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Identification of Optimal Call Patterns for Intensive Follow-up in Business Surveys using Paradata

by Louise Gates

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Identification of Optimal Call Patterns for Intensive Follow-up in Business Surveys using Paradata

Louise Gates¹

Abstract

Businesses which have not responded to a mail survey are generally subject to intensive follow up (IFU) by telephone or other means to obtain a response. As this contact is expensive, strategies are needed to optimise the approach to conducting calls for IFU purpose.

This paper presents results from an investigation conducted into the number and type of IFU contacts made for business surveys at the Australian Bureau of Statistics (ABS). The paper compares the amount of effort expended in IFU compared to the response rates and contribution to key estimates for these surveys, and discusses possible uses of this type of information to make more optimal use of resources.

Key Words: Intensive follow-up, Response, Business surveys.

1. Introduction

In recent years it has become feasible to collect daily operational *paradata* (i.e. data about the process) about statistical data collection activities in real time, with operations research methods being increasingly used to improve the efficiency and effectiveness of statistical collections. The issue of understanding the relationship between survey error and survey costs is a new but emerging theme in survey literature. Throughout the world, there is evidence to suggest that there has been a decrease in response rates over the last few decades, and where the response rates have been maintained this has been through significant additional cost and effort (Campanelli et al., 1997). In response to this, a key need has been identified for statistical models for forecasting respondent behaviour resulting from various allocations of effort (Robert Groves, cited in Karr and Last, 2006, Groves and Heeringa, 2006).

Some research has been conducted within Statistics Canada into the introduction of a cap on calls as an attempt to increase survey efficiency (Mohl and Laflamme, 2007), however the impact of introducing a cap has not been fully investigated. Within Statistics Sweden, research into the choice of a maximum number of call attempts and its impact on measurement error has been conducted (Isaksson et al., 2008).

In response to these developments and to utilise the large volume of paradata being generated by survey processing systems, the Australian Bureau of Statistics established an Operations Research Unit (ORU) in July 2006. At its inception, the ORU was given a clear brief to focus on high cost processes where investment into efficiency and effectiveness improvements is likely to pay substantial dividends. Initially, the ORU focussed on two such: the follow-up of non-responding business surveys providers by phone interviewers and collection of data from households by ABS field interviewers.

The focus of this paper is on the work on business collections, in particular *understanding the relationship between cost of follow-up and survey response and telephony patterns processes to identify cost effective practice.*

In the following sections, I describe a project undertaken by the ORU to look at the impact of different call patterns. The project looked at the differences between 3 major business surveys on their form receipt rate, contribution to estimate and cumulative effort expended by number of outbound telephone calls. Two experiments were then conducted to test the hypotheses formed from the data exploration phase. The main learnings from the experience

¹ Louise Gates, Australian Bureau of Statistics, Australia

were that the commencement date of IFU may be important and that in some cases a large amount of effort can be expended without noticeable gain to survey output.

2. Background

Within the ABS, the majority of business collections involve a mail out form. If the form is not returned by the due date, then an Intensive follow-up (IFU) process is undertaken. IFU is a major part of data collection procedures for business surveys. It involves contacting providers who have not returned their survey form to encourage them to return the form as soon as possible. Within the ABS, the percentage of providers receiving IFU in some form varies greatly from survey to survey from 37% to 87%. IFU can take the form of mailed reminders, faxed reminders or personal telephone calls. The expenditure on IFU accounts for a large percentage of total survey cost.

Prior to 2003, IFU was handled independently by separate teams for different collections. Since 2003, however, the majority of IFU has been centrally co-ordinated by a Provider Contact Unit for the majority of business surveys. This centralisation has had many benefits including the ability to capture detailed management information or paradata on contacts made to providers. However the process of IFU for each collection has remained unchanged and is therefore different for each collection.

