Developing a Response Chasing Strategy for Business Surveys at the Office for National Statistics (UK)

Pete Brodie and Mila Teneva

Strategy and Standards Directorate, ONS

Summary

The Office for National Statistics (ONS), like other national statistical offices, employs very simple processes for ensuring that response is adequate for our many business surveys. These traditional processes rely on prescribed targets for numbers of returned questionnaires often coupled with targets based on auxiliary information available from the sampling frame (such as employment size) so as to ensure that "important" responders provide their data.

Here we explore some alternative response chasing methods for maximising the quality of the resultant outputs. These methods use the basic maxim that the responders that will best improve quality should be prioritised within the response chasing strategy.

1. Introduction

The ONS employs very simple processes for ensuring that response is adequate for our many business surveys (around 100). These traditional processes rely on targets for numbers of returned questionnaires or are based on auxiliary information available from the sampling frame (employment size etc.). These targets are usually set at a global level and are based on historical resource availability and traditional response performance. The targets tend to be invariant over time, and hence do not take into account seasonality or changes in the economic cycle.

There are many drivers for seeking to change this situation. As with other national statistical offices (NSOs), these are fairly obvious. The first driver is the pressure to reduce costs and to combat falling response rates. There are also pressures from Government to reduce the response burden on businesses. At the moment, the response chasing process is also fairly disconnected from the real target of improving the quality of output estimates. Finally, there is an opportunity to standardise practice across surveys and improve relations with survey responders.

In addition to the challenges facing most NSOs, there are some more specific ONS drivers. The first is to leverage gains that have been made in the area of selective editing where there is a direct targeting of resources towards the most effective areas. The second incentive is to rebalance effort between distinct survey areas which have independently developed their own targets. Finally there is a specific need to deliver the new Statistical Business Strategy. This paper describes the process of assessing an alternative strategy for response chasing and presents the qualitative results of applying this strategy with a practical example.

A number of authors have already addressed the problem using various approaches. For example McKenzie (200) examined a procedure that aimed to minimise the non-response bias by applying intensive follow up techniques The process involved assigning scores to non-respondents to facilitate systematic prioritisation. Similar score assigning methods were described by Daoust (2006), then by James (2007) and finally by Berger (2009). An alternative approach was described by Brion (2009) whereby accuracy and timeliness were balanced to provide guidance as to when response chasing should be stopped. Buisson (2009) described a sophisticated alternative whereby response chasing was managed dynamically and Godbout (2011) looked at standardising approaches across all business surveys within Statistics Canada.

2. Methods and aims

The main aim of the project was to describe the current response chasing process and to explore some alternative strategies and assess the effect on the quality of output estimates. The alternatives would need to satisfy certain criteria which are set out below.

- The strategy should prioritise the response chasing of businesses so as to give the biggest improvement in the statistical quality of the output estimates.
- A major measure of a successful strategy would be one that is simple to implement.
- The statistical production staff and the administrative staff who carry out the response chasing should be engaged in the production of the strategy.

The process would consist of an analysis of historical data to test the alternative strategies empirically. The candidate strategies would be refined and iterated.

The methods employed were fairly simple (in contrast to the approach of other authors referenced in the introduction above). Historical micro data was supplemented with response dates so that a re-analysis could be carried out to estimate the levels of total turnover and confidence intervals around those estimates at any point in time. The graphical representation of these data were then used to assess (on a fairly high level scale) the significance of basing estimates only on earlier data. The judgement was based on whether or not early estimates were within the final confidence intervals. This was then developed into a simple strategy and the strategy was also partly tested using a practical example.

3. The data and paradata

3.1 The data

The most appropriate data that were available are returns for the Monthly Business Survey (MBS) which cover three main sectors of the economy, namely manufacturing, services and distribution. The survey is ideally suited because of the

simplicity of the collected data and the time critical nature of the data collection process.

