

Considering Lessons Learned from a Bridge Study for a Business Survey

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Abstract

Bridge studies, where a sub-sample uses a new set of procedures, allow questionnaires to be tested in a production environment to possibly obtain statistically significant results and understand how changes to questionnaires may impact the data series (Love, 2014). While researchers often suggest conducting bridge studies, they cannot always do them due to the difficulty of maintaining the data series (Pascale, 2016).

In 2017, the National Agricultural Statistical Service (NASS) conducted a bridge study using a new version of the Agricultural Labor Survey Computer Assisted Telephone Interviewing (CATI) questionnaire for a sub-sample of respondents. The Agricultural Labor Survey is a biannual business survey sent to farms and ranches within the United States, with each iteration of the survey collecting information for two one-week reference periods. Cognitive testing conducted for the primary method of data collection, CATI, revealed that respondents had difficulty categorizing their workers according to one of the Standard Occupation Codes (SOC) used in the survey. Many of these businesses attempted to report employees under multiple categories to reflect the employees' multiple roles, not understanding that each worker was to only be reported under one category.

This finding, among others, served as an impetus to develop a revised CATI questionnaire for the survey. In this revised questionnaire, worker categories were renamed to better reflect the category and reordered to mitigate question order effects found during cognitive testing. Instructions and transitions were also added to improve questionnaire flow. To test the efficacy of this questionnaire, NASS fielded it during production with a sub-sample of respondents to understand how it would impact survey estimates while still maintaining the Agricultural Labor data series. This paper describes the results and lessons learned from conducting this bridge study which may inform and benefit other survey organizations planning bridge studies.

Key words: bridge study, data quality, CATI, questionnaire design

1. Introduction

A major challenge for survey researchers is how to handle a change in survey procedures which could cause a break in the data series. A potential break in an established data series could cause problems for data users, making it more difficult to compare data across the change (Pascale, 2016). Bridge studies are beneficial in that they allow the effects of changes made to a survey to be evaluated and documented (Love, 2014).

Testing a new or revised questionnaire by using a bridge study can be helpful in cases where the questionnaire is created as a remedy to respondents reporting incorrect answers, resulting in measurement error (Briefel et al., 2010; Rothbaum, 2017). In such cases, a bridge study can be used to test a new questionnaire that has been designed to mitigate measurement error in ways such as: simplifying questions, adding needed-detail to explain what data is being requested from the respondent, or changing the order of the questions (Pascale, 2001; 2016). This type of study is also helpful for testing updated questionnaires, which have been created to capture data that has been requested for the first time during the next survey iteration (Guthrie et al., 2002).

The effects of changes in survey procedures are a particular concern in the case of data series for official statistics, such as the Farm Labor Survey, conducted by the National Agricultural Statistics Service (NASS) in cooperation with the U.S. Department of Labor. When NASS decided to revise the questionnaire for the Farm Labor Survey due to observed measurement error, concerns were raised regarding whether changing the questionnaire would affect the data series. The Farm Labor Survey is an ongoing survey with trend data, which could be disrupted if a revised questionnaire was used.

To determine if changing the questionnaire would impact the data series, NASS launched a bridge study to test the revised questionnaire using a sub-sample in a production environment, comparing the results to the original questionnaire. By testing the revised questionnaire in production, it is possible to determine, using a statistical sample, if the data series will be impacted. If it is found that the data series is impacted, the bridge study will serve as a “bridge” between the two versions (Love, 2014; Pascale, 2016).

This paper describes the results and lessons learned from conducting a bridge study for the Farm Labor Survey, including recommendations for future survey iterations.

2. Background of Farm Labor Survey

The Farm Labor Survey provides the basis for employment and wage estimates for all workers directly hired by U.S. farms and ranches (excluding Alaska) for each of four quarterly reference weeks. The target population includes all farms with \$1,000 or more in annual sales value. The survey is fielded twice per year, collecting labor data for reference weeks in two quarters each time. In April, the survey collects data for reference weeks in January and April, and in October, the survey collects data for reference weeks in July and October. The typical sample size is about 14,000 (National Agricultural Statistics Service, 2018). In October 2017, the sample size was 12,921.

