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Application of Operations Research to Improving Business Collection Efficiency

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Application of Operations Research to Improving Business Collection Efficiency

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Operations Research Unit
Statistical Services Branch

Methodology Advisory Committee

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INQUIRIES

The ABS welcomes comments on the research presented in this paper.
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APPLICATION OF OPERATIONS RESEARCH TO IMPROVING BUSINESS COLLECTION EFFICIENCY

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Operations Research Unit

QUESTIONS FOR THE COMMITTEE

1. Does the Committee agree that the step forward is to proceed to a stage of modelling and optimising the relationship between cost, effort, and outcome (form receival rate and contribution to estimate)?
2. Does the Committee have any views on on the relative benefits of agent-based simulation versus survival analysis?
3. Does the Committee agree that the main issues have been addressed via the data exploration stage?

CONTENTS

APPLICATION OF OPERATIONS RESEARCH TO IMPROVING BUSINESS COLLECTION EFFICIENCY

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ABSTRACT

The relationships between the cost of follow-up, survey response and telephony practices are complex and depend on many factors. This paper explores some initial data investigation into the efficiency and effectiveness of ABS strategies for follow-up of business survey providers leading to some conclusions and hypotheses about the types of issues involved. Two of these hypotheses are explored further through small scale trials, while the proposed analysis of the more complex relationship is discussed briefly.

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).

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 three major business surveys on their form receival 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 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 Intensive follow-up (IFU) commences. IFU is a major part of data collection procedures for collections involving businesses. IFU involves contacting providers who have not already returned their survey form to encourage them to return it as soon as possible. Within the ABS, the percentage of providers receiving IFU in some form can vary 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 can form a large percentage of total survey cost.

Originally, IFU was handled independently by collections. Since 2003, however, the majority of IFU has been co-ordinated centrally. This centralisation has had many benefits including the ability to access detailed management information or paradata on contacts made to providers. However the process of IFU for each collection has maintained its originality, little or no optimisation of processes has occurred.

Traditionally research into IFU has centred around issues such as significance IFU, the concept of giving higher priority in IFU to those providers whose contribution to estimate are significant in one way or another. Little or no research has been conducted into the amount, type and frequency of IFU and its effect on survey response and cost. The aim of this paper is to explore the efficiency of personal telephone calls made as part of IFU and in particular to identify optimal call patterns and procedures in terms of survey response, survey outcome and cost.

The telephone follow-up component of IFU is performed by the Provider Contact Unit (PCU). Thirteen annual collections and twelve subannual collections are managed by the PCU. At its maximum the PCU consists of 100 interviewers based in two sites, Canberra and Sydney. The interviewers work daily shifts from 8:45am to 4:50pm. The number of interviewers working at any one time varies quite considerably, peaking in September/October when the annual collections require IFU in addition to the normal quarterly surveys.

The number of interviewers to work on a particular survey on any one day is calculated in a relatively adhoc way based on numbers used in previous survey cycles. An automated workload allocation system known as Daybatch provides interviewers with telephone numbers to call for the majority of simple providers. More complicated providers are listed on paper lists. Within Daybatch, providers are sorted by a significance flag. Once a provider has been successfully contacted, the provider is moved to the bottom of the list within Daybatch. Daybatch has a number of rules associated with it, such as how long to wait before recontacting providers with previous unsuccessful contacts.

A provider management system known as PIMS records all contacts made with a provider, the day and time at which they were made, the contact-type and the result of the contact. PIMS also Records the day and time at which a form is received.

As already stated, different collections generally have quite different IFU strategies. In addition different collections have different complexities, different output requirements and different ways of assigning significance flags. These are detailed in Appendix A.

3. PROBLEM FORMULATION

The first stage of the project was the non-trivial task of defining the problem. The general brief for the project was *to understand the relationship between cost of follow-up and survey response and telephony patterns processes to identify cost effective practice* as mentioned above. One of the first things to consider therefore was what are the different components of follow-up that potentially might influence cost and/or survey response. Some of the main components identified were

- 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 problem to be answered 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? Would this then increase the likelihood of survey response? If it was ascertained that different times of day were more likely to produce a 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?