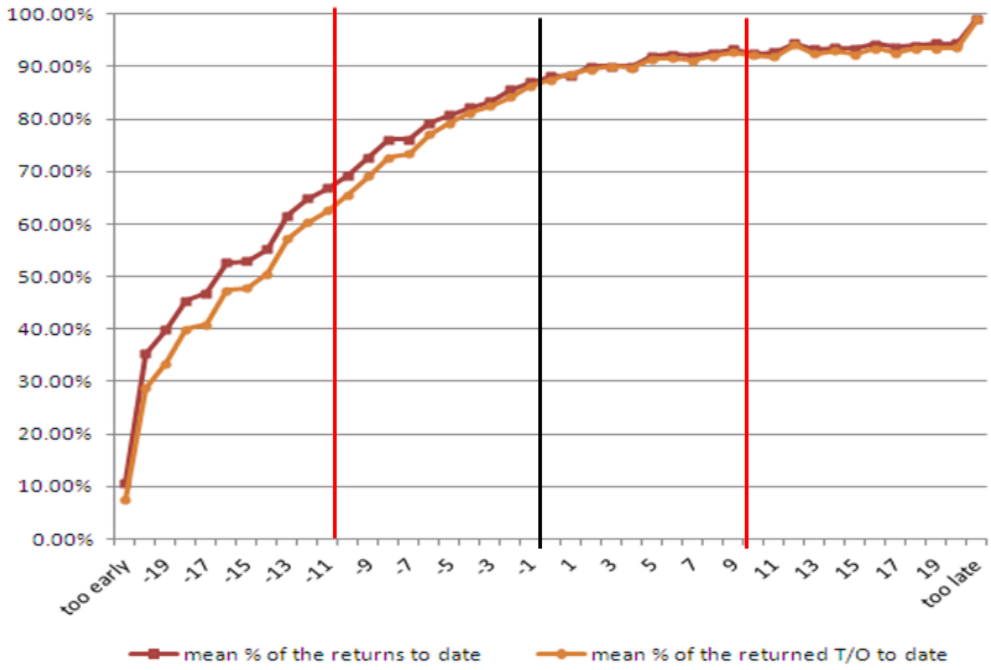
Each month around 32,000 businesses are sampled and the principle variable for which data are collected is the value of turnover for the current calendar month. Additionally every third month the number of employees is also collected but these data were not used during this analysis. Data were available for each of the twelve months during 2010 and the dataset comprises 304,689 separate responses. Crucially for each response the date of return of data was also available and this was critical to the analysis. Details of key dates for each month of collection were also available.

3.2 The existing strategy

The existing strategy is very simple. "Closedown" occurs on the 19th working day following the end of the calendar month. This was designed to allow an approximately equal resource for response chasing each month. Data arriving after closedown would not normally be used to produce estimates. Responders are asked to return data by the end of the week following the end of the reference month, reminders are sent in the week following this date and response chasing commences around a week later. There are simple targets for response chasing. The targets are twofold. Firstly, 75% of businesses must have returned and secondly there are targets utilising auxiliary information from the frame. There are separate targets by sector but the returned data for "Production" must cover at least 85% of the auxiliary turnover of the selected sample whereas for other sectors the target is 80%.

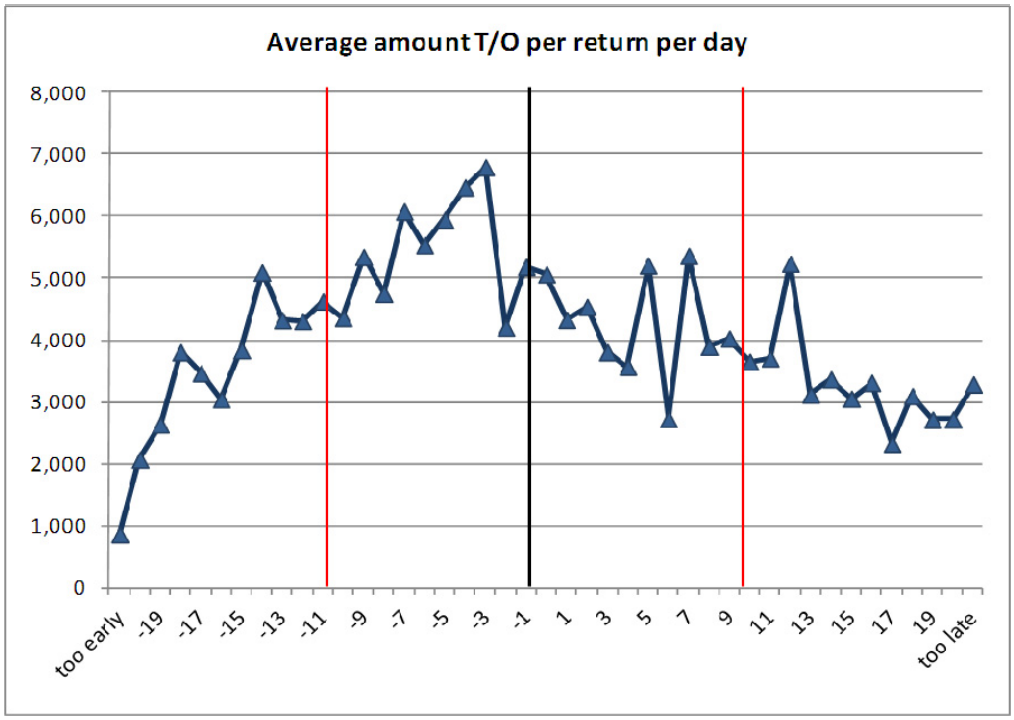
Graph 1 below shows the pattern of returned data by numbers of businesses and by auxiliary turnover. All data are combined and the time axis along the bottom relates to the number of days relative to the closedown date. The vertical axis is the percentage relative to that finally achieved. The vertical black line is the closedown day and the vertical red lines indicate the commencement and termination of response chasing.