For the Farm Labor Survey, respondents are asked to classify their workers into four main categories based on what the workers were hired to do. These worker categories are adapted from the 2010 Standard Occupational Classification System, developed by the Bureau of Labor Statistics (National Agricultural Statistics Service, 2018). The categories used in the Farm Labor Survey are: (1) field workers, which include crop, nursery, and greenhouse workers; (2) livestock workers; (3) supervisors and managers, who are farm or ranch managers and first line supervisors; (4) and all other workers, which includes office staff, mechanics, and any other worker involved in agricultural work on the farm. Respondents are instructed to report each worker under only one category. After classifying their workers according to these categories, respondents are asked to report the number of hours worked and total wages paid for each worker category.

The quarterly and annual estimates derived from these data are published for the United States as a whole, each of 15 multi-state labor regions, and the single-state regions of California, Florida, and Hawaii. These estimates are used by government agencies, farm organizations, and farm labor employers to establish rates for farm workers, including temporary or seasonal foreign farm workers (National Agricultural Statistics Service, 2018).

2.1 Measurement Error in the Farm Labor Survey

The Farm Labor Survey team requested that survey methodologists conduct cognitive interviews with the Farm Labor questionnaire, as NASS staff had reported that respondents often incorrectly categorized their workers. In November 2016, twelve cognitive interviews were conducted using the computer assisted telephone interviewing (CATI) questionnaire, as the majority of Farm Labor Survey responses are collected via CATI. Cognitive interviewers read the CATI questionnaire to respondents, mimicking a telephone interview, before administering a series of retrospective probes to judge the respondents' understanding of the questions, and willingness and ability to provide the information requested.

In the original CATI questionnaire, workers are listed in the following order:

- Field workers
- Livestock workers
- Supervisors/managers
- Other workers

In the original questionnaire, respondents who report having workers during the reference period are read these categories and asked, "What type of work were they hired to do?" Respondents are then allowed to answer for a category that they felt applied to their workers (Figure 1). After reporting the number of workers under that worker category, total hours worked, and total wages paid for the reference week, respondents are asked if any other workers worked during the reference week. Those who answered "yes" can report another category of workers. This continues until respondents reported that they had no more workers working during the reference week.

This round of testing showed that respondents had many difficulties answering the survey questions. In particular, many respondents had difficulty reporting their employees according to the categories provided in the questionnaire. Question order bias frequently occurred, as the order of the four categories influenced how respondents categorized their workers, with the earlier listed categories being more frequently selected. This is a common problem in survey research, in which "items presented earlier in a list are likely to be subjected to deeper cognitive processing" (Krosnick, 1987).

Many respondents reported that they do not conceptualize their workers according to the classification used in the survey, making it difficult to provide the data requested. Respondents explained that farm workers often do many jobs on the farm, and do not fall into the types of categories in the Farm Labor questionnaire. Many respondents did not understand that each employee could only be reported under one category. These respondents would attempt to report their employees under multiple categories, to reflect the multiple responsibilities the employees had during the reference week.

The screenshot shows a Windows application window titled "Agricultural Labor". The menu bar includes "File", "Forms", "Answer", "Navigate", and "Help". The toolbar contains icons for zoom, search, and file operations. The top status bar displays "AGRLB171000 Appointment NonResponse ELMComments OutsideAppointment". The main content area contains instructions and definitions for worker categories:

For the PAID WORKERS, I would like to record the number of workers, hours worked and the gross wages paid that week. Let's separate the workers by the main type of work they were hired to do.

Report each worker only once. For workers that fit into multiple categories, report those workers under ONE CATEGORY that best describes the type of work they were HIRED TO DO

[Explain the type of worker groups.]