Three surveys were chosen as case studies for this exploratory analysis. The Quarterly Economy Wide Survey (QEWS) was chosen as it is a high cost and also high profile collection. The annual Economic Activity Survey (EAS) was chosen as currently the EAS has a very long IFU period of up to six months and there is a desire to reduce this time without adversely impacting the quality of the collection. The quarterly Average Weekly Earnings Survey (AWE) was also chosen because it is traditionally a very difficult survey for IFU as it has a very high target response rate. There are a number of differences between the collections that it is important to be aware of. Table 2-1 contains key differences between the collections.

Table 2-1
ABS collection information

<i>Collection</i>	<i>Sample size</i>	<i>Frequency</i>	<i>IFU length</i>	<i>IFU details</i>	<i>Complexity</i>
QEWS	24,000	Quarterly	3 weeks	3/4 reminders, phone calls starting on due date	Middle
EAS	10,000	Annual	6 months	3/4 reminders, phone calls after 3–4 days	High
AWE	6,000	Quarterly	8 weeks	1/2 reminders, phone calls starting after 2 weeks	Low

The collections also have quite different target response rates, with the target response rate for AWE, being 10 percentage points higher than for either QEWS or EAS.

3. Problem formulation

To help identify cost efficient IFU practices, the first stage of the project was aimed at *understanding the relationship between how the cost of follow-up and survey response outcomes are related to the telephony patterns processes*. As part of this investigation, we characterise the IFU process by the following attributes which potentially might influence cost and/or survey response were identified

- frequency of collection
- complexity of collection
- length of IFU
- number of reminders
- number of phone calls

- starting date of IFU
- timing of IFU
- target response rate
- criteria for assigning significance flag
- number of staff available

One set of questions we wish the research to answer was in relation to the timing of IFU. Would the percentage of successful contacts be greater if different providers were called at different times of day? If it was ascertained that different times of day were more likely to produce successful results, would it be possible to make any changes on this basis?

Another question to be answered was how many calls are necessary? At what stage is the cost of making the calls outweighing the benefit? What contact patterns are most likely to promote survey response? How long should you wait before calling or recalling a provider to promote response without hassling them?

4. Results

4.1 Number of contacts

Table 4.1-1 shows the total numbers of forms and contacts for two cycles each of QEWS, AWE and EAS.