Graph 1. Returned data by day relative to closedown



Notice that the early returns are from smaller (in turnover terms) businesses whilst once response chasing starts the gap between the two measures quickly narrows. This is more clearly illustrated in Graph 2 below which shows the average size (again using turnover) of businesses returned on each day. The contrast between the average size before and after response chasing and before and after closedown is evident and obviously correlate very well with the targets that are set.

Graph 2. Average size of businesses returning data by day relative to closedown



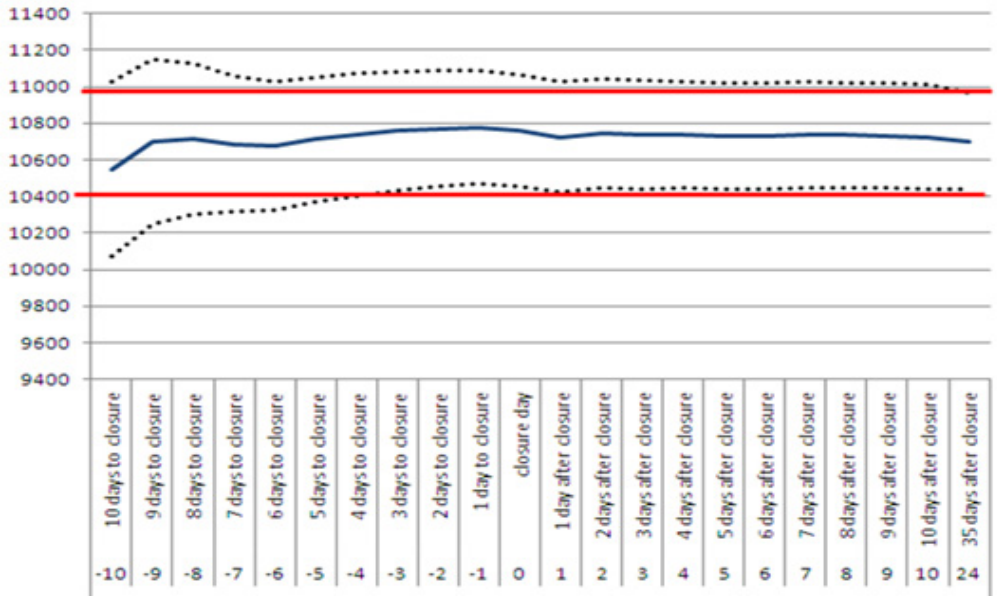
4. The analysis

Here the availability of the response dates for all returned data were crucial in allowing analysis to be repeated for every day relative to the closedown day. Estimates of total turnover were made for every day and separately for a range of different sub-sectors. Simultaneously, estimates of variance were also made for each estimate produced to allow 95% confidence intervals of output estimates to be determined. These calculations were performed using GES[1]. The estimates were plotted and examined to uncover any patterns that could be useful in informing any response chasing strategy. When data for all months were combined, different patterns were evident for different sub-sectors and when different months were analysed separately different patterns appeared in different months.

