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**PRIORITIZING FOLLOW-UP OF NON-RESPONDENTS USING SCORES FOR THE
CANADIAN QUARTERLY SURVEY OF FINANCIAL STATISTICS FOR ENTERPRISES**

Invited paper

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Abstract: The Quarterly Survey of Financial Statistics for Enterprises (QFS) is a quarterly survey of the corporate sector designed to obtain information on corporate income statements (elements of revenues, expenses and profits) and balance sheets (assets, liabilities and equity). The estimates for the survey are derived from two different components: a sample survey is conducted for larger businesses while the component for small businesses is modeled based on annual data compiled from the Canada Revenue Agency financial statements. The data collection activity related to sampled businesses is optimized by prioritizing the follow-up of non-respondents based on the relative importance of the businesses in each industry. To achieve this, a score function was developed that takes into account the contribution of each business to the total revenue and total assets for the industry. This paper introduces the methodology used to calculate the scores, and highlights future plans regarding the use of the score function.

I.   INTRODUCTION

1.   The Quarterly Survey of Financial Statistics for Enterprises (QFS) is a quarterly survey of the corporate sector designed to obtain information on corporate income statements (elements of revenues, expenses and profits) and balance sheets (assets, liabilities and equity). The estimates for the survey are derived from two different components: a sample survey is conducted for larger businesses while the component for small businesses is derived based on annual data compiled from financial statements submitted to the Canada Revenue Agency, Canada's central taxation authority.

2.   Balancing data quality and timeliness is very important for the QFS. Preliminary estimates need to be available two months after the start of collection, as they are used to prepare industrial financial statements for the Canadian business sector and serve also as input to the System of National Accounts. Revisions to these preliminary estimates are made the following quarter, at the end of a calendar year, and once QFS estimates can be benchmarked to annual data compiled from the Canada Revenue Agency taxation statements. However, these revisions need to be minimized to preserve the integrity of the program.

3.   In 2003, the QFS was identified as one of two surveys for a review under the Statistics Canada Strategic Streamlining Initiative (SSI). The objective was to investigate how to improve the efficiency of the survey design and improve the quality of the survey estimates. In December 2003, the SSI committee

came back with some recommendations which were investigated and implemented in subsequent years. This had an important influence on the methodology currently used for the QFS.

4.   Every quarter a sample of roughly five thousand large enterprises from eighty industry groups[1] are contacted. The sample size of the industry groups varies considerably, with some having fewer than 20 sampled enterprises and others more than 200. The majority of these enterprises can participate by returning their data by mail or, if an agreement is made with Statistics Canada, by reporting electronically (Electronic Data Reporters, EDR). The number of EDR participants has grown since the programme was introduced in 2003. For the first quarter of 2006, roughly 25% of the sampled enterprises agreed to participate in the EDR program. Special collection arrangements are also made for a small set of respondents (for example local credit unions and banks).

5.   The collection activities aiming to improve the participation of these sampled enterprises in the QFS are centralized at Statistics Canada's head office. This was one of the key processes targeted by the SSI. The response status of sampled enterprises is monitored through the use of the generalized software BLAISE (Statistics Netherlands). BLAISE is also used to schedule follow-ups of non-respondents with specialized staff, who receive dedicated training on how to obtain responses from those that have not responded yet to the survey. The majority of the follow-ups done on non-respondents happen within a two-week window. An escalation follow-up strategy is used to target chronic non-respondents. Non-responding units with the greatest impact on estimates receive ever-increasing levels of follow-up involving more senior staff. Also the QFS has a group of roughly 420 to 470 very large enterprises, identified as MUST units, whose follow-up is considered particularly important. Follow-up of MUST units is done by a special team.

6.   The data collection activity related to sampled businesses is optimized by prioritizing the follow-up of non-respondents based on the relative importance of the businesses in each industry. To achieve this, a score function was developed for the third quarter of 2004 that takes into account the contribution of each business to the total revenue and total assets for the industry.

7.   Score functions are now commonly used by Statistics Canada's business surveys. They attempt to maximize the benefits of collection activities in the context of balancing costs, timeliness and data quality. They aim to allocate collection resources optimally in the presence of highly skewed populations.

8.   This paper is divided as follows: Section II describes the methodology of the QFS score function. Section III introduces evaluation plans for the scores with respect to QFS processes and estimates. Future considerations and conclusions follow in Section IV and Section V.

II.   METHODOLOGY OF THE QFS SCORE FUNCTION

9.   The score function loaded to BLAISE includes three variables in addition to the unit identifier (Q-number): *PRIORITY*, *RANK* and *CONTINUE-ON* flag.

