

Integration of the Electronic Questionnaire: Impact on the Collection Process and Results of the Survey of Employment, Payrolls and Hours

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Abstract

The Survey of Employment, Payrolls and Hours (SEPH) produces monthly estimates and determines the month-to-month changes for variables such as employment, earnings and hours at detailed industrial levels for Canada, the provinces and territories. In order to improve the efficiency of collection activities for this survey, an electronic questionnaire (EQ) was introduced in the fall of 2012. Given the timeframe allowed for this transition as well as the production calendar of the survey, a conversion strategy was developed for the integration of this new mode. The goal of the strategy was to ensure a good adaptation of the collection environment and also to allow the implementation of a plan of analysis that would evaluate the impact of this change on the results of the survey. This paper will give an overview of the conversion strategy, the different adjustments that were made during the transition period and the results of various evaluations that were conducted. For example, the impact of the integration of the EQ on the collection process, the response rate and the follow-up rate will be presented. In addition, the effect that this new collection mode has on the survey estimates will also be discussed. More specifically, the results of a randomized experiment that was conducted in order to determine the presence of a mode effect will be presented.

Key Words: electronic questionnaire, mode effect, collection strategies, business survey.

1. Introduction

In recent years, the use of an electronic questionnaire (EQ) has become more prevalent. Many surveys are looking to use this new mode of collection. In order to improve the efficiency of the collection for the Survey of Employment, Payrolls and Hours (SEPH), an electronic questionnaire was introduced in the fall of 2012. The integration of this new mode of collection to the entire sample was done over a period of eight months. Given the time frame, a conversion strategy was developed to facilitate the transition and allow the implementation of a plan of analysis that would evaluate the impact of this change on the results of the survey. This paper will give an overview of the conversion strategy as well as the results of the various evaluations that were conducted.

In section 2, a brief overview of the Survey of Employment, Payrolls and Hours is given. Section 3 discusses the integration of the electronic questionnaire and presents the conversion strategy. Results of the various evaluations that were conducted are presented in sections 4 and 5. More specifically, section 4 describes the impact of the integration of the EQ collection results such as the response rate and the follow-up rate while section 5 presents the results of the randomized experiment that was implemented in order to determine the presence of a mode effect. Finally, concluding remarks are provided in section 6.

2. Overview of SEPH

The principal objective of SEPH is to provide monthly data on earnings, employment, vacant positions and hours worked. The survey's target population consists of all businesses in Canada having at least one employee and thus having issued at least one payroll deduction remittance in the reference month. Businesses excluded from the survey

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are those primarily involved in agriculture, fishing and trapping, private household services, religious organizations, international and other extra-territorial public administration and military personnel of defence services.

SEPH estimates are produced, by detailed industry, at national, provincial and territorial levels using a combination of a census of administrative data and a monthly survey, which collects data from a stratified simple random sample of 15,000 businesses. Generally, sampled units follow a monthly rotating panel survey design where 1/12 of the sample is rotated every month. Sampled units enter the sample for a given rotation month and are then removed from the survey portion after 12 months, becoming ineligible for re-selection for one year. However, around 800 take-all units are permanently in the sample either because they represent a significant share of employment in their industry or because they are sufficiently different from other businesses in their industry that they can only be represented by themselves. Further information on the survey methodology, data collection and processing, and data quality of SEPH can be found in the survey's guide (Statistics Canada, 2014).

3. Introduction of the Electronic Questionnaire

In 2010, a corporate initiative began at Statistics Canada to introduce electronic reporting and web-based EQ as the principal collection mode for business surveys. Among the first surveys to use EQ to collect data were seven surveys belonging to the Unified Enterprise Statistics program (Karaganis *et al.* 2011). The shared experience of these initial EQ surveys helped to establish a standard, generic EQ that responds to the needs of various survey programs. Respondents to the EQ receive an email (or letter) introducing the survey and providing them with a link and secure access code that is used to log into the questionnaire.