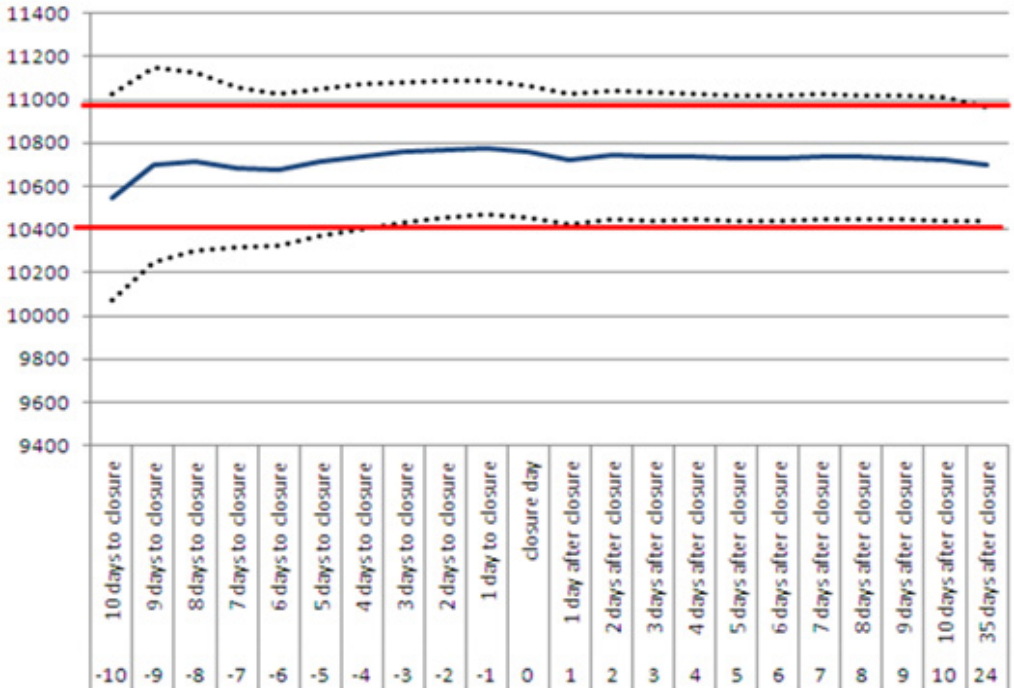
To illustrate this finding a small number of graphs (3-6) are shown below. In each of them the central estimate is shown with a blue line, the instantaneous 95% confidence interval is shown with dotted black lines and the 95% confidence interval as measured at 14 days after the closedown day is shown with solid red lines.

[1] Generalized Estimation Software – calibration and estimation tool produced by Statistics Canada

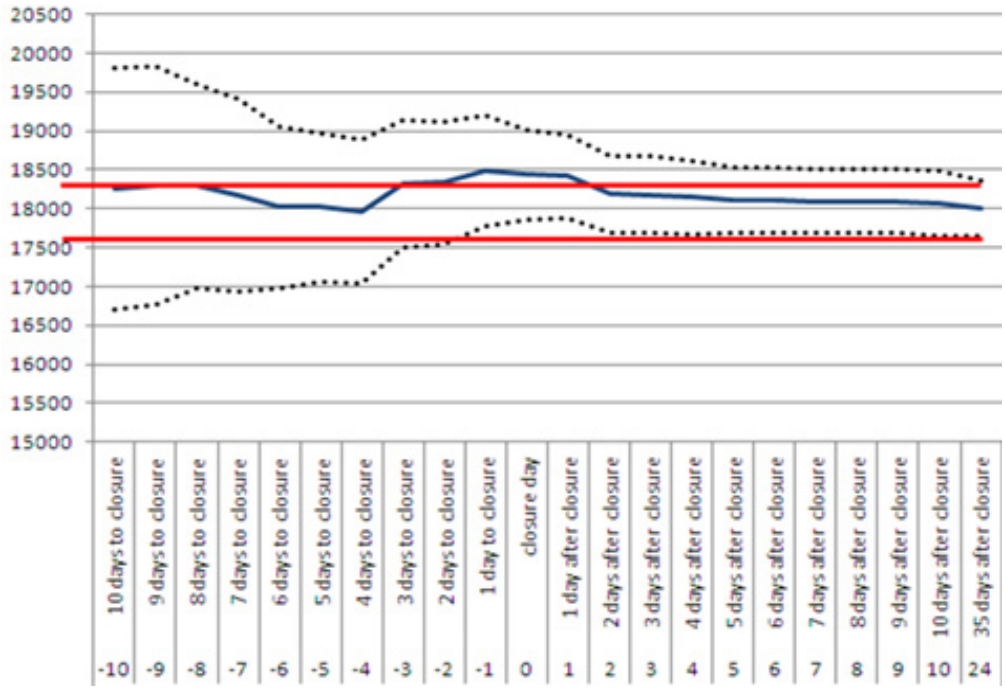
Graph 3. Manufacturing of paper and paper products