10.   PRIORITY: The acceptable values for BLAISE are set at 1, 3 and 5, with 1 being a higher priority and 5 being a lower priority. The PRIORITY groups are calculated independently within each industry group (IND80). For QFS, PRIORITY=1 is reserved for the MUST units and 5 identifies units that will not get called for a follow-up.

11.   RANK: The acceptable values are integers from 1 to 9999, with 1 being higher. Ranks are used to prioritize units within each PRIORITY group. Ranking is initially calculated independently within each IND80/PRIORITY group. However the final ranks are calculated so that at any time during the

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[1] This partition of the industries (denoted IND80), created to allocate the sample, represents a finer partition of the industries than the level at which the data are typically released

collection period the progress toward achieving target coverage goals would occur uniformly across industry groups.

12.   CONTINUE_ON: The acceptable values are 0 and 1, with CONTINUE_ON=0 for any unit that will not be followed up by the regular follow-up staff to encourage response. In the current strategy CONTINUE_ON=0 is equivalent to PRIORITY=5. However it is planned that the score function will be used in the future to identify priority of units for editing, and units with *CONTINUE_ON*=0 will not be edited.

13.   The QFS score function is produced dynamically in production, and takes into account the up-to-date collection status (responded or not, need to be followed-up by special staff, et cetera) of sampled enterprises. A static version of the scores, prior to receiving collection feedback regarding the status of the sampled enterprises, is run once prior to the start of collection activities to test the BLAISE application. The dynamic version is run prior to each of the critical two weeks in which most of the follow-ups are completed. For simplicity the strategy for the score function will be described based on a static run. Differences for the QFS dynamic run will be noted at the end of this section.

14.   The score function developed for QFS was inspired by the score function used for Statistics Canada's Unified Enterprise Survey (Pursey, 2003). However, while the UES score function is defined based on total revenue only, the QFS score function takes into consideration both total revenue and total assets for most industries. These variables are both important for the survey and are not strongly related for many industry groups. Also the QFS MUST units need to be flagged within the score function as they need to receive special treatment.

15.   For the static version of the UES score function, the units within each stratum are sorted in descending order by weighted revenue (largest first), and a cumulative weighted revenue is calculated. The cumulative weighted revenue is divided by the total weighted revenue for that stratum to produce a measure of the cumulative percent of total revenue covered. There is a target coverage set for each stratum, and this is compared to the cumulative percent calculated for each unit. All the units whose cumulative percent revenue is below the target, as well as the unit that is needed to pass the target, are flagged for high priority. The units are also given ranks, ordered by descending weighted revenue.

16.   The UES score function is used as a building block in defining the strategy adopted for the QFS score function. To incorporate for the QFS score function the information from both total revenue and total assets, the following multiple-step process was used for identifying priorities and ranking.

17.   Step1: In each industry group, a target coverage goal was set for each of the two variables (total revenue and total assets). These are based on a study conducted in 2004. For each industry group the study analysed the volatility of the two variables on a quarterly basis. Industries were identified as being either of low, medium or high volatility. The target coverage was set higher for those industries with high volatility, and lower for those with lower volatility. No revenue targets are set for financial industries where revenue is not considered to be a relevant industry descriptor.

18.   Step 2: MUST units are put in PRIORITY=1. Out-of-scope[2] (OOS) units, as well as enterprises that have special collection arrangements or that need to be followed-up by special staff are flagged not to be scheduled in BLAISE for a follow-up (PRIORITY=5). All other units loaded into BLAISE are temporarily flagged to get called for a follow-up (PRIORITY=3).

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[2] OOS units occur mainly because at the time of conducting the survey the central business register at Statistics Canada has not been updated yet for a small number of enterprises known to be out-of-scope for the QFS.

Table 1.1: Example of a basic score function for UES: Target coverage = 70%.

Weighted Revenue	Cumulative Weighted Revenue	Cumulative Percent (Percent Covered)	High Priority	Rank
200	200	25.00%	**Yes**	1
100	300	37.50%	**Yes**	2
100	400	50.00%	**Yes**	3
100	500	62.50%	**Yes**	4
75	575	71.875%	**Yes**	5
75	650	81.25%	No	6
50	700	87.50%	No	7
50	750	93.75%	No	8
25	775	96.875%	No	9
25	800	100.00%	No	10

Table 1.2: Distribution of target coverage goals for QFS industry groups

Target Coverage	Coverage for Total Revenue (Number of Industry Groups)	Coverage for Total Assets (Number of Industry Groups)
60%	10	12
70%	23	26
80% or more	24	42
Not applicable	23	0
Total	80	80

19.   Step 3: A version of the UES score function method is used to identify ranking and high priority units within each industry group separately for total revenue and total assets. The enterprises within an industry group are sorted by PRIORITY and then by descending order of the weighted variable, to reflect the strategy adopted in Step 2. Out-of-scope units are not counted when deriving the cumulative totals and percentages.