SEPH was approached in the summer of 2010 to develop a collection strategy and timeline for introducing an EQ application to as many eligible businesses as possible. Among the discussions during this development stage was the importance of conducting studies to determine if any shifts in the estimates would occur as a result of a change in collection mode. In order to facilitate this, it was decided to introduce EQ in two phases. First, EQ was offered only to birth units that were entering the sample for its first month. Then, after studying these birth units over several months, the EQ application was offered to non-birth units that were already receiving a paper questionnaire.

A strategy to stagger the introduction of EQ to non-births during different collection months was designed to allow for an investigation of any effects that may exist due to the transition. Units in each rotation group considered for EQ were randomly divided into two treatment groups, with the transition of each treatment group done in separate collection months. The assignment to each treatment group accounted for equitable distribution by stratification variable (geography, industry and employment size).

4. EQ Results

4.1 Pre-contact

In the month prior to collection, birth units are contacted in order to inform them that they have been selected for SEPH and to confirm their contact information. With the introduction of EQ, the pre-contact phase was also used to determine whether they are eligible to receive the electronic questionnaire. During this pre-contact phase, approximately 1,200 birth units are contacted every month. Among these units, a small minority (~1%) have multiple payrolls, which the EQ application is not currently designed to handle. These units are thus ineligible to complete the survey using the electronic questionnaire.

At the end of the pre-contact phase, approximately 60% of birth units also have an email address on file. This email address was either provided by the respondent during the pre-contact phase or obtained from Statistics Canada's Business Register. Since an email address is required in order to receive the electronic questionnaire, only these units become eligible to complete the survey online. The other 40% of birth units without an email address will either receive a paper questionnaire by mail or be contacted by telephone. There are various reasons why these units do not have an email address on file. It may be because they simply do not have an email address or it may be because they refuse to provide one. Furthermore, there are a small percentage of units that interviewers are unable to successfully contact during the pre-contact period.

Among the birth units with an email address, approximately 94% successfully complete the pre-contact process. Among these units, about 25% refuse to complete the survey using the EQ application and prefer to receive a paper questionnaire by mail. Therefore, at the end of the pre-contact process, approximately 500 to 600 birth units are added to the EQ sample every month. The EQ sample is the list of units that will receive an email invitation to complete their survey questionnaire online during the collection month.

These results were fairly consistent throughout the EQ integration process. However, it is important to note that stronger efforts to convince birth units to use EQ have been made by the interviewers in recent months. This has had a positive impact on the numbers observed. Now, a year after the end of the EQ integration process, there are 75% of birth units that have an email address on file at the end of the pre-contact phase and only 10% of these units refuse to complete the survey using EQ.

4.2 Collection Results

The electronic questionnaire was first introduced with the November 2012 sample. Birth units joining the sample in this month were the first units offered this new mode of collection. In the months that followed, the electronic questionnaire continued to be made available to birth units joining the SEPH sample. Additionally, beginning with the March 2013 sample, units already in the sample were also offered the opportunity to complete the survey using this new mode of collection (more details about the transition of non-birth units to EQ are available in section 5). By June 2013, all units in the SEPH sample that were eligible to complete the survey using the electronic questionnaire had received an EQ offer.

This section will present various collection results that were observed during the transition of the SEPH sample to this new mode of collection. It will show how the take-up rate, response rate and failed edit follow-up rate of the EQ sample have evolved since the introduction of the electronic questionnaire in November 2012.

4.2.1 EQ Take-Up Rate

In the November 2012 sample, there were 1,247 birth units. Among these units, 607 were in the EQ sample. At the beginning of December, each of these units received an email invitation to complete their survey online. Among the 607 units in the EQ sample, only 60% used the EQ application to respond to the survey.

Throughout the transition process from paper to EQ, this take-up rate has progressively increased. At the end of the transition process, the take-up rate has stabilized and now, slightly more than 80% of units in the EQ sample (i.e., units that receive an email invitation to complete the survey online) utilize the EQ application to respond. Nevertheless, it should be noted that birth units continue to have a lower take-up rate (~75%) during their first month in sample. Units in the EQ sample who respond using an alternative mode of collection continue to receive an email invitation in subsequent months unless they request to receive a paper questionnaire or indicate their preference for a telephone interview. Therefore, some units begin to respond using the electronic questionnaire after they have been in the sample for a few months.