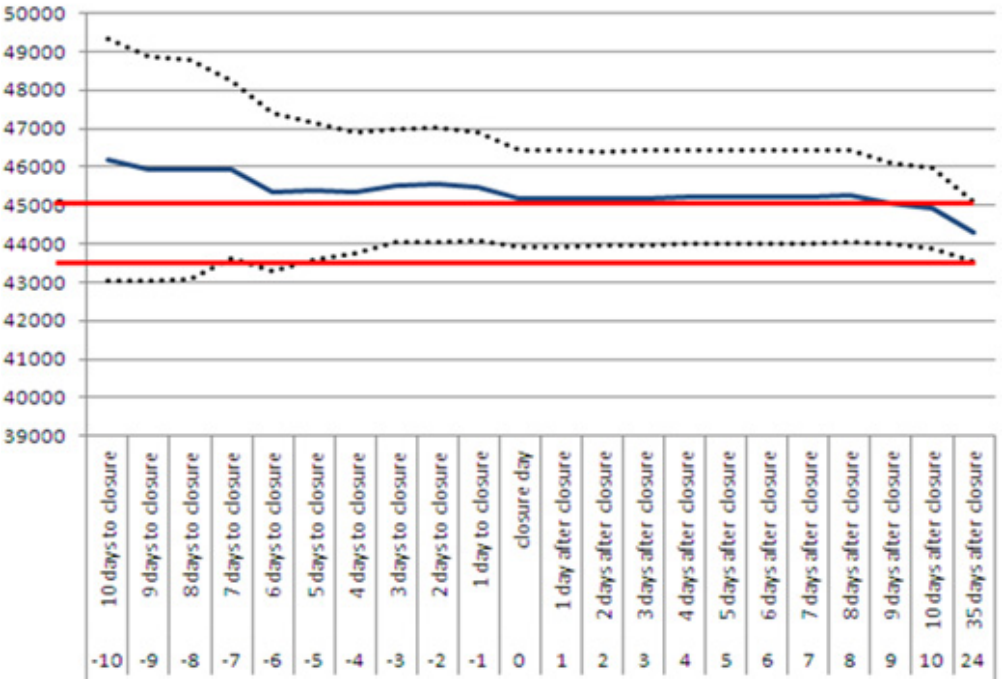
Graph 4. Computer programming and consultancy



Graph 5. Manufacturing of beverages



Graph 6. Manufacturing of motor vehicles



Although there are many patterns, for simplicity we chose to classify them into four different patterns. The first (referred to as green pattern) is where the blue line reaches the gap between the red lines before response chasing commences and stays

in this interval for the duration. The second (yellow) pattern is where the red confidence interval is reached between 10th and 6th day before closedown. The third (amber) pattern is similarly defined but the interval is reached sometime between the 5th and first day before closedown and the last (red) pattern is everything else.

With the pattern types as defined above it is straightforward to automatically classify each sub-sector into one of the four categories. The colours associated with each pattern are used to illustrate the ideal strategy to be used to response chase for businesses in that sub-sector. Those groups of estimates which are categorised as green probably don't need any response chasing, those classified as yellow may be chased, those classified as amber should be chased and the red groups need to be more intensely chased.

In the next part of the analysis colour codes were applied to estimates by appropriate industrial classification, size of business and month of the year to produce a "carpet" diagram which could then be used to directly inform administrative staff. Diagram 1 below illustrates the picture for some divisions within the manufacturing sector.