Some exploratory analysis around these components was conducted to try and better understand their relationship with cost and survey response.

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. Details of the

differences between these three collections is given in Appendix A. More detail about the data used and definitions of terminology are given in Appendix A.

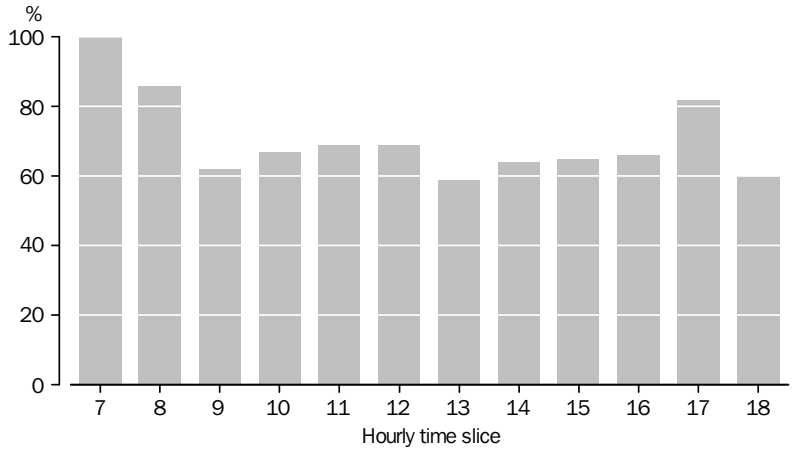
Initial investigations of these three collections highlighted some interesting differences in both procedures and outcomes. These are described in more detail in the results section. Some of the differences observed resulted in two trials of alternative procedures. However the main outcome of the exploratory analysis was that this was a complex problem and more mathematical techniques were required to better understand the relationships between the different components and cost and survey response.

4. RESULTS

4.1 Best time to call

Looking at one quarter of QEWS showed that the average percentage of contacts that resulted in a direct contact was 65%. This varied marginally across the day with a lower success rate between 1 and 2pm as would be expected. Results from this are shown in figure 4.1. The morning seems to be a slightly more successful time to call. This is interesting given a larger proportion of calls are made in the afternoon as the first part of the morning can be spent in resolving queries. Tables B.1 and B.2 in Appendix B contain the values.

4.1 Percentage of all contacts resulting in a direct contact, by hourly time slice



Some research was conducted into whether it made a difference depending on the industry. Overall different industries had different percentages of direct contacts, with education having the lowest at 58% and Retail Trade, the highest at 71%. Across the time slices, there was also some variation across industry, however there was not significant information to justify any conclusions here. Numbers from this analysis are given in table B.3 in Appendix B.

Across state, the lowest percentage of direct contacts were for Tasmania and the Northern Territory at 58%. South Australia and Western Australia were the highest at 67%. Neither of these states seem to have suffered from having a lower percentage of calls in the late afternoon, due to the difference in time zones. There does not seem to be anything outstanding across the different time slices between states. The numbers from this analysis are in table B.4 in Appendix B.

4.2 Number of contacts

Table 4.2 shows the total numbers of forms and contacts for two quarters of QEWS, two of AWE and two years of EAS.