FIELD WORKERS: jack-of-all trades and machinery operators on crop farms, fruit or vegetable pickers, greenhouse or nursery workers, hay balers and haulers, etc.

LIVESTOCK WORKERS: jack-of-all trades and machinery operators on livestock or poultry operations, workers hired to fix fences, tend animals, milk cows, gather eggs, etc.

SUPERVISOR/MANAGER: hired managers, range foremen, crew leaders, etc.

OTHER WORKERS: office workers, bookkeepers, pilots, Pesticide applicators, etc.

Below the definitions, there is a section labeled "1. Enter 1 to continue." followed by a large empty text area for input. At the bottom, the status bar shows "12:16 AM 1100145160 1 1 Modified Dirty Hired1New.Lead_Pd AGRLB171000 58/113".

Figure 1: Original CATI questionnaire screen which introduces the worker categories.

Many respondents reported all of their workers as field workers, explaining that this category seemed appropriate, as it was listed first and had a very generic name. Some respondents commented that they reported all workers in this category because their work takes place in fields. However, many of these employees would have been more appropriately placed in one of the other three categories. One observed issue was the misreporting of supervisors as field workers. As supervisors often do manual labor alongside their supervisory duties, some respondents mistakenly reported these supervisors as field workers because their jobs fit the description of a field worker in addition to that of a supervisor (Sloan, 2016).

Based on these findings, survey methodologists revised the Farm Labor CATI questionnaire, and conducted another round of cognitive interviews with five respondents. In general, the respondents were better able to understand the task of allocating their employees to each category. With some additional changes from this round of cognitive testing, survey methodologists developed the CATI Bridge Questionnaire (Sloan, 2017).

2.2 Revised Farm Labor CATI Questionnaire

In October 2017, this revised questionnaire was set to be tested. The bridge questionnaire renamed the generic sounding field worker category to crop, nursery, and greenhouse worker to better describe the category. In addition, the labor categories were reordered to list supervisors first (previously third) and the new field worker category third (previously first). The categories were reordered to:

- Supervisors
- Livestock workers
- Crop, nursery, and greenhouse workers
- All other workers

Questions were also added to the beginning of each reference period, asking for the total number of workers paid during the reference week (Figure 2). The total number of

workers was then referenced in subsequent questions that asked respondents to classify their workers. If the total number of workers reported as supervisors, livestock workers, crop, nursery, and greenhouse workers, and all other workers did not add up to the total overall number of workers reported, an error would appear, and the interviewer would ask the respondent to make corrections.

The screenshot shows a software interface titled "Agricultural Labor". The menu bar includes "Forms", "Answer", "Navigate", and "Help". Below the menu is a toolbar with various icons. A tab bar at the top has tabs for "AGRLB171000", "Appointment", "NonResponse", "ELMOComments", and "OutsideAppointment". The main content area contains the following text:

How many employees did this operation have on the payroll to do agricultural work
the week of **Sunday, October 8th THROUGH Saturday, October 14th?**

Include part-time workers, paid family members and hired managers.
Only report hired workers that were directly paid by the farm operation.

If your payroll records do not begin on a Sunday, report using the pay week that includes Thursday, October 12th.

Agricultural work includes any activity directly related to the production of agricultural products.

Agricultural work also includes the maintenance of buildings and machinery, bookkeeping, and supervision of employees if these activities are directly related to the production of agricultural products

Figure 2: The bridge study questionnaire asking for the total number of employees during the October reference week. Purple text is optional text that the interviewer can read if needed.

3. Study Methodology

The bridge study was conducted via CATI during the October 2017 data collection cycle. All other modes, (paper, web, and personal enumeration), were administered with the original instruments for those modes. While the majority of CATI respondents received the original questionnaire, a sub-sample of CATI respondents received the bridge questionnaire, allowing us to investigate the effects (if any) that using the revised CATI questionnaire would have on the Farm Labor estimates.