Tables 1.3 and 1.4: Example of the rank and high priority calculations for separate variables in an IND80 group (Revenue target coverage = 80%, Assets target coverage=70%).
Note that a unit that would be considered a high priority for the separate variables will not necessarily be a high priority when the combination of ranks is investigated in the subsequent step. Units already flagged as not to be called for follow-up (PRIORITY=5) are not included in examples in this paper.

Unit Identifier	Priority	Weighted **Revenue**	Cumulative Weighted Revenue	Cumulative Percent Revenue	Prelim Revenue High Priority	Revenue_ Rank
Q022	1	20	20	22.99%	**Yes**	1
Q020	1	15	35	40.23%	**Yes**	2
Q011	3	10	45	51.72%	**Yes**	3
Q018	3	10	55	63.22%	**Yes**	4
Q004	3	7.5	62.5	71.84%	**Yes**	5
Q015	3	7	69.5	79.89%	**Yes**	6
Q009	3	6.5	76	87.36%	**Yes**	7
Q003	3	6	82	94.25%	No	8
Q016	3	3	85	97.70%	No	9
Q005	3	2	87	100.00%	No	10

Unit Identifier	Priority	Weighted **Assets**	Cumulative Weighted Assets	Cumulative Percent Assets	*Prelim* Assets High Priority	Assets _Rank
Q020	1	50	50	31.25%	**Yes**	1
Q022	1	6	56	35.00%	**Yes**	2
Q005	3	30	86	53.75%	**Yes**	3
Q018	3	20	106	66.25 %	**Yes**	4
Q004	3	20	126	78.75%	**Yes**	5
Q011	3	10	136	85.00%	No	6
Q016	3	10	146	91.25%	No	7
Q009	3	5	151	94.38%	No	8
Q003	3	5	156	97.50%	No	9
Q015	3	4	160	100.00%	No	10

20.   Step 4: Up to now, high priority units have been identified separately for total revenue and total assets within IND80/PRIORITY groups. In order to identify priority units across all IND80/PRIORITY groups, units are classified into one of the three CATEGORY[3] groups as defined below:

Tables 1.5: CATEGORY groupings within IND80/PRIORITY groups.

CATEGORY	For Non-Financial Industry Groups	For Financial Industry Groups
2	Units that are important to achieve the target coverage for both variables	Units that are important to achieve the target coverage for total assets
3	Units that are important to achieve the target coverage for only one variable	Not applicable
4	Units not needed to achieve any of the target coverages	Units not needed to achieve the target coverage for total assets

In production, all CATEGORY 2 units are followed-up before moving onto CATEGORY 3 units. Similarly, all CATEGORY 3 units are followed-up before moving onto CATEGORY 4 units (if time and resources permit).

21.   Once the ranking is identified for each variable, the REVENUE_RANK and ASSETS_RANK are added (SUM_RANK) for each unit. The units are then ordered by IND80/PRIORITY/CATEGORY/SUM_RANK/ASSETS_RANK. This new ordering is used to establish ranks within INDUSTRY/PRIORITY groupings.

22.   Step 5: The IND80/PRIORITY/CATEGORY groups are adjusted based on these new ranks. This is required because the ordering of enterprises within the priority groups has an impact on the determination of units needed to achieve the coverage target goals for each variable. This can only impact units that were previously classified as CATEGORY=3.

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[3] The temporary variable CATEGORY is not loaded into BLAISE.

Table 1.6: Example of classifying and ordering units in an IND80 group (based on the data in Tables 1.3 and 1.4 above).

Unit Identifier	PRIORITY	CATEGORY	REVENUE_ RANK	ASSETS_ RANK	SUM _RANK	NEW _RANK
Q020	1	2	2	1	3	1
Q022	1	2	1	2	3	2
Q018	3	2	4	4	8	1
Q004	3	2	5	5	10	2
Q011	3	3	3	6	9	3
Q005	3	3	10	3	13	4
Q009	3	3	7	8	15	5
Q015	3	3	6	10	16	6
Q016	3	4	9	7	16	7
Q003	3	4	8	9	17	8

Table 1.7: Example of adjusting the IND80/PRIORITY/CATEGORY groups (based on the data in Tables 1.3, 1.4 and 1.6 above). Recall that the revenue target is 80% and the assets target is 70%. *Units whose revenues and/or assets high priority has changed from the Prelim high priorities are underlined.*

