Using Call Records to Understand Response in Panel Surveys

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Abstract

Panel surveys rely on repeated survey responses. Attrition may bias estimates, so identifying sampled units with a higher propensity to attrit may reduce bias. The literature suggests that call records from previous contacts are useful in identifying households inclined to attrit. In 2002, the U.S. Census Bureau developed an automated system to collect call record data after each contact attempt (the Contact History Instrument, or CHI).

This paper examines the utility of feeding forward call history records to interviewers and whether contact history paradata can predict which cases will attrit from a panel survey. First, we compare refusal and noncontact rates for cases with access to previous quarter case history data to those without it. We also predict survey attrition using logistic regression models. This analysis first explores whether core paradata predicts attrition, then looks at including qualitative data in the models (concerns expressed by sampled units at the previous wave).

Keywords: attrition, nonresponse bias, noncontact, paradata, panel data

1. Background

Panel survey data is a rich source of information because it allows researchers to observe changes over time. This type of analysis is possible because data are collected from the same individuals at multiple points in time. If sampled units respond initially but not at follow-up survey requests, the resulting sample attrition may complicate analysis. Biased estimates result when attrition is correlated with a characteristic of interest. When this bias occurs, representativeness of the sample to the population is degraded and results may not be generalizable (Menard, 2002).

To measure the impact of panel survey attrition, analysts can look to data available from previous interviews as well as paradata, or information maintained about the data collection process. At a minimum, this paradata includes the number of contact attempts (call records or contact histories) made to an individual case and the outcome of each attempt (e.g., no contact, refusal, scheduled callback, completed interview, etc.).

When paradata is collected for all contacts and contact attempts, analysts have information about nonrespondents as well as respondents. Recently, researchers have documented the trend of incorporating different types of data collection information into nonresponse analysis. For instance, Zabel's analysis (1998) of attrition in the Panel Survey of Income Dynamics (PSID) and the Survey of Income and Program Participation (SIPP) examined the impact of the length of the interview, the mode, and whether the interviewer changed from wave to wave. Zabel determined that these survey design features are correlated with attrition.

Another example of unique paradata comes from a study on the sensitive topic of sexual behavior, where interviewers were asked to record a measure of respondent embarrassment (Copas and Farewell, 1998). This was a successful way of evaluating the role that sensitive questions have on nonresponse, as this measure was associated with attrition.

Identifying characteristics associated with attrition has several benefits. First, this type of information can be used to assist during data collection by identifying cases that are at a higher risk of attriting a survey. For example, knowing that high item nonresponse and number of contact attempts are associated with attrition (Bates and Henly, 2005; Zabel, 1998), survey managers might take special precautions for cases with a large number of "don't know" responses or households that were difficult to contact in past rounds of data collection. Specialized techniques could be implemented in the earliest contact attempts. Because refusal aversion training has been shown to increase participation (Mayer and O'Brien, 2001), trained interviewers could be dispatched to these potentially problematic households.

1.1 The Contact History Instrument

A contact history is a record of contacts and contact attempts for an individual sampled unit. For mail surveys, this may include the number of pre-notice letters, questionnaires, and reminder notices sent, as well as the outcome of each attempt (response, refusal, or undeliverable as addressed). For phone surveys, a contact history would include the dates and times of all calls made, the person with whom contact was made at each attempt, and the outcome of each call. Personal

visit survey contact histories might include the date and time of each visit, whether contact was made, whether any informational materials were distributed or whether any refusal conversion techniques were implemented, and the outcome of each attempt.

The Contact History Instrument (CHI) was developed at the U.S. Census Bureau as a method for documenting and quantifying the case histories from computer-assisted personal interview (CAPI) surveys. The CHI (pronounced 'khi', as the Greek letter) is a separate survey instrument, programmed in Blaise. When an interviewer makes or attempts to make contact with a household, he must launch the CHI instrument and answer a series of questions about that contact attempt, including:

- Time and date of contact attempt
- Mode of contact attempt
- Whether outcome of attempt was noncontact or contact (with a person in the sampled household or another person)
- If a successful contact, whether it resulted in a complete interview, partial interview, or whether the interviewer was unable to conduct the survey
- The types of concerns or reluctance the sample person expressed
- The strategies the interviewer used to try to solicit response
- If a noncontact, whether no one was home, the interviewer had contact with any neighbors, or it was a busy signal when dialed, etc.
- If the interviewer drove by the unit, the time of day of the drive-bys
- Additional items about moved units and language problems

The primary function of the CHI instrument is to provide summary information on a case for interviewers to use during repeat contact attempts with sampled households. Key pieces of information are captured each time the interviewer attempts a contact. With CHI, an interviewer can open a case and see the dates and times of previous contact attempts, the outcomes of those attempts, and whether any informational materials were distributed on previous attempts. This can be useful for both one-time, cross-sectional surveys and for longitudinal surveys. CHI is standardized and is designed to be more efficient than the previous system of using case notes.