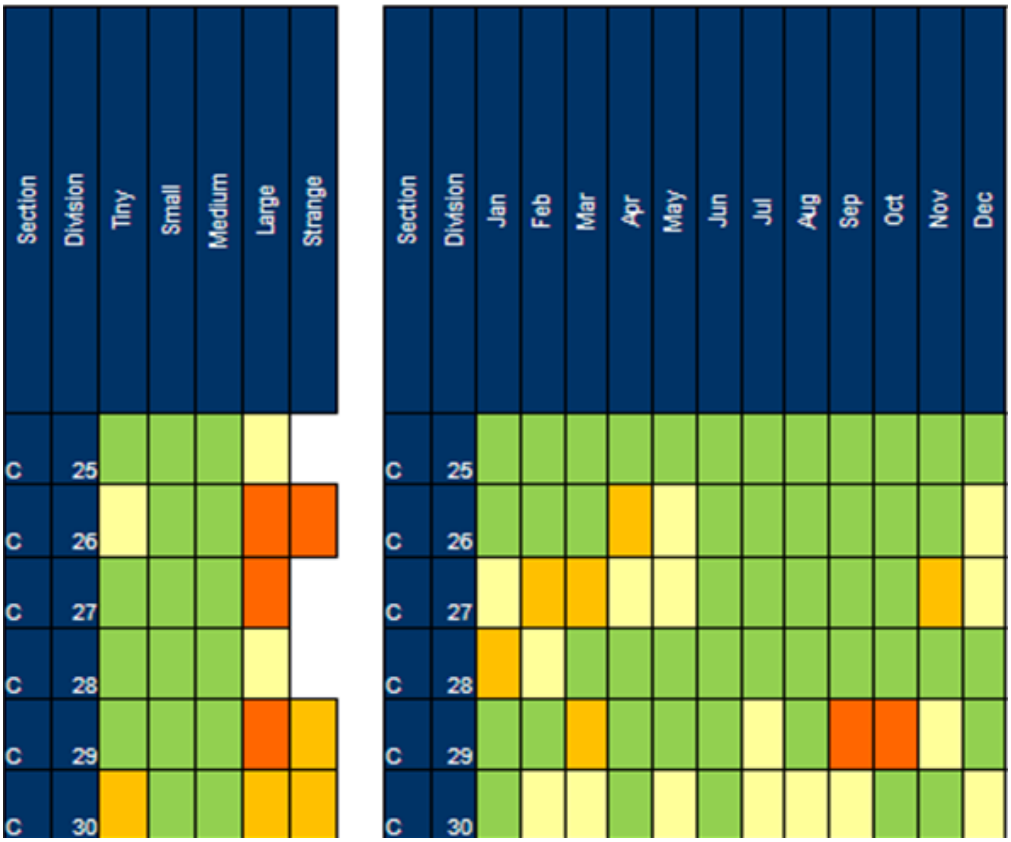
Diagram 1. Classification of response required for Divisions within sectors C and E

Section	Division	Estimate in M£	Standard Error in M£	Responders	CV before the response chasing	CV at the data passing to IoP/IoS	Suggestion
C	25	30,685	411	6,895	1.6%	1.3%	no chasing required
C	26	20,625	302	5,942	1.9%	1.5%	optional chasing
C	27	13,618	177	2,765	2.3%	1.3%	chasing
C	28	34,167	365	6,590	2.2%	1.1%	no chasing required
C	29	44,919	551	2,139	3.5%	1.2%	intensive chasing
C	30	27,402	427	1,725	4.0%	1.6%	chasing

It is clear to see that all four classifications exist across the divisions shown. Further breakdown by size of respondents and by month of the year is shown in Diagram 2 below.

The information in Diagram 2 can then be readily used to target particular strata within the survey for intensive response chasing. It is interesting to see that it is the large and strange (businesses with small employment but large turnover) which typically require additional response chasing effort and that even Division 28 which appears green in Diagram 1 seems to have some requirements for extra chasing in January whilst Division 37 which appears to require little additional effort according to Diagram 1 would certainly benefit from extra chasing in March, April and May.

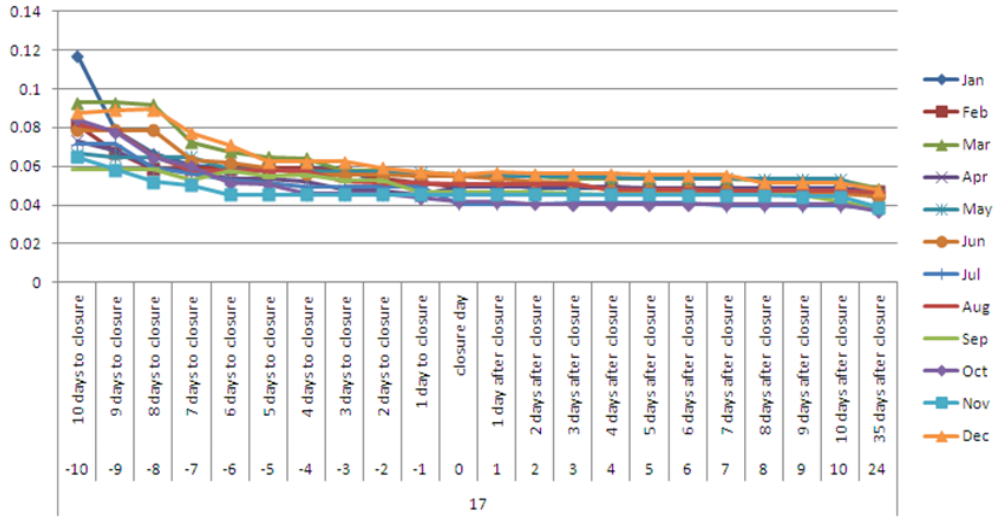
Diagram 2. Classification by size of business and calendar month