Unit Identi- fier	Weighted Revenue	New Cum Percent Revenue	Weighted Assets	New Cum Percent Assets	New Revenue High Priority	New Assets High Priority	PRIO- RITY	CATE- GORY
Q020	15	17.24%	50	31.25%	**Yes**	**Yes**	1	2
Q022	20	40.23%	6	35.00%	**Yes**	**Yes**	1	2
Q018	10	51.72%	20	47.5%	**Yes**	**Yes**	3	2
Q004	7.5	60.34%	20	60.00%	**Yes**	**Yes**	3	2
Q011	10	71.84%	10	66.25%	**Yes**	<u>**Yes**</u>	<u>3</u>	<u>2</u>
Q005	2	74.14%	30	85.00%	<u>**Yes**</u>	**Yes**	<u>3</u>	<u>2</u>
Q009	6.5	81.61%	5	88.13%	**Yes**	No	3	3
Q015	7	89.66%	4	90.63%	<u>No</u>	No	3	4
Q016	3	93.10%	10	96.88%	No	No	3	4
Q003	6	100%	5	100%	No	No	3	4

23.   Step 6: BLAISE is set up so that, within a PRIORITY group, the collection staff will attempt to contact all units with a certain rank before going on to the next unit. For example, all non-responding units of rank 10 across the industries would be contacted before going on to rank 11. However, the various industries in the QFS have different numbers of sampled units, some fewer than 20 and others more than 200. Therefore, a proportional relationship among the rankings is preferred so that at any given time in the collection the percentage of each *IND80/CATEGORY* group to have been followed up will be similar. To respect this, the ranks are scaled so that the corresponding range within each IND80/PRIORITY/CATEGORY group is similar.

24.   The QFS score function calculates a different scale variable for the ranks within each *IND80/PRIORITY/CATEGORY* group. This is done by first identifying the highest number of units (maximum) in each *PRIORITY/CATEGORY* combination across all industry groups. The scale for each *IND80/PRIORITY/CATEGORY* group is then calculated by dividing this maximum by the number of units in the particular *IND80/PRIORITY/CATEGORY* group. The scale is multiplied by a constant (C=10) ensuring that the new ranks will meet the desirable properties described in Step 4 after rounding to integer values, as required by BLAISE. The final ranks within IND80/PRIORITY groups, with units ordered as defined in Step 5, are based on the cumulative sum of the scale variable.

Table 1.8: Example of calculating different scaling variables for each CATEGORY within an IND80/PRIORITY group (based on Tables 1.6 and 1.7 above, with the exception of the values for the maximum number of units across all industries for which hypothetical values are provided for this example).

PRIORITY	CATEGORY	Size (# Units) of this IND80/ PRIORITY/ CATEGORY	Largest (Max) # of Units in this PRIORITY/ CATEGORY	Scaling Variable where Scaling Constant=10
1	2	2	26	10x26/2=130.0
3	2	4	111	10x111/4=277.5
3	3	1	120	10x120/1=1200.0
3	4	3	121	10x121/3=403.33

Table 1.9: Example of calculating final ranks for different PRIORITY/CATEGORIES groups within an IND80 (based on Tables 1.6, 1.7 and 1.8 above).

PRIORITY	CATEGORY	Scaling Variable	Units	Scaled Rank	Final (rounded) Rank
1	2	130.0	Q020	=1**30**	130
			Q022	=130+130=2**60**	260
3	2	277.5	Q018	=**277.5**	278
			Q004	=277.5+277.5=**555**	555
			Q011	=555+277.5=**832.5**	833
			Q005	=832.5+277.5=**570**	1110
3	3	1200.0	Q009	=1110+1200.0=**2310.0**	2310
3	4	403.33	Q015	=2310+403.33 =2**713.33**	2713
			Q016	=2713.33+403.33 =**3116.67**	3117
			Q003	=3116.67+403.33 =**3520.0**	3520

25.   Step 7: When the score function was first implemented all enterprises with PRIORITY=3 and CATEGORY=4 were re-assigned to not be followed-up for non-response (PRIORITY=5). A strategy was established in 2005 to limit the number of units in PRIORITY=5 to 1000 units, including the special non-respondents and OOS pre-identified in Step 2 (excluding special collection arrangements). This now limits the number of re-assignments to be roughly between 500 and 600 enterprises. The enterprises reassigned to PRIORITY=5 are chosen among the largest ranks for enterprises that are not births for the current quarter and that have PRIORITY=3 and CATEGORY=4. A minimum number of units flagged for follow-up per industry group can be imposed at this point. The minimum number is currently arbitrarily set at 4.