In this paper, we address two specific questions using contact history paradata. First, did making previous wave CHI data available to interviewers improve data collection efforts? Second, can we use CHI data from a previous wave of a survey to identify and predict those likely to attrit in subsequent waves?

2. Data

The Consumer Expenditure Survey is the main source of information about consumer habits in the U.S. The Census Bureau collects these data for the Bureau of Labor Statistics. In this survey, households, or consumer units, are selected from a first stage sample of counties. The survey program consists of two parts: a diary and an interview. Each consumer unit receives either a diary for which they record the household expenses for the past two weeks, or an interview that is repeated every three months for a total of five interviews (waves). Interviews are usually conducted in person. However, after the initial wave, follow-ups may be done by phone. This is a rotating panel design; as such, new consumer units are added into the sample each quarter. The following analysis focuses on the Consumer Expenditure Quarterly Interview (CEQ).

Like other government-sponsored household surveys, response rates to the CEQ have been declining (Atrostic et al, 2001). In 1990, the initial (wave 1) response rate was around 88% for the CEQ. Over the next nine years the response rate decreased, ending the decade at about 82%. By 2004, that rate decreased by another 5% to 77% (Bates and Stoner, 2005).

The central question in our analysis is whether access to contact histories improves interviewer efficiency in a panel survey where repeated contacts are made. If properly collected and used, CHI data should result in fewer contacts needed to obtain a response, higher response rates, and lower refusal and noncontact rates. We address these questions using CHI data from two quarters of the 2005 CEQ covering call records from approximately 25,000 households.

2.1 Limitations of the Data

It is important to discuss some limitations of the CHI data. First, our data reflect the first six months that CHI was used in the CEQ and therefore most interviewers were using the CHI for the first time. Because the tool was so new to the survey, we urge caution when making inferences. A replication of the analysis in subsequent quarters may reveal different results as interviewers gain experience with this tool.

It is also important to note that CHI data are subjective to some degree. Interviewers are instructed to record the types of concerns, reluctance, and behaviors they

encounter at every contact. Some interviewers are inclined to perform this task with regularity, while others may occasionally skip an entry or may fail to select all categories that reflect a sample person's reluctance.

Information recorded in the CHI could reflect contact with different sample unit members. For example, on the initial visit the interviewer could make contact with the wife of a married couple, but on subsequent visits make contact with the husband. Each CHI entry will reflect the reluctance/concerns/behaviors of the particular person (or persons) with whom the interviewer interacts, but the CHI does not have an indicator to link a CHI record with a particular sample unit member. This is not so much a concern when the unit of the analysis is the household and not an individual person, as in the CEQ.

For some of the analysis, we report whether certain behaviors, concerns, or reluctance were recorded (yes or no). To simplify the analysis, we report whether a particular concern was reported during at least one contact. This suppresses some of the detail of the CHI data because in some cases, a particular concern was voiced multiple times over multiple contacts.

CHI data were not collected for every single case studied during the six-month period. There were a total of 26,287 sample cases assigned during the period studied but CHI data were collected for only 25,029 households. Consequently, 4.8 percent of cases are not represented in our analysis. The lack of CHI data most likely resulted from either laptop malfunctions or, more likely, from interviewers purposely bypassing the CHI instrument.

Finally, to assess the efficacy of feeding forward previous wave contact histories, we compared cases that had previous wave data to those that did not. However, there was no controlled experiment whereby a random number of cases had the condition while others did not. Instead, we evaluated by comparing wave-pairs before and after the CHI was introduced. This meant making similar wave-pair sequence comparisons between pairs occurring in different calendar months. For example, we compared final outcomes between wave 2 cases in quarter 2 to wave 2 cases in quarter 3. The former did not have data fed forward while the latter cases did. However, while the time-in-sample (wave number) was the same for both, the field period was not. Quarter 2 cases occurred in April through June while quarter 3 cases were conducted in July through September. We are assuming these wave-pair comparisons are still valid despite the calendar differences.

3. Results
3.1 Impact of Previous Wave Contact Histories

The first time interviewers had previous wave CHI data available was in quarter 3. For each household previously in sample, an interviewer could review the data to see the number of contact attempts for the first wave interview, the outcome of each attempt, the time of day contact was made, which time periods resulted in a successful contact, and any concerns expressed in the previous interview.

Because interviewers with previous wave contact data had information regarding the time of day/day of week that was successful previously, we expected to find lower attrition rates and fewer contacts required for cases where CHI data had been fed forward. The interviewer could also come equipped with some materials or prepared statements knowing the types of concerns expressed at the previous interview.