4.2.2 Response Rate

SEPH is a mandatory survey, therefore response rates of 88% to 92% are typically observed. However, as can be seen in Figure 4.2.2-1, the November 2012 EQ sample had a response rate of 71%. The response rate for other units in the November 2012 SEPH sample (the non-EQ sample) was 88%, indicating a difference of 17 percentage points with the EQ sample response rate. Part of this difference can be explained by the fact that the November 2012 EQ sample contained only birth units. Generally, birth units have a lower response rate than non-birth units in their first month of collection. In the past, this difference has been about 6 to 7 percentage points. Nevertheless, this still leaves an unexplained 10 percentage-point difference between the response rate for the EQ sample and the response rate for the non-EQ sample in November 2012.

The contact strategy had an effect on the low response rate observed in November 2012. After the initial email invitation, non-responding units in the EQ sample received up to three email reminders that were sent at one-week

intervals. Telephone follow-up for EQ non-respondents then began after the third email reminder, which was quite late during the collection month. For units not in the EQ sample, telephone follow-ups are conducted much earlier in the month as this is the only method used for non-response follow-up. As Table 4.2.2-1 indicates, non-respondents in the November 2012 EQ sample had fewer telephone contact attempts in comparison to other non-respondents. Although both groups had a similar number of contact attempts when considering both telephone and email reminders, a telephone follow-up may have a different impact on a non-respondent than an email reminder. Therefore, it was decided to increase the number of telephone contact attempts for units in the EQ sample.

Table 4.2.2-1
Average Number of Contact Attempts

	Average # of Contact Attempts (Telephone)	Average # of Contact Attempts (Telephone and Email)
EQ Sample Non-respondents	2.8	5.0
Other Non-respondents	5.7	5.7
Total	5.4	5.6

In fact, modifying the contact strategy so that telephone follow-up began earlier in the collection month, while maintaining the three email reminders, significantly improved the overall response rate observed for the EQ sample. For example, Figure 4.2.2-2 indicates the response rate for the May 2013 SEPH sample. At this time, the EQ sample had 7,200 units. The response rate observed for the May 2013 EQ sample was 91%, which is slightly higher than the response rate observed for the non-EQ sample (87%). Since modifying the contact strategy, these response rate results have been consistently observed every month.

Figure 4.2.2-1

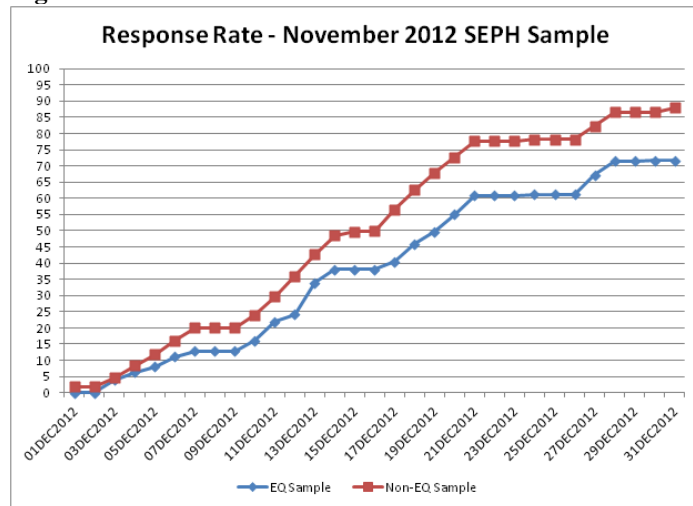
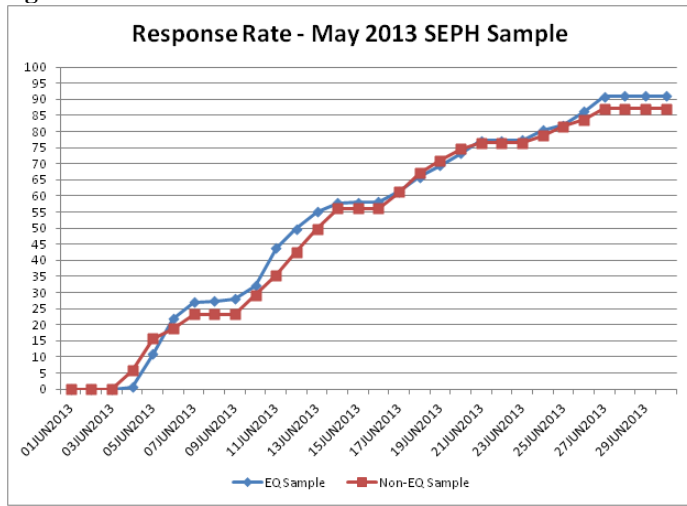