Table 4.1-1
Total forms and total contacts for QEWS, EAS and AWE

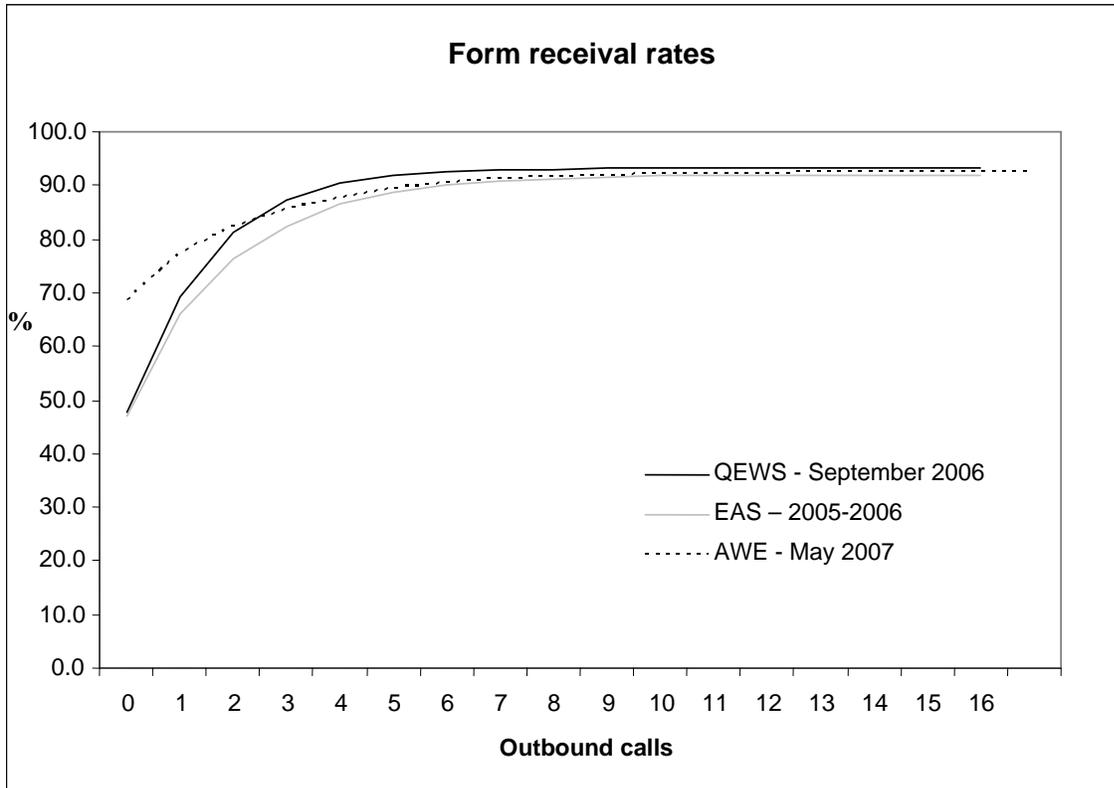
	<i>QEWS</i>		<i>EAS</i>		<i>AWE</i>	
	<i>Sept. 2006</i>	<i>Dec. 2006</i>	<i>2004-2005</i>	<i>2005-2006</i>	<i>Feb. 2007</i>	<i>May 2007</i>
Contacts						
Total number of contacts	75,576	78,737	46,067	39,332	13,801	13,334
Number of outbound contacts	60,733	57,256	35,7456	29,158	9,316	9,975
Number of outbound calls in	26,346	20,197	20,440	16,248	6,213	5,269
Forms						
Total number of forms	23,573	23,640	11,713	11,194	6,136	5,999
Number of forms returned	21,998	21,760	10,526	10,290	5,710	5,552
Form receival rate	93.3%	92.0%	89.9%	91.9%	93.1%	92.5%
Staff days						
Total staff days	404	367	681	519	154	149
Average calls						
Average calls per form returned	1.2	0.9	1.4	1.2	1.1	0.8
Average calls per form not returned	3.6	1.4	5.0	4.6	2.2	2.3
Average calls All	1.1	1.1	1.8	1.5	1.0	0.9
Average calls per staff day	65	55	30	31	40	35

The time periods selected in the above table are just examples of the variability that there is between collections and even between cycles of the same collections. While the number of forms is constant within the cycles of the same

collection, there are differences in the numbers of inbound and outbound contacts as well as in the form receival rate. The average numbers of outbound calls per staff per day is also quite variable. What is causing these differences and how can this knowledge be used to improve our strategy for both contacting providers and improving the quality of survey output? How many calls are needed to ensure a form returned? How many staff are needed to make these calls? What other factors influence the return of a form?

Preliminary analysis on when forms are returned by the number of outbound telephone calls received was conducted. Figure 4.1-1 shows the cumulative form receival rates by the number of outbound calls made.

Figure 4.1-1
Cumulative form receival rates by number of outbound calls made



This graph shows that the form receival rate after 0 outbound calls is quite large, indicating that a large percentage of providers return their form without requiring any telephone contact. Around 47% of forms for QEWS and EAS are returned without any telephone contact and nearly 70% of forms for AWE. One hypothesis as to why the percentage is much greater for AWE is that telephone IFU is not commenced until 2 weeks after the due date.

The second observation from Figure 4.1-1 is that the majority of the forms are returned after a relatively small number of calls. For QEWS, a 90% form receival rate is achieved after 4 calls and the final form receival rate is only 3 percentage points higher at 93%. For AWE, a 90% form receival rate is received after 6 calls, with the final form receival rate being 93% also. A similar result can be seen for EAS.

Considering these results led to the second part of the investigation which was to look at the amount of the final estimate after a certain number of outbound calls had been made. In order to do this, the estimate for all forms returned after a particular number of outbound calls was computed and divided by the final estimate. The final estimate was calculated including the imputed values for the forms which had not been returned giving a 'cumulative non-imputed contribution to estimate'. For QEWS, the estimate chosen was the key estimate for Sales. For EAS, the estimate was Industry Value Added (IVA). For AWE, the key headline figure is Average Weekly Earnings,

however for this analysis, the numerator of this figure was chosen which is Weekly Ordinary Time Earnings (WOTE). A graph comparing this figure with the number of outbound calls is given in Figure 4.1-2.