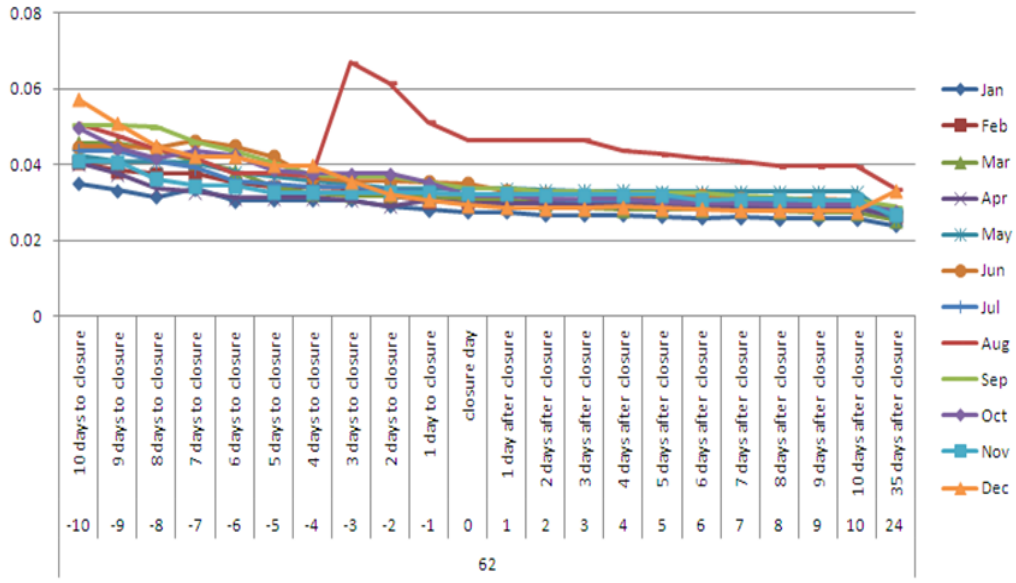
5. Considerations of variance

In the preceding sections no consideration has been given to the estimation of variance under alternative response chasing strategies. This is important since the quality measures associated with our estimates are extremely useful to users of the information. This was addressed by plotting the estimates produced in section 4 as a set of monthly estimates of coefficients of variance (CVs). Graphs 7-10 below are the CV equivalents to Graphs 3-6 with the plots for each of the twelve months shown as separate lines.

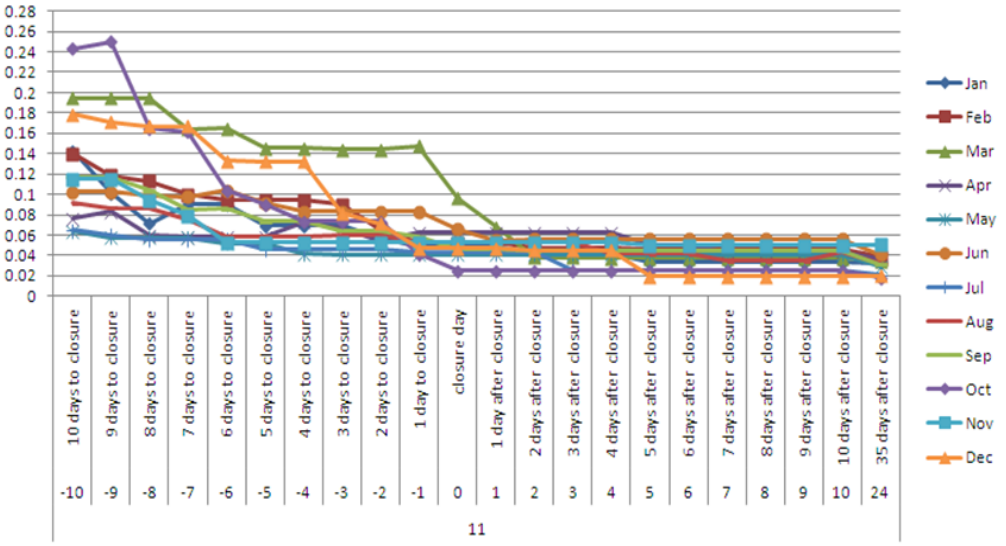
Graph 7. CV at point in time for manufacturing of paper and paper products