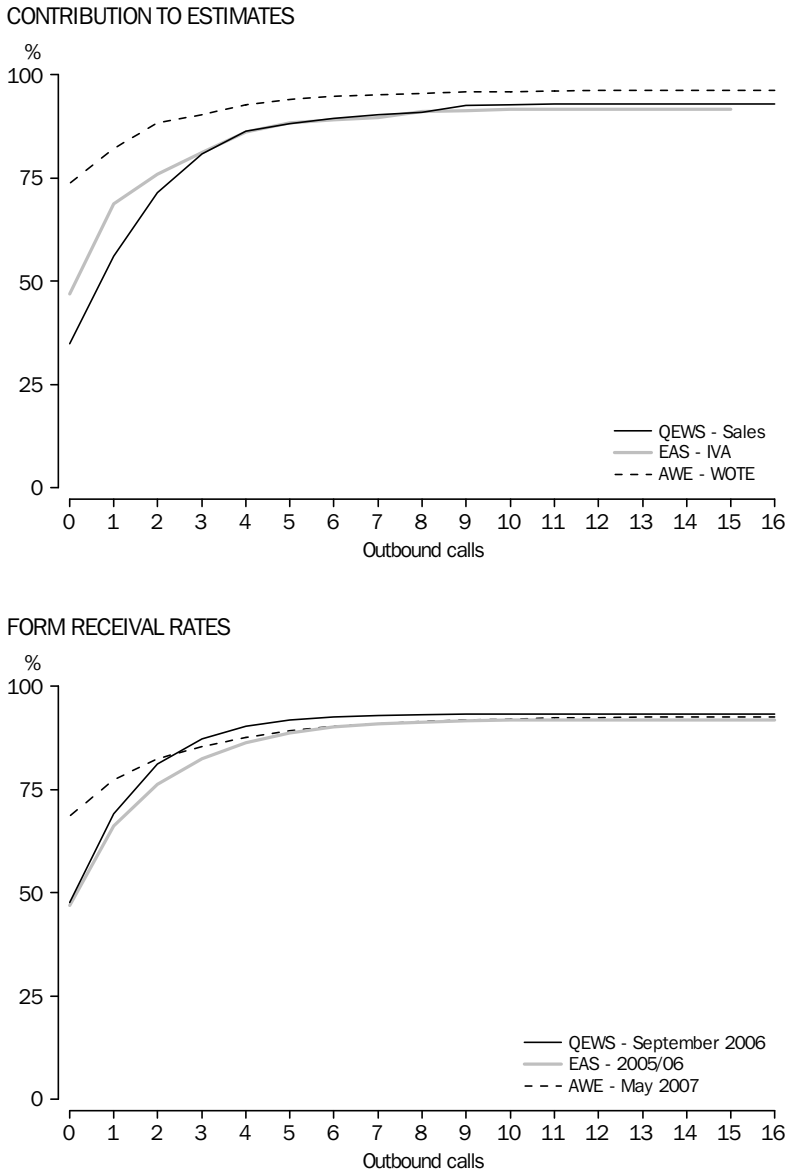
4.2 Total forms and total contacts for QEWS, EAS and AWE

	QEWS		*EAS*		*AWE*	
	Sep–06	*Dec–06*	*2004/05*	*2005/06*	*Feb–07*	*May–07*
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	35,745	29,158	9,316	9,975
Number of outbound calls	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?

To answer these questions, some preliminary analysis on when forms are returned by the number of outbound telephone calls received was conducted. The non-imputed contribution to estimate by the number of outbound telephone calls was also calculated. Figure 4.3 shows these results for the three collections. Numbers from this graph are given in table B.5 in Appendix B.