Figure 4.1-2
Cumulative non-imputed contribution to estimates by number of outbound calls made

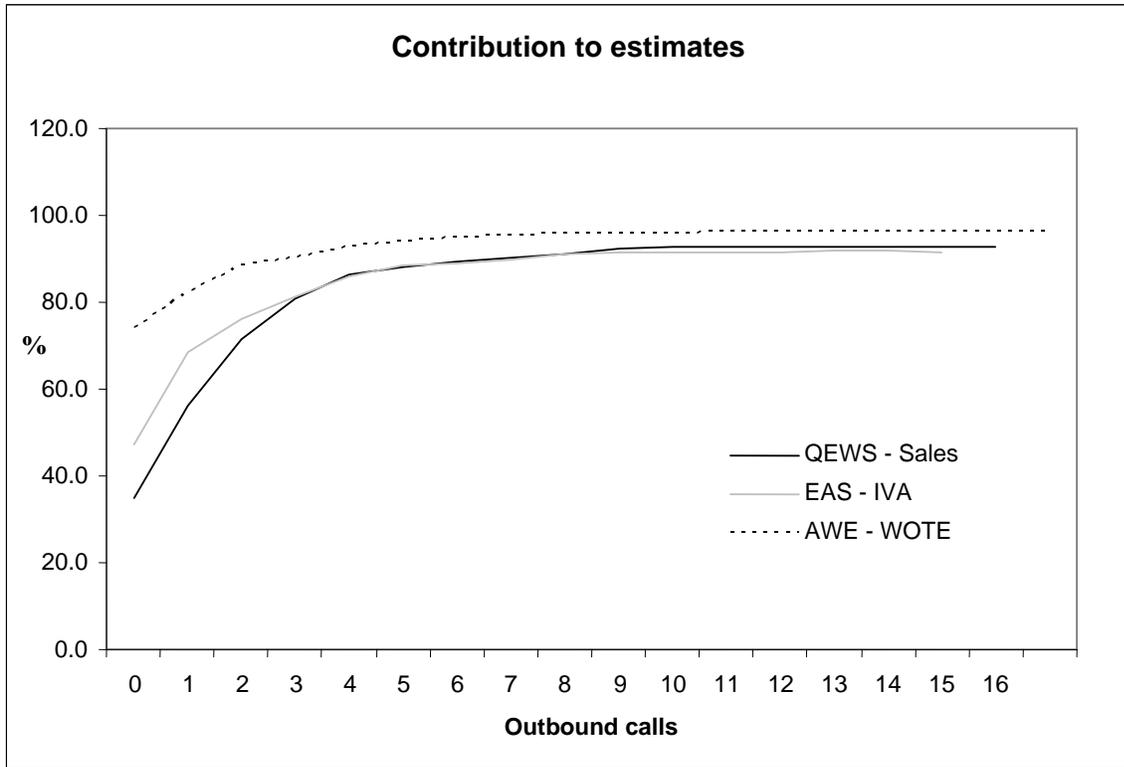


Figure 4.1-2 follows a similar pattern to Figure 4.1-1. A high percentage of the estimate is obtained after no outbound telephone calls, although not always as high as the form receipt rate, suggesting that smaller businesses are more likely to return their form without any outbound telephone contact. At the same time, larger businesses are considered more significant and therefore more likely to be contacted early, therefore giving them less chance to return their form without any outbound telephone contact.

As for form receipt rate, a large amount of the estimate is also obtained after a small number of calls. For all 3 surveys, a majority of the estimate is achieved after 4 calls. For QEWS, 90% is achieved after 4 calls, with only 93% of the estimate being non-imputed at the close. For EAS the comparative figures are 86% and 92% and for AWE, 93% and 96%.