To make direct comparisons, we have restricted our analysis to households where the first wave resulted in an interview (unless otherwise noted). We will compare outcomes for the second wave by whether CHI data was available or not. As previously stated, this will not compare the same households over time, but rather the same types of households at the same time in the CEQ sample. In Table 1, the first column shows the final outcomes at wave 2 for cases *without* previous wave CHI data available. The second column shows wave 2 outcomes where CHI data from the first wave *was* available. The base for this table is cases interviewed in wave 1.

Table 1 suggests that the availability of CHI data had no impact on attrition at wave 2. Noncontact and refusal rates are almost identical whether or not CHI data were available for reference. This does not offer support for our hypotheses that a case's contact history record from previous interviews improves response rates when available in a panel study.

We can speculate why this information had no impact. It could be that interviewers have not yet mastered this tool for this particular purpose. Since this was the first opportunity to utilize previous wave CHI data in a panel survey, interviewers may need more experience with CHI data. When the interviewers themselves were surveyed about their initial experiences using CHI, we found that only 20% use previous wave CHI data all the time or often. Another 20% indicated that they only refer to CHI data if the case has been reassigned to them. About 15% of interviewers said that they rarely or never use CHI data. Interviewers may have come to rely so heavily on their case notes

that they do not yet see the use of also referring to CHI.

Additionally, perhaps CHI is not as helpful when the previous wave resulted in a completed interview. Previous wave CHI data may be more useful to interviewers when the previous wave resulted in a refusal or other noninterview.

We next explore the wave 2 outcomes of wave 1 non-interviews. In CEQ, non-interviews stay in sample and are reattempted at all subsequent waves. Only ineligible cases, such as demolished buildings, are dropped between waves. The availability of CHI data may have had more of an impact on outcomes of these households. With this information available, an interviewer could theoretically tailor his approach from the start.

Table 2 displays the outcomes of wave 2 cases where the first time in sample was a non-interview. While none of the differences in proportions (between columns) are statistically significant (at p<0.10), they do show a pattern that indicates that CHI data may be helpful when the previous interview was a refusal. For example, those with access to contact histories had a larger proportion of cases converted to response compared to those without access (28.3 percent versus 26.3 percent, respectively). One possible explanation is that if an interviewer approaches a case knowing that the household refused to participate in the prior wave, he may be spending more time reviewing the other CHI data, such as reasons for reluctance. Perhaps after interviewers gain experience referring to the available information, we will find a substantial increase in refusal conversions.

Another metric to consider is the number of contact attempts needed to close out a case. A large number of contact attempts is undesirable due to the cost and difficulty of obtaining a response. More attempts are necessary for hard-to-reach cases and this may be indicative of a potential nonrespondent.

We would expect households in sample that have previous wave contact history data to require fewer contact attempts to close the case. Knowledge of the time of day that an interview was completed and concerns expressed at earlier waves should be useful in planning for follow-up visits to the household. However, as Table 3 shows, the average number of attempts was not significantly different between cases with and without the benefit of previous wave contact data.

One possible explanation for CHI not reducing the number of contact attempts could be the season of the data collection. Cases with contact histories are from the third quarter of CEQ, which is conducted during the summer.

In most of the preceding analyses, we have restricted comparisons between cases with and cases without CHI data to second wave interviews. This was done to simplify the explanations for the reader. However, as noted earlier, CHI data for the previous interview is available for waves 3, 4, and 5 as well. Because the third and later waves may have different response characteristics than the second wave, it may be helpful to examine some basic paradata for all interviews.

Table 4 compares the refusal rates across waves and by availability of CHI data. Refusal rates are somewhat lower for cases with CHI data for waves 2 and 3 compared to cases without CHI data. But again, wave 4 shows higher refusal rates for cases with CHI data. Note that none of these differences are statistically significant at p<0.10, so we can only speculate as to whether the directions of these differences would hold if replicated with a larger sample.

As mentioned previously, this could be related to the time of year of data collection. All of the cases with CHI data were selected from the third quarter of the CEQ, including the months of July, August, and September. Cases without CHI data were from the previous quarter: April, May, and June. Due to the vacation habits of American households, third quarter data may require more contact attempts to complete a case regardless of whether CHI data is available.

After the CHI instrument has been incorporated into the CEQ for several quarters, we can examine this relationship more closely. If CHI performs as hypothesized, then we would expect the contact ratio to rise and these other averages to decrease over time, as interviewers gain experience.

3.2 Doorstep Concerns

The CHI provides interviewers with the opportunity to examine a list of doorstep concerns or behaviors that the respondent may have expressed (verbally or non-verbally) when contact was made. Does this data indicate that respondents are warning the interviewers about their future response patterns? By comparing the reasons cited at the first wave to the outcome at the time of the second wave, we can determine whether those households that provide some type of qualification for their participation are any less likely to respond during follow-up interviews.