26.   The strategy for the dynamic version of the scores, which takes into account the up-to-date collection status of sampled enterprise, mirrors the strategy for the static version described above. The first important difference is that target coverage goals are revised to exclude the coverage already achieved by respondents. The second difference is that cumulative totals, the numerator used to derive the cumulative percentage, are defined based on only those enterprises that should still be followed-up. This excludes respondents, out-of-scope units, and non-respondents that need to be followed-up by special staff. The denominator for the cumulative percentages that are compared to the revised target coverage

goals represents all sampled enterprises with the exception of out-of-scope units, as was the case for the static version.

III.   EVALUATING EFFICIENCY OF THE SCORE FUNCTION FOR QFS

27.   A formal evaluation is under way to determine the efficiency of the QFS score function with respect to the collection process and its impact on the data quality of QFS estimates. Results of this evaluation will be known by the fall of 2006.

28.   The results from this evaluation will need to be considered from the perspective that other important factors also have an impact on the collection methodology. The availability of dedicated and trained staff, the importance of establishing strong pre-contacts and a good rapport with important contributors, as well as specific economic factors that could be affecting the response behaviour of some of the industries, are examples of additional factors that could have a positive or negative effect on collection processes.

29.   An additional limitation for the evaluation will be that the score function has evolved since it was first implemented for the third quarter of 2004. The dynamic version of the scores was introduced for the fourth quarter of 2004, although it became fully operational only for the first quarter of 2005. Improvements regarding the identification of chronic non-respondents were made for the third quarter of 2005. Other small improvements to the methodology were made for the third quarter of 2005, and a new version is planned for the second or third quarter of 2006. This version will integrate a limit on the number of attempts[4] to contact the non-respondents and will have small improvements to the programs to comply with the methodology described in this document. Nevertheless the evaluation should provide some useful insights on the impact of the score function on the QFS.

30.   Even without the results from the formal evaluation, it is believed that the score function is fulfilling its role for the QFS. The collection staff believes that collection resources are spent more wisely by collecting information from the larger contributors in each industry.

IV.   FUTURE PLANS

31.   A project aiming to increase the QFS response rates was recently undertaken. One important improvement that has been proposed would be to rethink the management of follow-up activities. The current approach of concentrating the bulk of follow-up attempts in a short two-week window would be replaced by a progressive process that would devote dedicated staff for a longer period of time. Under this new approach the dynamic version of the score function would be produced more frequently. It has not been decided if the alternative methodology for the follow-up process would be done for the same cost, or if additional resources would be allocated, in which case an increased response rate would be achieved at a higher cost for collection. Also it should be noted that the released dates for QFS would not be changed, so the benefits of these changes on response rates might impact more on revisions or future quarters based on long term improvements of response rates.

32.   It is considered desirable that a limit be imposed in terms of the number of attempts to contact the non-respondents that can be made through the follow-up process, at least for smaller enterprises. A new procedure is currently being implemented to achieve this and will be in place for the second or third quarter of 2006.

33.   When the score function was developed it was assumed that the methodology would be extended to prioritize the editing process. However, the imaging technology used by the QFS currently does not

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[4] An attempt to contact a respondent is counted when an interviewer registers in BLAISE an effort to contact the enterprise.

allow synchronization between the bank of imaged questionnaires available and the set of enterprises identified by the editing scheduler. Given progress in the imaging technology, this extension will likely occur.

34.   As we are gaining experience with the strategy of prioritizing follow-up activities, some adjustments could be made in the future. For example, response rates of births tend to be lower than usual for the first few quarters after they join the QFS sample. Modifications are being considered for priorities and/or ranks of births in the score function to improve on this situation. The results of the evaluation study will also undoubtedly reveal additional issues that need to be addressed for future quarters.

V.   CONCLUSIONS

35.   A score function was first implemented for the QFS in 2004. The score function optimizes the follow-up of non-respondents by prioritizing them based on the relative importance of the businesses in each industry. Scores are produced multiple times for each quarter. These represent dynamic processes that integrate the up-to-date status of sampled enterprises in collection activities.

36.   The score function used for QFS is slightly more complex than a similar function developed for the UES. For most industries the score function takes into consideration both total revenue and total assets. It also prioritizes special treatments for extremely important enterprises.

37.   A formal evaluation is underway to determine the efficiency of the QFS score function with respect to the collection process and its impact on the data quality of estimates. Results of this evaluation will be known by the fall of 2006. A revised version of this paper, integrating key results from this study, will be made available at that time.

References

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