These figures then lead to the questions, how much effort is expended to get the last few percent (and thus what does it cost)? Figure 4.1-3 looks at the cumulative percentage of effort by the number of outbound calls.

Figure 4.1-3
Cumulative effort expended by number of outbound calls made

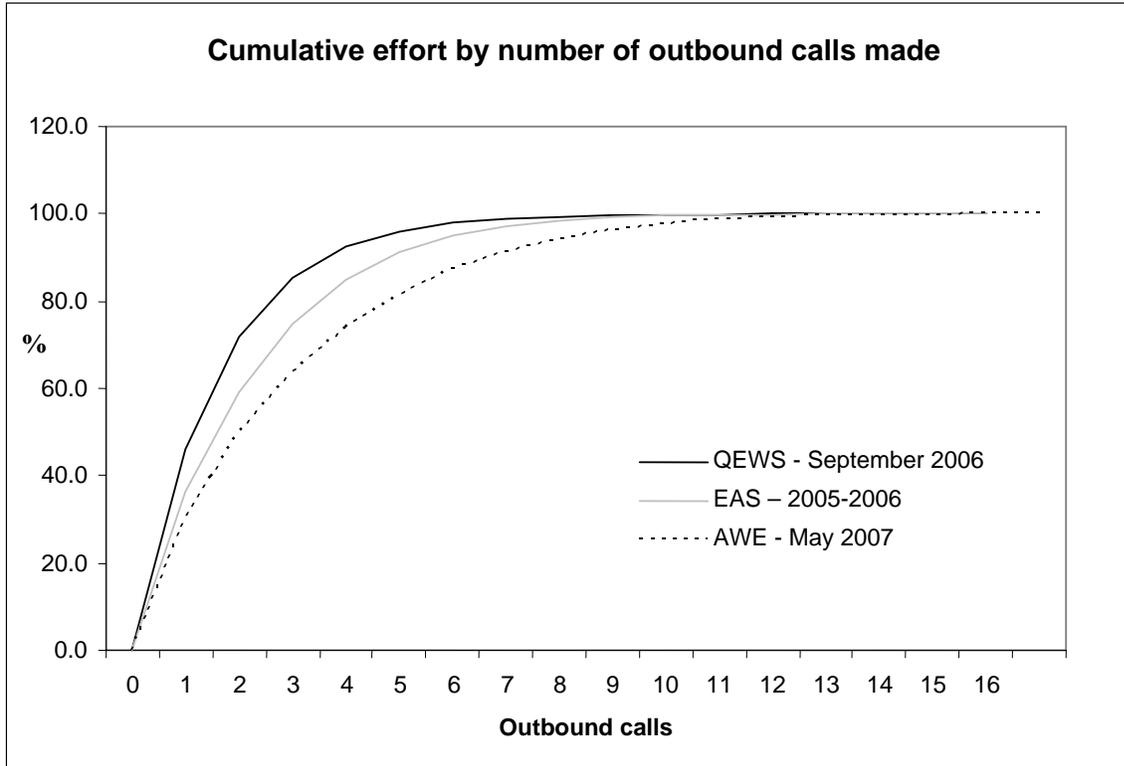


Figure 4.1-3 shows that the cumulative effort expended by the number of outbound calls varies between the three collections. For AWE, 20% of total effort is expended making more than four calls to providers and results in a 3% increase in the estimate. For EAS, the last 15% of effort results in a 5% increase in estimate. For QEWS, the results are not so marked.

Considering these graphs and the overall collection differences, the overall conclusions from this analysis are that

1. Some providers return their form without requiring any outbound telephone call.
2. In some cases, a large amount of effort is expended with little or no gain.

Related to these conclusions, two hypotheses were made

1. Date of commencement of IFU may be important - Variation of this timing could be a possible explanation as to why the percentage of forms returned for 0 calls was so much higher for AWE than QEWS when the IFU for AWE starts 1–2 weeks after that for QEWS.
2. Target form receipt rates can have a large impact on the number of calls required (as a possible explanation as to why a large amount of effort is expended at the end in AWE given their high target form receipt rate and also due to PCU staff comments in relation to the difficulty relating to AWE for the same reason).