Figure 4.2.2-2



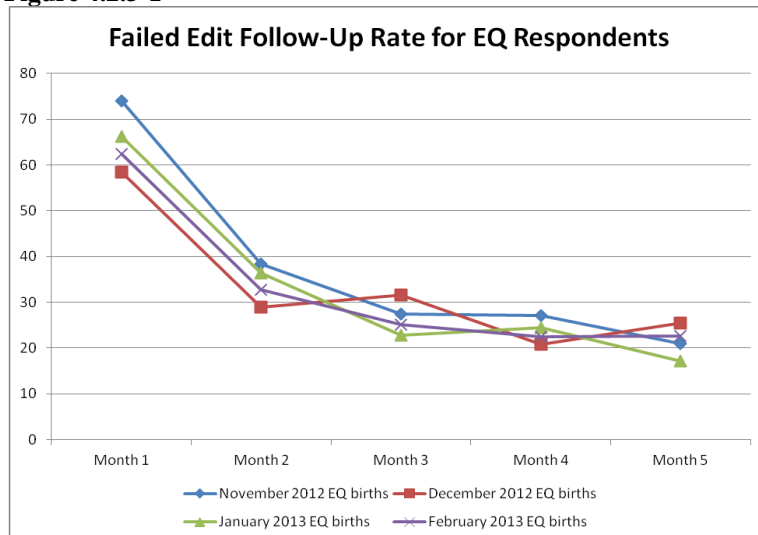
4.2.3 Failed Edit Follow-Up Rate

When a respondent fails a critical edit, an interviewer must follow up to verify the information provided. Before introducing the electronic questionnaire, self-respondents who completed a paper questionnaire had an average monthly failed edit follow-up rate of 35% to 40%.

With the introduction of the electronic questionnaire, it has been noticed that birth units who respond using the EQ application have a high failed edit follow-up rate during their first month in sample. The percentage of EQ birth units requiring follow-up for failed edits is often more than 60% during the first month of collection. However, as Figure 4.2.3-1 indicates, by their second month in collection, the failed edit follow-up rate for these units drops significantly and resembles the follow-up rate previously observed for paper self-respondents. Moreover, the rate of failed edit follow-up for EQ respondents continues to decrease the longer they remain in sample and stabilizes around 22% to 25%.

As the EQ sample increases, the birth units only represent a small percentage of the EQ sample. Therefore, although the birth units have a higher follow-up rate, EQ respondents have an overall lower failed edit follow-up rate than self-respondents completing a paper questionnaire. Hence, with the introduction of the electronic questionnaire, fewer interviewer follow-ups are required during collection.

Figure 4.2.3-1



5. Acceleration Process and Results

5.1 Acceleration Process

The introduction of EQ was done in a progressive manner. During the first four months of the EQ integration, the electronic questionnaire was only offered to birth units in the SEPH sample. This strategy facilitated the transition from paper to EQ and provided time to observe and respond to any issues arising from the introduction of this new mode of collection (e.g., timing of the telephone follow-up).

Continuing with this approach would have required an entire year to transition the SEPH sample to EQ. However, in order to ensure that this goal was met by June 2013 (8 months after the introduction of the electronic questionnaire), the transition process had to be accelerated by not only offering the electronic questionnaire to birth units but also to units already in the SEPH sample.