3.1 Bridge Study Sub-Sample

Bridge studies can use a randomly assigned sample (Guenther and Perloff, 1990; Pascale, 2016), to administer the bridge version of the questionnaire (Briefel et al., 2010; Rothbaum, 2017) to a sub-sample of respondents. For this study, a sub-sample of the 2017 October Farm Labor CATI respondents was chosen to receive the bridge questionnaire, while the remainder of the sample would receive the original questionnaire. Respondents who had not responded via paper or web would be contacted via CATI, and would complete either the original or bridge version of the questionnaire depending on which sample they were in. The sub-sample selected to receive the bridge questionnaire (Table 1) was selected from two of NASS's geographical regions: the Southern and Northwest Regions. These two regions were selected to participate in the bridge study because they have similar types of operations. They are comparable to other regions when looking at historical Farm Labor Survey response rates. Both the Southern

and Northwest Regions also had a sample receive the original questionnaire. All other NASS Regions only received the original questionnaire.

Table 1: Sub-Sample Selected to Receive Bridge Questionnaire

<i>Regional Field Office</i>	<i>State</i>	<i>Sample Size (n=)</i>
Southern	Alabama	139
Southern	Florida	241
Southern	Georgia	174
Southern	South Carolina	119
	Total=	673
Northwest	Idaho	78
Northwest	Oregon	121
Northwest	Washington	125
	Total=	324

A systematic random sample was used to pull the bridge study sub-sample. Records marked as part of this sub-sample would receive the bridge questionnaire if they completed the survey via CATI.

3.2 Data Collection Procedures

Since the bridge study was only being administered in CATI, the Southern and Northwest regional field office staff were instructed to follow normal data collection procedures with all other survey modes. Paper and web responses were collected following normal data collection procedures.

Interviewers in the Southern and Northwest regional field offices administered both the bridge and original versions of the CATI questionnaire. The interviewers were instructed to follow whichever CATI questionnaire appeared on their screens for each call, and were not informed which CATI questionnaire they would be administering until they began the interview. CATI data collection was conducted from October 16th-November 3rd, 2017.

3.3 Research Hypotheses

For this study, we developed two hypotheses concerning how estimates may be affected by using a revised CATI questionnaire to collect the farm labor data.

3.3.1 Hypothesis 1

H₁: Respondents will report more workers in the Supervisor, and Other Worker categories in the revised CATI questionnaire (referred to as the bridge questionnaire) than what is reported in the original CATI questionnaire (referred to as the original questionnaire).

H₀: There will be no difference between the number of respondents reporting each worker category between the two versions of CATI questionnaires.

Since the field worker category was renamed to sound less generic from the respondents' perspective and moved from being listed first to being listed third in the bridge questionnaire, we expected more of supervisors and other workers would be reported in the bridge version.

For this analysis, we created binomial variables for each category. Responses would be coded as 0 if the respondent reported no worker for that category, and 1 if the respondent reported a worker for that category. We then compared the data from the 2017 Bridge CATI and the 2017 Original CATI.

3.3.2 Hypothesis 2

H_2 : Estimates will increase for the number of workers reported in the Supervisor, and Other worker categories in the bridge questionnaire when compared to the original questionnaire.

H_0 : There will be no difference between the estimated numbers of workers reported in the worker categories between the two versions of the CATI questionnaires.

To examine this hypothesis, we conducted a comparison that only included bridge study regions (Southern and Northwest Regions), but due to small sample sizes, we had to extend our comparison to other regions, none of which had a sub-sample that received the bridge questionnaire.

4. Results

Analyses were conducted to address the two research hypotheses. Separate analyses were conducted for each reference period, the week of October 12th, 2017, and the week of July 12th, 2017, using unweighted edited data.

