the improvement in the response rates, the most important ones being mode of data collection and follow-up procedures. In the old survey, questionnaires were mailed out from and returned to Head Office (Industry Division). The mailout was carried out using manually controlled reporting arrangements. Immediate follow-up of nonrespondents was restricted to large units, and was done by telephone from Ottawa. Smaller sized nonresponding units were followed up by mail one month later, and the mail follow-up was continued for up to two additional months. Nonrespondents which had not responded for three consecutive months were referred to the regional offices for a telephone follow-up.

For the new survey, prior to their first occasion in the survey, newly sampled units (new entrants) are mailed an advance letter explaining the survey and the importance

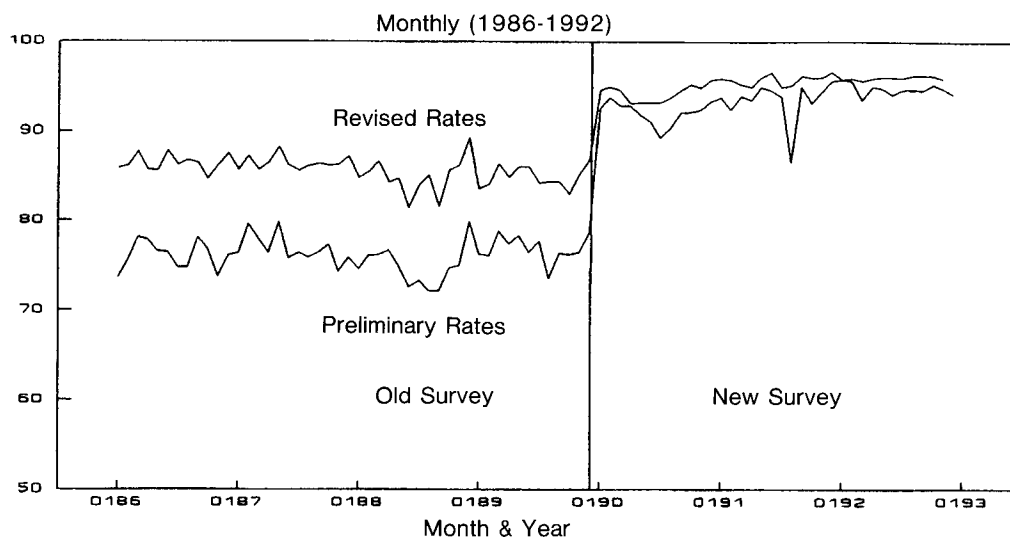


Figure 2. MRTS Response Rates

of their participation. A blank questionnaire is included. Also, each new entrant is telephoned about a week after the expected receipt of the advance letter to explain difficult ideas, to answer questions, and to offer a choice of mail or telephone data collection. For the mail respondents, questionnaires are mailed out by Industry Division using automated collection arrangements that are derived from the information on the Business Register. These collection arrangements are updated on the Business Register via profiles carried out by the Business Register Division, as well as new information found out by the regional offices during their contact with the respondent. Regional offices request data from the telephone respondents at pre-arranged dates and times, and the collected data are transmitted to Head Office after each monthly collection cycle.

#### 4.2 Labour Force Survey

The Labour Force Survey is the largest continuous social survey conducted by Statistics Canada with a sample size of approximately 62,000 households per month. The impact of different aspects of the survey design on LFS nonresponse were discussed in Section 3. In this section, we examine historical trends in nonresponse and consider in more detail the role of nonresponse follow-up.

Table 2 below shows that the overall nonresponse rates have been steady in the 4% – 5% range throughout most of the period 1977-1991, as have refusal rates, in the 1.0% – 1.5% range. However, a few patterns are evident. One is the positive effect of the Census of Population on the nonresponse rates for the LFS, pointing to the benefit of the publicity surrounding the Census spilling over to household surveys. Nonresponse rates dropped by 1.0% between 1980 and 1981, and by 0.6% between 1985 and 1986, and by 0.4% between 1990 and 1991, the only years in which substantial drops in nonresponse rates have occurred. In 1986 virtually all the decrease was in refusals, while these accounted for over half the reduction in 1981. While the changes in nonresponse over the period are not dramatic, a gradual lessening of the positive effects of the Census is apparent. There is a slight increase in the last four years in both nonresponse and refusal rates as compared to the period from 1981 to 1987.

The graph below (Figure 3) giving the nonresponse and temporarily absent rates by month shows: the seasonal trends in the rates, with a peak in the summer months for the overall nonresponse rates, accompanied by a parallel increase in the Temporarily Absent rate. The strong relationship between the overall nonresponse rate and the Temporary Absent rate is apparent in the graph. The data collection period for the survey is normally a six day period from the Monday to the Saturday following the reference week. By Saturday of interview week the interviewers have returned all their cases to the regional offices. To reduce the seasonal peak, a Monday follow-up procedure was started in the late 1970's for the July and August surveys. Occasionally, the Monday follow-up is extended to June depending on the school year. The Monday follow-up of nonrespondents who could not be reached during the survey week is carried out from the regional offices. It has been observed that it reduces the number of cases of Temporarily Absent nonresponse.