In order to maximize the efficiency of EQ transitions, only units where at least three months of collection remained were considered for the acceleration process. Moreover, since these units are already in sample, they are not included in the pre-contact phase, which is a process done only for birth units. Since an email address is required to receive the invitation to complete the survey online, only units in sample with an existing email address on the Statistics Canada Business Register were eligible to be transitioned to EQ during the acceleration process. Note that take-all units were excluded from the acceleration process given their importance to the sample. A special transition process was later put in place for these units.

Based on these criteria, only take-some units, with an email address, that were added to the SEPH sample from July 2012 (201207) to October 2012 (201210) were eligible for the acceleration process. These units, already in sample and selected to be converted to EQ, received a letter with their paper questionnaire in the last month of collection before switching to EQ. This letter informed them that in the following month, they would receive an email inviting them to complete their survey questionnaire online. This transition strategy was tested with a small non-probability sample of units from the December 2012 SEPH sample and gave good results.

The EQ acceleration process was done over a three-month period using the March, April and May 2013 samples. The units in the 201207 and 201208 rotation groups were part of a first randomized experiment. These units were randomly divided into a treatment group (which would receive the EQ in March 2013) and a control group (which would not receive an EQ until April or May 2013). A second similar randomized experiment was conducted using the units in the 201209 and 201210 rotation groups. The units were randomly divided into a treatment group (which would receive the EQ in April 2013) and a control group (which would not receive the EQ until May 2013).

The randomized experiments were designed in order to be able to test for differences between the treatment and control groups. Using the results from the March 2013 sample, units in the 201207 and 201208 rotation groups that were transitioned to EQ can be compared with the units from the same reference months that were not transitioned. A similar comparison can be done for units in the 201209 and 201210 rotation groups, using the results of the April 2013 sample. In what follows, only results for the March 2013 sample will be presented. However, similar results and conclusions were equally observed for the April 2013 sample.

5.2 Acceleration Results

The units to be accelerated in the March 2013 sample were selected using the February 2013 sample file. Based on this file, there were 1,505 units from the 201207 and 201208 rotation groups that were eligible for the EQ acceleration process. These units were randomly divided into two groups: the treatment group that would be transitioned in March 2013 (753 units) and the control group that would be later transitioned in April/May 2013 (752 units).

After accounting for out of scope units, units excluded from collection and non-respondents, there were 589 units that responded in the control group and 573 in the treatment group. Among the treatment group respondents, 2/3 used the EQ application to respond while the remaining responding units utilized an alternative mode of collection.

5.2.1 Collection Process Analysis

Not all units in the treatment group responded using EQ. This may affect comparisons between EQ respondents in the treatment group and non-EQ respondents in the control group since the selection mechanism of the EQ units is no longer completely random. Hence, in order to determine if there is a mode effect, we cannot simply use theoretical results for an experimental design embedded in a survey.

However, if all responding units in the treatment group (regardless of the mode used to respond) are compared with all responding units in the control group, then the theoretical results for an experimental design embedded in a survey can be used to test for differences in the collection processes of these two groups (van den Brakel and Renssen 2005). A significant difference between collection processes may indicate the presence of a mode effect.

The two main variables of interest for SEPH are average weekly earnings (AWE) and average weekly hours (AWH). These two ratio variables were used to determine if there were any significant differences between the collection processes. In order to test for differences between these variables for the treatment group and the control group, the software program X-Tool, which is part of the BLAISE package, was used.

Table 5.2.1-1 presents the estimates and standard errors calculated with X-Tool for AWE and AWH for both the treatment and control groups of the March 2013 sample. Based on the p-values, it can be concluded that there are no significant differences between the treatment group and the control group.