To maximize response rates, the regional field offices sent much of the sample not marked for the bridge study directly from paper to in-person field interviews, skipping CATI. While this maximized response rates, it resulted in a low original CATI sample size for comparison as shown in Table 2.

Table 2: Sample Size (Southern and Northwest Regions Only)

<i>Questionnaire Version</i>	<i>Sample Size (n=)</i>
Bridge CATI	110
Original CATI	25

Due to the small sample size, the analysis was conducted using a larger original CATI sample (Table 3) which included additional regions (Delta, Mountain, Upper Midwest, Southern Plains, and Great Lakes) administering only the non-bridge questionnaire.

Table 3: Sample Size (Southern, Northwest, Delta, Mountain, Upper Midwest, Southern Plains, and Great Lakes Regions)

<i>Questionnaire Version</i>	<i>Sample Size (n=)</i>
Bridge CATI	110
Original CATI	357

4.1 Hypothesis 1

Table 4 shows the comparisons that were conducted for hypothesis 1 for the October reference period. This table shows a significant difference between the number of respondents reporting having “supervisor workers” and “other workers” in the October reference period, but not in the number reporting “livestock workers.” Statistical significance at the <.001 level was observed for reported supervisor workers and other workers between the bridge and original questionnaires.

Table 4: Workers Reported by Questionnaire Version (October)

<i>Worker Category</i>	<i>Questionnaire Version</i>	<i>0 Workers Reported (%)</i>	<i>1 or More Workers Reported (%)</i>	<i>Chi-Square p-value</i>
Field Workers	Bridge CATI 2017	42 (38.2%)	68 (61.8%)	
Field Workers	Original CATI 2017	161 (45.1%)	196 (54.9%)	0.20
Livestock Workers	Bridge CATI 2017	70 (63.6%)	40 (36.4%)	
Livestock Workers	Original CATI 2017	191 (53.5%)	166 (46.5%)	0.06
Supervisor Workers	Bridge CATI 2017	70 (63.5%)	40 (36.6%)	
Supervisor Workers	Original CATI 2017	323 (90.5%)	34 (9.5%)	0.00*
Other Workers	Bridge CATI 2017	84 (76.4%)	26 (23.6%)	
Other Workers	Original CATI 2017	336 (94.1%)	21 (5.9%)	0.00*

* Significant at the .05 level.

Table 5 shows the same comparisons for the July reference period. The same comparisons found to be statistically significant for the October reference period were also found for the July reference period.

There wasn't a statistically significant difference between the number of respondents reporting field or livestock workers between the two versions of CATI questionnaires in either reference period.

Table 5: Workers Reported by Questionnaire Version (July)

<i>Worker Category</i>	<i>Questionnaire Version</i>	<i>0 Workers Reported (%)</i>	<i>1 or More Workers Reported (%)</i>	<i>Chi-Square p-value</i>
Field Workers	Bridge CATI 2017	43 (44.3%)	54 (55.7%)	
Field Workers	Original CATI 2017	133 (41.0%)	191 (59%)	0.57
Livestock Workers	Bridge CATI 2017	57 (58.8%)	40 (41.2%)	
Livestock Workers	Original CATI 2017	189 (58.3%)	135 (41.7%)	0.94
Supervisor Workers	Bridge CATI 2017	67 (69.1%)	30 (30.9%)	
Supervisor Workers	Original CATI 2017	289 (89.2%)	35 (10.8%)	0.00*
Other Workers	Bridge CATI 2017	82 (84.4%)	15 (15.6%)	
Other Workers	Original CATI 2017	306 (94.4%)	18 (5.6%)	0.00*

* Significant at the .05 level.

We are able to reject the null hypothesis. There is evidence that more supervisors and other workers are reported in the bridge version than in the original questionnaire.

4.2 Hypothesis 2

Table 6 shows the comparisons that were conducted for hypothesis 2 for the October reference period. To evaluate the differences between the estimated numbers of workers reported in the job categories between the two versions of the CATI questionnaires, we computed several descriptive statistics that provide measures of central tendency and skewness.