4.3 Contribution to estimates and Form receival rates, by Number of outbound calls made

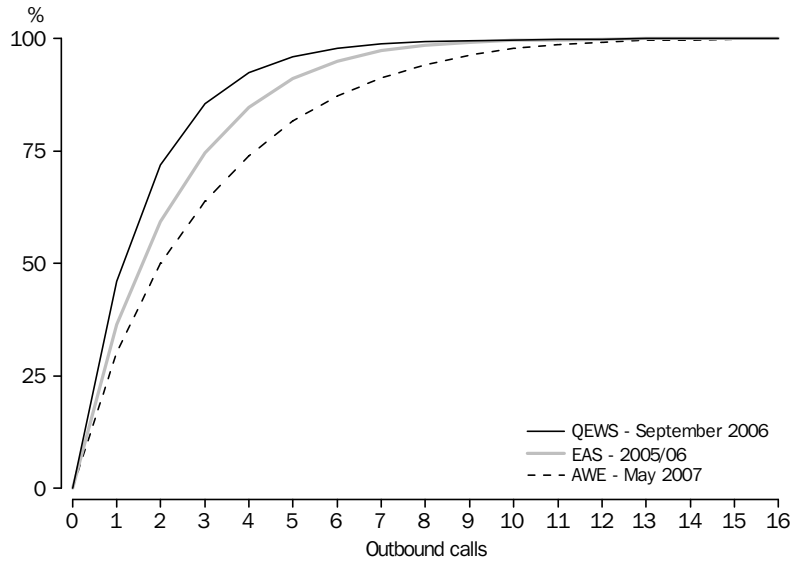


The above graph shows two main results. The first of these is in relation to the form receival rate and non-imputed contribution to estimate after 0 calls. This percentage is significantly greater than 0 for all collections. Therefore, a percentage of providers return their form without any outbound telephone call from the ABS. In fact around 47% of forms from QEWS and EAS are returned without any outbound telephone calls being required and nearly 70% of forms from AWE are returned without any outbound telephone calls. The figures are similar for non-imputed contribution to estimate with around 47% of Sales being estimated from forms returned with no outbound telephone call for QEWS, 37% of Industry Value added for EAS and 75% of Weekly Ordinary time earnings for AWE. One hypothesis as to why there is such differences between the collections is that IFU starts later for AWE, therefore giving providers more time to respond without receiving an outbound telephone call.

The second thing to observe from the graph is that the majority of forms are returned and the majority of the estimate is obtained after a relatively small number of outbound telephone calls. For QEWS, a 90% form receival rate is achieved by four calls, while EAS and AWE require six calls. A 90% contribution to Sales and IVA is achieved after around seven calls and after four calls for WOTE.

Given a number of providers receive in excess of these numbers of calls, how much effort is expended making large numbers of contacts to providers? Figure 4.4 shows the distribution of effort as measured by number of outbound calls for the three collections.

4.3 Cumulative effort expended, by Number of outbound calls made



The amount of effort expended achieving a particular number of calls, varies from collection to collection. In AWE, the last 20% is spent making more than four calls to providers and results in about a 2% increase in Form receival rate and Contribution to WOTE. For EAS, the last 15% of effort results in a 5% increase in both Form receival rate and Contribution to IVA. For QEWS, the last 8% of effort results in a 3–4% increase in Form receival rate and Contribution to Sales. Thus it seems that for AWE in particular, a large amount of effort is expended in getting the last few percent in form receival rate and contribution to estimate.

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 important (as 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 receival 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 receival rate and also due to PCU staff comments in relation to the difficulty relating to AWE for the same reason).

GOLD STAR PROVIDER INITIATIVE

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) 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. The PCU estimate 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.

4.3 Contact patterns

What contact patterns are most likely to result in a form being returned? Table 4.4 shows the final contact prior to returning a form for EAS, QEWS and AWE. Inbound calls are included in the contact types as well as in the %inbound calls in the final row.

This table shows that reminders, one of the cheaper forms of IFU are the most common contact prior to a form being returned, in 36% of cases for QEWS, 25% of cases for EAS and 47% of cases for AWE, with the first reminder being the most successful. Inbound calls are also a high prior contact, particularly for EAS. This suggests that perhaps some recognition of inbound calls should be made when deciding whether to call a provider or not.

4.4 Final contact type prior to a form being returned – QEWS, EAS and AWE

	QEWS December 2006	*EAS 2005/06*	*AWE May 2007*
No contacts	19.2%	32.8%	29.7%
Comment	16.2%	20.7%	14.8%
Data collected	12.1%	1.6%	3.4%
Data item queried	0.0%	7.7%	0.0%
Extension	7.7%	2.7%	1.4%
Form sent back	4.4%	8.1%	1.6%
Redespatch	1.8%	0.0%	2.2%
Reminder stat=13	14.6%	14.0%	38.8%
Reminder stat=14	11.5%	8.9%	7.3%
Reminder stat=15	6.2%	2.2%	0.0%
Reminder stat=16	4.4%		
Other – inc. refusal, SFMP, contact details change	1.9%	1.3%	0.8%
% inbound calls	17.9%	20.1%	6.6%

As one of the hypotheses above was that the timing of IFU commencement was important, the question was how long does it take before a form is returned after the final contact by the ABS whether phone or reminder letter? Table 4.5 shows the average number of days between the final reminder letter and the form being returned. The average is across the four quarters of 2006 for QEWS, two years 2004/05 and 2005/06 for EAS and two quarters of 2006 and two of 2007 for AWE .