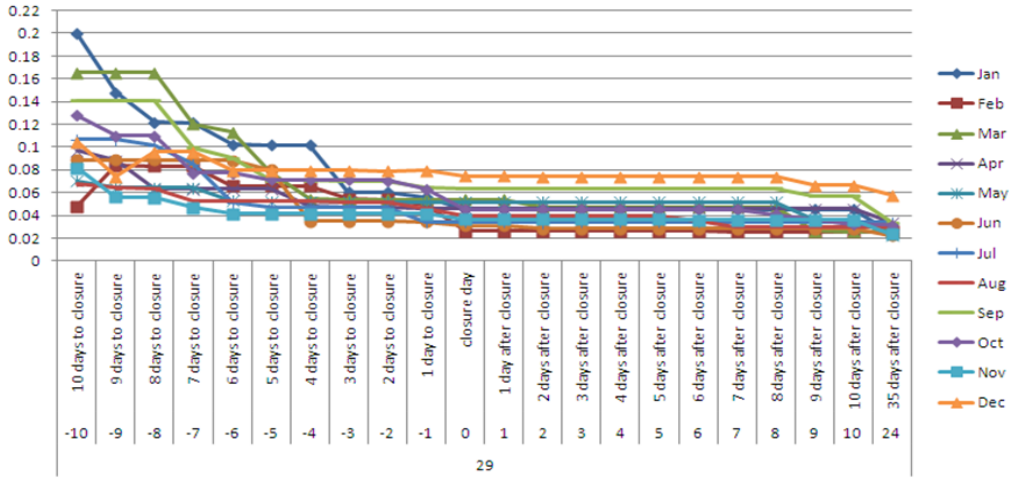
Graph 8. CV at point in time for computer programming and consultancy



Graph 9. CV at point in time for manufacturing of beverages



Graph 10. CV at point in time for manufacturing of motor vehicles



In each of the Graphs (7-10) there is a marked trend of reducing CVs over time which is obviously linked to the increase in returned sample but there are also some interesting effects in some of the graphs. For example, in Graph 8 the trend is bucked for the August returns at a point three days before the closedown day though the downward trend then resumes. This is a direct result of a single outlier. It is also interesting that Graphs 9 and 10 appear to take longer to stabilise which highlights the importance of an appropriate response chasing strategy.

6. Practical applications

6.1 The Retail Sales Inquiry

Some of the ideas generated by the above analysis have been implemented in a small practical pilot. The Retail Sales Inquiry (RSI) is part of the Monthly Business Survey family though there are some subtle differences. The data collected are processed very quickly and the initial estimates are based on only 60% response. The existing response chasing process was very simple and involved chasing respondents by stratum in numerical (arbitrary) order until a 60% response was obtained in the stratum and this was applied in turn to each stratum on the list. Once an overall response rate of 60% was obtained the response chasing stopped.

The changed strategy had a couple of elements to it. Firstly a new prioritised list of strata was produced and secondly some local knowledge relating to specific strata which were prone to high variability was utilised. The new prioritised list was produced by ordering the strata from the highest to lowest sampling fraction. The sampling fractions of strata are of course related to the sample design, which is in turn highly correlated with the expected variance within the strata. Effectively the "red" strata were chased first though the analysis used to produce diagram 2 was not in fact carried out for the RSI . A much smaller second list of highly influential sample members was also used. This list was produced by utilising the knowledge and experience of survey staff.

6.2 Result of new "strategy"

As a result of this adjusted response chasing process there were a number of immediate benefits:

- Overall response rates increased by 1-2% without any additional resource costs since no effort was wasted in chasing responses which would have been received anyway.
- The most variable strata are now getting the highest response rates.
- The estimate revisions are now much smaller.
- The most influential businesses are now returning their data earlier which is increasing the opportunity for checking and correcting errors.
- There is much greater collaboration between staff responsible for tasks within the statistical value chain and methodologists.

7. Conclusions

This paper has presented some ideas backed up with analysis and a practical example of how some adaptation of the response chasing strategy could possibly improve the quality of output estimates with no additional resource. A practical approach to how this can be achieved is also shown. It should be noted that where changes are made it is very important to recheck assumptions in the future. There is a danger that the quality of estimates could improve while the quality of estimates of CVs could deteriorate or bias could be introduced. Here lessons can also be learned from work on selective editing.

8. Future work

Within ONS some future work is planned:

- Other survey managers have volunteered to pilot the RAG mapping to improve prioritisation.

- We are also looking to employ a scoring system by respondent rather than the simple stratum by stratum approach. This would certainly be needed for complex surveys with many data items. We can learn from our approach to selective editing.

- The current work only examined short term surveys so we would be looking to develop a strategy for annual surveys where response chasing is extended.

- Finally we still need to keep processes simple since we do not have real time estimation tools.

9. References

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