As mentioned earlier, the sample size of the 2017 Original CATI group was small so we expanded the analysis to include other regions that only administered the non-bridge questionnaire. Because we used this expanded original CATI sample, differences in the number of workers reported using the bridge and non-bridge version may be due to the demographic differences between the farming operations. The regions differ on characteristics such as farm types, operation sizes, and commodities produced, which can affect the number and types of workers working during the reference period. Therefore, this analysis remained exploratory for this study, and does not fully address the hypothesis.

Table 6: Number of Workers Reported by Questionnaire Version (October)

<i>Worker Category</i>	<i>Questionnaire Version</i>	<i>N</i>	<i>Mean</i>	<i>Median</i>	<i>Max</i>
Field Workers	Bridge CATI	110	14.17	2	477
Field Workers	2017 Original CATI	357	4.46	1	215
Livestock Workers	Bridge CATI	110	1.9	0	45
Livestock Workers	2017 Original CATI	357	2.47	0	200
Supervisor Workers	Bridge CATI	110	1.32	0	31
Supervisor Workers	2017 Original CATI	357	0.2	0	6
Other Workers	Bridge CATI	110	1.09	0	30
Other Workers	2017 Original CATI	357	0.1	0	4

Table 6 shows that the number of field workers reported has gone up in the bridge version, as compared to the original version. This is unexpected and contrary to our hypothesis, as we would have expected a lower number of field workers in the bridge version, due to the order of worker categories being changed to de-emphasize the field worker category. However, the generic field worker category was renamed to crop, nursery, or greenhouse worker in the bridge version which could have resulted in more workers being reported, particularly for nursery and greenhouse operations. This finding may also have been due to outliers from large operations.

These results are inconclusive. Since we were not able to conduct statistical analysis due to the small number of original CATI records, it is impossible to accept or reject the null hypothesis using these comparisons.

5. Conclusions

There is some evidence to suggest that changing the order of the worker categories may have resulted in more respondents reporting workers in the “supervisor” and “other” categories. However, there is inconclusive evidence on how the bridge study questionnaire impacted the estimates.

5.1 Recommendations for Farm Labor Questionnaire

Since there is some evidence to suggest that more respondents report “supervisor” and “other” workers in the bridge questionnaire, we recommended using the bridge questionnaire category order and category names for the next iteration of the Farm Labor Survey:

- Managers/Supervisors

- Livestock Workers
- Crop, Nursery, and Greenhouse Workers
- Other Workers

Where applicable, we recommended applying these changes to the other survey modes. We do not expect these changes to have a major impact on the data series.

5.2 Lessons Learned

When conducting this bridge study, we learned that we needed to account for competing priorities between the research group, whose goal was to test the new questionnaire, and the data collection team, whose goal was to maximize response rates. To maximize response rates, the data collection centers sent many cases to field interviews, by-passing CATI data collection. Due to this issue, we were not able to get a large enough sample size to conduct adequate statistical analysis on our second hypothesis.

We found that documenting all stages of the bridge study methodology was extremely helpful. We kept documentation of the sampling plan, hypotheses, and data analysis plan, routinely communicating with Farm Labor Team members to implement the study.

5.2.1 Study Limitations

As previously noted, due to the small sample size of respondents within the Southern and Northwest Regions who received an original CATI questionnaire, we did not conduct significance testing and therefore did not fully address our second hypothesis. For this study, we were also unable to split telephone interviewers into two groups so that each would administer only one version (i.e., bridge and non-bridge) of the questionnaire. As a result, CATI interviewers administered both the bridge and non-bridge versions of the questionnaire, which could confound the results.

5.2.2 Future Research

For future bridge studies, we recommend increasing the sample size of both the bridge and non-bridge groups. This will help to prevent the problems that occurred in this bridge study due to competing priorities between the research group and the data collection group.

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