4.5 Average number of days between reminders and form being returned

Number of reminders	*Average for QEWS*	*Average for EAS*	*Average for AWE*
1	6.8	11.2	15.2
2	5.4	17.1	
3	7.7	44.5	
4	15.1		

While there was a large amount of variation as to the number of days between the reminder being sent and the form being received, the average was similar to the median. This table shows that for QEWS it takes on average almost seven days for providers to return their form after the first reminder, assuming they received no other reminders. Interestingly, it takes them on average about five days to return their form even if there are no outbound calls in addition to the reminder. This again indicates that perhaps there should be some delay in calling providers in QEWS rather than immediately after the first reminder is sent.

A similar pattern is noticed for EAS, with the average number of days after the first reminder being around 11. In EAS, phone IFU commences about five days after the reminder is sent, which again seems to be a bit early given the average number of days is around 11 and around 10 even if there are no outbound calls in addition to the reminder.

The high average number of days to return (nearly 45) after the third reminder is indicative of the long lag for some providers. Thirty percent of all returned forms are returned after the third reminder and 10% are returned over three months late. This highlights a need for something alternate to be done for these chronically late returns. One distinguishing feature of the providers that are returned after the third reminder is that a large percentage of these do not receive an outbound telephone call until at least after the second reminder.

TRIAL OF ALTERNATIVE IFU TIMINGS

As a result of the research on average numbers of days to return forms after reminders, 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 receival 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. See table B.6 in Appendix B.

The trial highlighted two facts:

- delaying IFU does not seem to reduce form receival 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.

4.4 Conclusions of data exploration stage

The main conclusions from the data exploration stage 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. Thus the main conclusion is that a more detailed investigation into the relationships between cost, effort and output measures such as form receival rate and contribution to estimate needs to be conducted.

5. NEW PROBLEM FORMULATION

As discussed throughout the paper, the relationship between cost and output is complex and requires further investigation. 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.

One discussion around this is to define 'fitness for purpose' and how to measure it. One way to measure fitness for purpose is to look at mean square error or more particularly the bias. Therefore, the question becomes what is the cost of each call and what is the contribution of this call to reduce bias? It must also be remembered that the contribution varies not only by the call but also by the provider to whom the call is made.

There are several possible approaches to investigating the cost structure of a survey operation. The remainder of this section discusses 3 possible approaches.

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 a 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 workschedule 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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APPENDIXES

A. DATA SPECIFICATIONS

Data specifications

The data used in the analysis was from the Quarterly Economy Wide Survey (QEWS) and Average Wekly Earnings Survey (AWE) for several quarters across 2005, 2006 and 2007 as well as the Economic Activity Survey (EAS) for 2005, 2006 and 2007. The variables used to assess contribution to estimate are the headline figures for each collection. For QEWS the variable used is Total Sales. For AWE, the headline figure is Average Weekly Earnings, a rate, so for this analysis, Weekly Ordinary Time earnings (WOTE) has been used. For EAS, the variable Industry Value Added (IVA) is used.

The contacts include all contacts registered in PIMS. This excludes any contacts that may have been made by the collection area itself and not included in PIMS.

Data definitions

Outbound contacts are defined as those contacts initiated by the PCU rather than by the provider including reminder letters.

Outbound calls are defined as outbound contacts excluding reminder letters.

Inbound calls are defined as those contacts initiated by the provider.

Direct contacts are where the PCU spoke directly with a person in the target business who was responsible for completing the form.

Indirect contacts are where contact was made with the target business but the PCU was unable to speak directly with a person who was responsible for completing the form, e.g. answering machine, message left with colleague, etc..

Failed contacts are where no contact was made with the target business, e.g. busy line, phone rang out, etc.

Form receival rate is calculate as the number of forms returned, whether they are marked in, cancelled or temporary nils.