4.2 Trials of hypotheses

The conclusion that some providers return their form without requiring any outbound telephone call resulted in the Gold Star Provider initiative. This initiative ‘rewards’ those providers with good response history (as defined by requiring no outbound telephone calls in the previous quarter). The providers are ‘rewarded’ by allowing them time to again return their form without any telephone prompting.

This initiative was initially run on the QEWS and incorporated around 8,000 providers per quarter, but is now being extended across other subannual collections. It is estimated that this is saving them around \$35,000 per year for QEWS alone, as well as making the IFU process simpler for staff and less burdensome for providers.

To test hypothesis 1, a trial was conducted on QEWS and EAS where the start of telephone IFU was delayed by a number of days for a sample of providers from each collection.

The results of this trial were that form receipt rate was higher for providers in the trial, suggesting that there was no detrimental effect in delaying IFU. However at the same time, the number of calls received was higher for providers in the trial. The trial highlighted two facts:

- delaying IFU does not seem to reduce form receipt rate;
- the number of calls received by a provider can be influenced by a number of factors such as other collections in the field, the way in which providers are allocated to daybatches and staff being absent.

4.3 Conclusions and future work

The main conclusions are as follows

1. Some providers return their form without any prompting. Rewarding these providers via the 'Gold Star provider strategy' is a good approach.
2. There are a large number of calls made in some circumstances without noticeable gain and a high percentage of effort is expended to get last few providers.
3. Changing the timing of IFU possibly has gains, however needs to be considered as part of the overall strategy.
4. The number of calls received by a provider is influenced by a number of factors such as other collections in the field, the way in which providers are allocated to daybatches, target response rates and staff being absent.

While the trials served a useful purpose, the relationships between cost, effort and outcome are complex and need to be explored further. We are conducting a detailed investigation into how the process design would affect the costs and output measures such as form receipt rate and contribution to estimate. The aims of such an investigation would be to

- minimise cost for a particular target response rate
- be able to estimate the increase in cost for a specified increase in response rate
- be able to determine the effect of an increase or decrease in cost on survey output
- maximise survey output for a particular fixed cost
- during enumeration of a survey, be able to develop a strategy for IFU conditional on the sample already received, the cost available and the desired outcomes

There are several possible approaches to investigating the cost structure of a survey operation.

One possible approach to this problem is to use agent based simulation as proposed by Groves (cited in Karr and Last, 2006). In this scenario the agents are the providers. Each of these agents has a range of ways of behaving depending on the external influences which include general circumstances (which are out of our control) and the activities of the ABS in using techniques such as pre-approach letters, different IFU strategies and so on.

The benefit of agent based simulation is that it allows for the wide variety of different events apparent in this problem. It allows for individual providers to act independently in their propensity to return a survey form both with and without outside stimulation such as a reminder letter or telephone call. It also allows for the independent probability of interviewers to make calls and interact with the probability of the providers.

As discussed above, there are a number of aims within using agent-based simulation. It is possible that some of these may be able to be addressed simultaneously, otherwise a systematic approach may need to be adopted, considering all the different options. Initially however, the option of minimising cost for a given response rate will be considered.

A second approach proposed in the literature (Campbell et al., 2008) applies survival analysis where the event is responding to the survey. Survival analysis is an appropriate form of analysis for this type of problem as it is time to event modelling. The event of interest is returning a survey form, or responding to a survey. Providers that are considered censored are those that are non-respondents or who have not returned their form at the end of the data collection period.

A third approach is to take a simulation-optimisation approach. In this case the approach is to optimise the number of interviewers at a particular level to employ each day. This will be done by simulating the number of calls each interviewer could make and therefore the expected number of calls to be received by the provider in order to achieve the best survey output. The benefit of this approach is that it optimises the overall calling strategy and work schedule for interviewers rather than optimising the maximum number of call attempts conditional on a particular calling strategy and work schedule for interviewers. Considering the initial data exploration stage which suggests that both calling strategy and work schedule for interviewers are important determinants in both the cost and success of IFU, this approach is considered important.

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