From 1984 onwards, there has been a change in the pattern of seasonal peaks in Temporarily Absent Nonresponse. The summer peaks are less severe, but a second peak in February and March is becoming more pronounced. This seems to reflect a shift in vacation patterns of households toward more winter breaks. Consequently, in recent years, the Monday follow-up has been carried out in March if the survey week coincides with the school break.

Another noticeable feature in the LFS nonresponse pattern is higher nonresponse for households that are in the sample for the first time than for the other households. In 1980, the nonresponse rate for the first month interview households was 6.9% versus 3.5% for later months. Most of this difference occurs in the No Contact component of nonresponse. Since interviewers employ mostly face-to-face interviewing in the first month, they are limited in the number of contact attempts they can make. In later months, telephone interviewing and information obtained during the initial interview on the best time to call lead to a substantially improved contact rate.

During the 1981 post-censal redesign of the LFS, a detailed time and cost study was undertaken. The primary purpose of the study was to obtain cost information needed to carry out a cost/variance optimization of the

**Table 2**  
LFS Nonresponse and Refusal Rates by Year

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
NR	5.42	5.39	5.35	5.37	4.41	4.67	4.65	4.57	4.69	4.08	4.23	5.07	5.18	5.57	5.20
REF	1.34	1.45	1.41	1.47	1.16	1.19	1.14	1.18	1.18	0.99	1.06	1.30	1.31	1.51	1.38

NR = Overall Nonresponse rate.  
REF = Refusal rate.

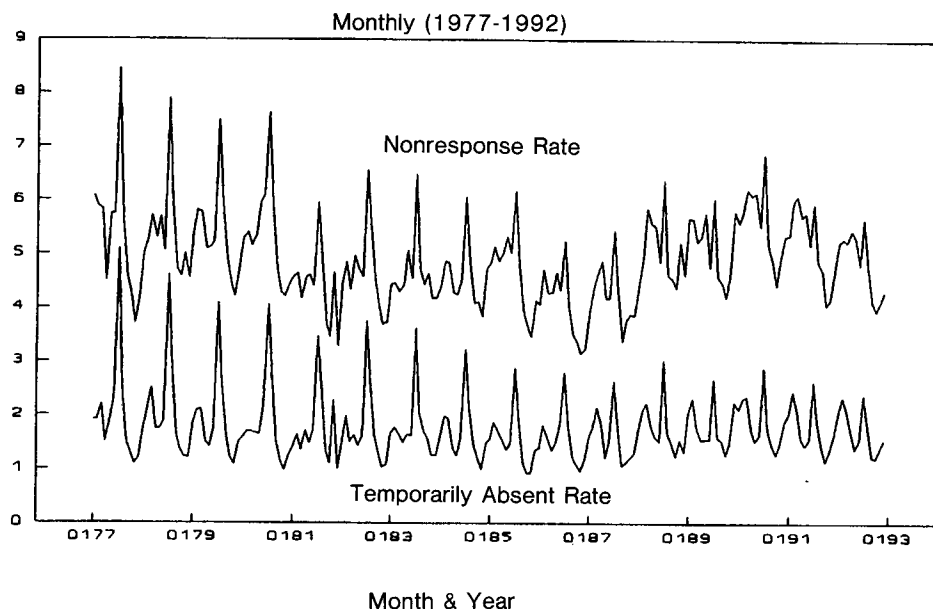


Figure 3. LFS Nonresponse Rates

survey design. The study reported by Lemaître (1983) also yielded interesting information on interviewer movement and household visit patterns, and the effect of nonresponse follow-up on response rates under face-to-face interviewing. He found a response rate of 92.4% was achieved after 3 visits, with the ratio of responses per visit consistently high at 56-61% for each round of visits. More extensive follow-up was carried out for only 3.5% of dwellings. These dwellings were visited on average another 2.5 times, with only 29% of such visits resulting in a response. The extra visits for these households accounted for 5.8% of all dwelling visits, and increased the response rate by 3.1% to 95.1%.

The 1983 Time and Cost Study was undertaken before the introduction of telephone interviewing in smaller urban and rural areas for non-first month in the sample cases, and before the introduction of telephone follow-up of first month nonresponse cases. Consideration is being given to repeating the study under the current survey conditions. One of the questions such a study could address is the cost benefit of extra visits to reduce nonresponse rates. While fourth and subsequent visits may not represent a high proportion of visits, their contribution to collection costs may be considerably higher due to the dispersion of such dwellings. Costs of such visits, coupled with information on their characteristics relative to those of other respondents, would permit an assessment of how much follow-up is warranted based on cost and mean squared error considerations.