Data limitations

The data used in the analysis is generated as a by-product of an administrative process rather than collected for the purpose of the analysis. Consequently, the analysis must take into consideration the following limitations of the processes/systems that have an impact on the scope and consistency of the contacts data:

- Whilst the majority of outbound calls, made via the call scheduling system, cannot be terminated without first creating a comment and designating a contact type, other calls and other types of contact require a PCU employee to manually process a comment. At this stage the extent of under-reporting resulting from unrecorded comments is unknown. However, given that approximately 75% of calls are made via the call scheduling system, this potential under-coverage does not invalidate results reported in this paper.
- When recording a comment, the type of contact must be selected by the interviewer. This, combined with the fact that there is a generic "Comment" option available, has the potential to introduce error in the type of contact recorded. Consequently, analysis of comment types reported in this paper should be treated with caution.
- The number of staff working on a particular collection is not that reliable as staff may work on more than one collection in a day, yet the whole day is only recorded for one collection.

Collection differences

A.1 ABS collection information

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

B. SELECTED TABLES

B.1 Daily distribution of outbound and inbound contacts

	Hourly time slice												
	7	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*Total*
Inbound calls	0	23	870	939	1,104	887	740	911	958	763	96	0	7,291
% per time slice	0%	0%	12%	13%	15%	12%	10%	12%	13%	10%	1%	0%	100%
Outbound calls	20	74	3,144	3,469	4,361	3,558	2,736	4,492	4,270	2,892	178	5	29,199
% per time slice	0%	0%	11%	12%	15%	12%	9%	15%	15%	10%	1%	0%	100%

B.2 Summary table of outbound calls including % of direct contacts

	Hourly time slice												
	7	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*Total*
Direct contact	20	64	1,946	2,313	3,001	2,440	1,617	2,890	2,766	1,912	146	3	19,118
Failed contact	0	0	519	523	611	498	549	825	760	470	8	0	4,763
Indirect contact	0	10	679	633	749	620	570	777	744	510	24	2	5,318
Total	20	74	3,144	3,469	4,361	3,558	2,736	4,492	4,270	2,892	178	5	29,199
% Direct contact	100%	86%	62%	67%	69%	69%	59%	64%	65%	66%	82%	60%	65%

B.3 Percentage of direct contacts across ANZSIC divisions

ANZSIC division	Hourly time slice 9	10	11	12	13	14	15	16	Total
E	59%	66%	69%	70%	62%	66%	63%	65%	65%
F	72%	73%	72%	66%	63%	66%	60%	66%	67%
G	71%	70%	69%	71%	68%	71%	74%	70%	71%
H	57%	69%	73%	70%	53%	58%	64%	66%	65%
I	66%	67%	72%	75%	61%	64%	68%	62%	67%
J	57%	61%	69%	66%	63%	76%	57%	66%	64%
K	58%	61%	63%	63%	54%	56%	63%	72%	61%
L	64%	71%	69%	69%	50%	61%	66%	70%	65%
N	60%	49%	54%	74%	39%	68%	57%	56%	58%
O	66%	56%	67%	59%	53%	63%	65%	67%	62%
P	56%	60%	64%	59%	60%	61%	63%	58%	61%
Q	54%	61%	59%	60%	55%	64%	63%	55%	59%

B.4 Percentage of direct contacts across State

State	Hourly time slice 9	10	11	12	13	14	15	16	Total
New South Wales	62%	68%	68%	70%	56%	65%	66%	65%	66%
Victoria	63%	64%	72%	69%	59%	64%	65%	70%	66%
Queensland	62%	67%	72%	65%	67%	66%	63%	65%	66%
South Australia	64%	69%	72%	69%	58%	67%	69%	66%	67%
Western Australia	61%	74%	67%	71%	64%	63%	65%	74%	67%
Tasmania	61%	56%	54%	64%	51%	60%	60%	54%	58%
Northern Territory	58%	59%	64%	66%	52%	53%	55%	54%	58%
Aust. Capital Territory	59%	80%	54%	56%	62%	63%	60%	59%	62%