Table 5.2.1-1
Collection Process Analysis Results

	AWE		AWH	
	Estimate	Std Error	Estimate	Std Error
Control	822.90	37.87	31.86	0.62
Treatment	832.30	35.76	31.64	0.84
Difference	-9.40	52.09	0.22	1.05
	p-value = 0.857		p-value = 0.835	

5.2.2 Mode Effect Study

In order to determine if there is a mode effect, the EQ respondents in the treatment group can be compared with the respondents in the control group. However, any significant differences that are identified by simply comparing these two groups may not only be due to a mode effect. They may also be due to the fact that respondents in the treatment group who chose to use EQ as a response mode may have different characteristics than non-EQ respondents. The different characteristics of the units must be accounted for in order to better identify differences due to a mode effect. To do so, a propensity score analysis was utilized.

For control group respondents and EQ respondents in the treatment group, a logistic regression model was used to predict their probability of responding by EQ. The variables used in the model include geography, industry, structure of the enterprise, number and type of employees as well as paradata. As suggested by Zanutto (2006), the propensity score obtained from the logistic regression model was used to classify the units into five strata of equal size. By using the propensity score to create the five strata, it ensured that EQ respondents and non-EQ respondents had similar characteristics within a stratum. Therefore, EQ respondents and non-EQ respondents in a same stratum could be compared in order to determine the presence of a mode effect.

The overall mode effect was measured as a weighted average of the difference observed between EQ respondents in the treatment group and control group respondents, across all five strata. The overall mode effect, Δ , as well as its standard error, $\hat{s}(\Delta)$, were calculated using the following formulas:

$$\Delta = \sum_{k=1}^5 \left(\frac{\sum_{i \in S_k} w_i}{\sum_{k=1}^5 \sum_{i \in S_k} w_i} \right) \left(\frac{\sum_{i \in S_{k,control}} w_i y_i}{\sum_{i \in S_{k,control}} w_i x_i} - \frac{\sum_{i \in S_{k,treatment}} w_i y_i}{\sum_{i \in S_{k,treatment}} w_i x_i} \right)$$

$$\hat{\sigma}(\Delta) = \sqrt{\sum_{k=1}^5 \left(\frac{\sum_{i \in S_k} w_i}{\sum_{k=1}^5 \sum_{i \in S_k} w_i} \right)^2 (\hat{\sigma}_{k,control}^2 + \hat{\sigma}_{k,treatment}^2)}$$

where

S_k = units in propensity score stratum k ,

$S_{k,control}$ = units in propensity score stratum k and also in the control group,

$S_{k,treatment}$ = units in propensity score stratum k and in the treatment group and having responded using EQ,

y_i, x_i = numerator and denominator variables in the ratios of interest (AWE, AWH) for unit i ,

w_i = survey weight of unit i ,

$\hat{\sigma}_{k,control}^2$ = estimated variance of the estimated ratio for control group units in propensity score stratum k and

$\hat{\sigma}_{k,treatment}^2$ = estimated variance of the estimated ratio for treatment group units (having responded using EQ) in propensity score stratum k .

Table 5.2.2-1 provides the estimated treatment effect as well as its standard error for both AWE and AWH. Assuming a Normal distribution for the test statistic Δ , the results indicate that there is no significant effect between the control and treatment groups for both variables.

Table 5.2.2-1
Mode Effect Study Results

	AWE	AWH
Treatment Effect (Δ)	28.74	0.955
Standard Error	67.79	1.15
P-value	0.67	0.41

6. Concluding Remarks

Currently, approximately 2/3 of the SEPH sample receives an email invitation to complete their survey online. Among these units in the EQ sample, more than 80% of them use the EQ application to respond to the questionnaire.

By changing the timing of the telephone follow-up in the contact strategy, the response rates of the SEPH sample continue to remain similar to what was observed prior to the introduction of EQ. Units receiving an electronic questionnaire now have similar response rates to those receiving a paper questionnaire. However, the overall failed edit follow-up rate is lower for units responding with EQ, which results in fewer interviewer follow-ups during the collection month.

Finally, when comparing data received from the electronic questionnaires to data received using other modes of collection, the studies were not able to detect a significant mode effect for the two main variables of interest for the Survey of Employment, Payrolls and Hours.

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