## 5. SUMMARY

In this paper we have presented standards for the definition of nonresponse. In a pilot study of 7 major business and social surveys at Statistics Canada, no difficulties were found in applying the standard definitions. Beginning with the 1993 reference year, information on nonresponse for major surveys according to these standards will be reported and maintained in a central repository within the agency. This will facilitate analysis of global trends affecting response and nonresponse to surveys.

We have discussed what measures can be taken in various aspects of the survey design to help minimize nonresponse, and have illustrated their application for two major recurring surveys. Although we have restricted our focus to the role such measures play in nonresponse, they constitute good survey taking practice whose benefits encompass more than improved response rates.

In speculating about what the future holds for survey response rates in Canada, there is nothing in current trends to be alarmed about, despite a slight increase in nonresponse rates for social surveys over the last decade. However, Statistics Canada is pursuing cognitive research efforts in nonresponse aimed at better understanding respondents' attitudes and concerns about issues such as privacy, confidentiality, response burden, and record linkage. Selective editing studies are also being undertaken to focus on editing and follow-up efforts on large units. There is much scope for reducing response burden and

costs, with little impact on estimates. Findings from these studies will be helpful in designing our surveys and statistical programs in ways that respect respondents' concerns. This will permit us to continue the high levels of cooperation from the Canadian public and businesses.

### ACKNOWLEDGMENTS

The authors thank B.N. Chinnappa, Statistics Canada, and the referees for their helpful comments, and to Statistics Canada: Methods and Standards Committee for its guidance and support in the development of the nonresponse framework.

### REFERENCES

- BILOCQ, F., and BERTHELOT, J.-M. (1990). Analysis on Grouping of Variables and on the Detection of Questionable Units. Methodology Branch Working Paper, BSMD, 90-005E. Statistics Canada,
- BILOCQ, F., and FONTAINE, C. (1988). Étude sur la mise à la poste échelonnée pour le recensement des manufacturiers. Statistics Canada report.
- CIALDINNI R.B. (1991). Deriving Psychological Concepts relevant to survey participation from the literatures on compliance, helping and persuasion. International Workshop on Household Survey Non-response, Sweden, October 1990.
- COLLEDGE, M.J. (1989). Coverage and classification maintenance issues in economic surveys. In *Panel Surveys*, (Eds. D. Kasprzyk, G. Duncan, G. Kalton and M.P. Singh). New York: John Wiley & Sons, 80-107.
- CATLIN, G., and INGRAM, S. (1988). The effects of CATI on cost and quality. *Telephone Survey Methodology*, (Eds. R. Groves *et al.*). New York: Wiley, 437-450.
- COUTTS, M., JAMIESON, R., WILLIAMS, B., and BRASLINS, A. (1992). The building of an integrated collection operation in Statistics Canada's regional offices. *Proceedings of the 1992 Annual Research Conference*. US Bureau of the Census, 395-411.
- DREW, J.D. (1991). Research and testing of telephone surveys methods at Statistics Canada. *Survey Methodology*, 17, 57-68.
- DREW, J.D., and GRAY, G.B. (1991). Standards and guidelines for definition and reporting of nonresponse to surveys. Prepared for the Second International Workshop on Household Survey Non-response, Washington, DC.
- GOWER, A.R. (1979). Nonresponse in the Canadian Labour Force Survey. *Survey Methodology*, 5, 29-58.
- GOWER, A., and ZYLSTRA, P.D. (1990). The use of qualitative methods in the design of a business survey questionnaire. Presented at the *International Conference on Measurement Errors in Surveys*, Tucson, Arizona.
- HIDIROGLOU, M.A., and BERTHELOT, J.-M. (1986). Statistical editing and imputation for periodic business surveys. *Survey Methodology*, 12, 73-83.
- JULIEN, C., and MARANDA F. (1990). Sample design of the 1988 National Farm Survey. *Survey Methodology*, 16, 117-129.
- KOVAR, J.G., MACMILLAN, J.H., and WHITRIDGE P. (1988). Overview and Strategy for the Generalized Edit and Imputation System. Methodology Branch Working Paper, BSMD, 88-007E. Statistics Canada.
- KUMAR, S., and DURNING, A. (1992). The Impact of Incentives on the Response Rates for FAMEX 1990: an Evaluation. Methodology Branch Working Paper, SSMD 92-001E. Statistics Canada.
- LATOUCHE, M., and BERTHELOT, J.-M. (1992). Use of a score function to prioritize and limit recontacts in editing business surveys. *Journal of Official Statistics*, 8, 389-400.
- LEMAÎTRE, G. (1983). Results from the Labour Force Survey Time and Cost Study. Internal report, Household Survey Methods Division, Statistics Canada.
- PLATEK, R., and GRAY, G.B. (1986). On the definitions of response rates. *Survey Methodology*, 12, 17-27.
- SWAIN, L., DREW, J.D., LAFRANCE, B., and LANCE, K. (1992). The creation of a residential address register for coverage improvement in the 1991 Canadian Census. *Survey Methodology*, 18, 127-141.