B.5(a) Remaining forms and Remaining calls, by Number of outbound calls

Number of outbound calls	Remaining forms			Remaining calls		
	QEWS	EAS	AWE	QEWS	EAS	AWE
0	12,311	5,936	1,892	26,346	16,248	5,269
1	7,274	3,783	1,354	14,201	10,321	3,677
2	4,397	2,667	1,052	7,386	6,608	2,635
3	2,992	1,958	869	3,806	4,127	1,909
4	2,263	1,518	747	1,965	2,471	1,373
5	1,935	1,262	645	1,046	1,427	966
6	1,774	1,092	583	561	792	670
7	1,681	1,015	538	305	443	452
8	1,636	970	516	170	233	304
9	1,602	933	489	93	113	193
10	1,593	918	472	54	54	117
11	1,580	910	463	28	25	70
12	1,578	908	457	18	12	39
13	1,577	905	451	10	6	18
14	1,577	905	450	6	4	11
15	1,577	904	449	2	2	5
16	1,575	904	449	0	1	2

B.5(b) Contribution to estimates, Form receival rates and Cumulative effort, by Number of outbound calls

Number of outbound calls	Contribution to estimates (%)			Form receival rates (%)			Cumulative effort (%)		
	QEWS (Sales)	EAS (IVA)	AWE (WOTE)	QEWS	EAS	AWE	QEWS	EAS	AWE
0	34.9	47.0	73.8	47.8	47.0	68.5	0.0	0.0	0.0
1	56.2	68.7	82.1	69.1	66.2	77.4	46.1	36.5	30.2
2	71.5	76.0	88.4	81.3	76.2	82.5	72.0	59.3	50.0
3	80.8	81.2	90.4	87.3	82.5	85.5	85.6	74.6	63.8
4	86.4	86.1	92.7	90.4	86.4	87.6	92.5	84.8	73.9
5	88.1	88.4	94.1	91.8	88.7	89.3	96.0	91.2	81.7
6	89.5	89.1	94.8	92.5	90.2	90.3	97.9	95.1	87.3
7	90.4	89.6	95.2	92.9	90.9	91.0	98.8	97.3	91.4
8	91.0	91.1	95.5	93.1	91.3	91.4	99.4	98.6	94.2
9	92.5	91.3	95.9	93.2	91.7	91.9	99.6	99.3	96.3
10	92.7	91.6	95.9	93.2	91.8	92.1	99.8	99.7	97.8
11	92.9	91.6	96.1	93.3	91.9	92.3	99.9	99.8	98.7
12	92.9	91.6	96.3	93.3	91.9	92.4	99.9	99.9	99.3
13	92.9	91.7	96.3	93.3	91.9	92.5	100.0	100.0	99.7
14	92.9	91.7	96.3	93.3	91.9	92.5	100.0	100.0	99.8
15	92.9	91.7	96.3	93.3	91.9	92.5	100.0	100.0	99.9
16	92.9		96.3	93.3	91.9	92.5	100.0	100.0	100.0
Elbow point				5	6	5	5	6	5

Source: QEWS – September 2006; EAS – 2005/06; AWE – May 2007.

B.6 Total forms and total contacts for Trial and Non-Trial same scope providers – QEWS and EAS

	QEWS		*EAS*	
	Trial B	*Same scope*	*Trial*	*Non-Trial*
Contacts				
Total number of contacts	4,300	19,053	14,216	26,870
Number of outbound contacts	3,872	17,024	11,491	20,850
Number of outbound calls	2,173	7,637	7,688	11,586
Forms				
Total number of forms	1,024	5,072	3,031	6,345
Number of forms returned	913	4,455	2,773	5,622
Form receival rate	89.2%	87.8%	91.5%	88.6%
Average calls				
Average calls per form returned	4.2	3.0	2.0	1.4
Average calls per form not returned	1.9	1.3	8.5	5.0
Average calls All	2.1	1.5	2.5	1.8
Days to return				
Median days to return	14	14	n/a	n/a
Contribution to estimate				
Contribution to estimate	89.5%	86.3%	n/a	n/a

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