After making contact, interviewers could select from 22 categories to indicate reasons for reluctance, questions about the survey, or other doorstep concerns voiced by household members.[1] Across all concern categories, those who did not respond at the second wave were more likely to hedge at the first wave by providing an indication that they were reluctant. Among those who agreed to be re-interviewed, the percentage that named any of the top ten concerns at the previous interview was significantly lower (p<0.05) than those who refused at the next wave attempt. Namely, the households that continued to participate were less likely to voice concerns at the previous interview.

In addition to the 22 concern categories, there was an option for the interviewer to note if there were no concerns expressed. Interviewers marked "no concerns" during at least one contact attempt in the previous wave for 80% of respondents who continued in sample at the next wave. Conversely, only 65% of refusal attriters had previously indicated "no concern". This difference is statistically significant (t=-3.39, df=300, p<0.001).

3.3 Predicting Attrition

The next section turns attention to the use of CHI data as a predictor of attrition. If we can identify respondent characteristics correlated with later wave nonresponse, field representatives can target cases exhibiting these characteristics to try and prevent attrition before it occurs.

Table 5 displays the odds ratios from two logistic regression models that use information collected in the CHI for predicting later wave attrition due to refusals. The first model uses only the basic paradata collected for a case: number of contact attempts to solicit an interview at the previous wave and the current wave number. Wave number was divided into three dichotomous variables to measure the effect of each wave number separately. Wave 5 was used as the reference group because we know the risk of attrition decreases at this final interview. This is likely because households indulge interviewers after being promised that this will be the last interview.

The first model indicates that time in sample, or wave number, is a significant predictor of attrition. When compared to Wave 5, the second wave has three times increased odds of attritting, the third wave has about two and a half times increased odds, and the fourth wave is twice as likely to attrit by reason of refusal. This information corroborates the concept of "panel fatigue" over waves.

This simple model also shows that the number of attempts to gain cooperation at the previous wave is a significant predictor of compliance at the next wave. Each additional contact needed to solicit an interview in the previous wave is associated with an 11% increase in the odds of refusing in the next wave. Based on this information, we may want to train interviewers to be prepared to use refusal conversion techniques if the previous wave required a large number of contacts.

In the second model, we incorporate a summary measure of the number of doorstep concerns expressed at the last wave. While any reason could be cited at multiple contacts, this measure simply counts the number of unique concerns provided. We found that for each additional concern recorded during the previous field period, there is a 25% increased odds of refusing during the next interview round. Therefore, we felt it was important to incorporate each type of concern into a third model in order to determine which particular reasons were most highly associated with attrition (model III data not shown).

Several of the concerns were significant in the third model, while preserving the impact of the original paradata from the first model. Those households expressing concerns about privacy at the last interview each had about a two-thirds increased odds in refusing the next interview and attriting out of the panel -- likewise for those who said they were reluctant to comply because the survey is voluntary. There was almost a fifty percent increased odds in attriting between both those households who said they had no interest and those who said that the survey was too long. With the exception of the "other" concern category, none of the remaining doorstep concerns were significant in predicting attrition.

4. Conclusions

This paper is a first attempt to evaluate whether a contact history record is a useful tool to reduce both nonresponse and the number of contacts needed to close a case in a panel survey. When provided with information such as time of day previous contact was attempted, the outcome of the attempt, the number of

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[1] The top 10 Wave 1 selected categories included: Too busy; not interested/don't bother; scheduling difficulties; privacy concerns; interview takes too much time; "other"; survey is voluntary; asks questions/doesn't understand survey; anti-government concerns, and talk only to specific household member.

attempts needed to solicit a response, and the types of respondent concerns expressed during an earlier interview, interviewers should have an accurate picture of the household's response pattern during follow-up visits later in the year. We hypothesized that this would help to obtain responses more quickly and to lower the noncontact and refusal rate. However, we did not find overwhelming evidence to support this claim.

Attrition rates for interviewers who had previous wave CHI data were not significantly different from attrition rates in cases without CHI data. While the differences were in the direction hypothesized, contact histories did not have a significant impact on the proportion of previous wave nonrespondents who became respondents. The number of calls needed to close a case did not differ significantly by the presence of previous wave CHI data. Response and refusal rates also did not show an impact of having CHI available.

There are several reasons that might explain why cases with CHI data did not behave as expected. First, the contact history instrument is still new to interviewers. In order for CHI to work to its full potential, interviewers must record the information accurately during initial interviews and must utilize this information in follow-up attempts. Further training may be required to instruct interviewers on the best way to collect and use previous wave CHI data. In addition, we should plan to repeat this analysis as interviewers gain experience.

Second, our comparisons of interviews with and without CHI data are made at different times in the year. Seasonal differences can have a substantial impact on response patterns. We found no significant improvement in response rate and number of attempts necessary to make contact when comparing cases with and without CHI data. However, the cases with previous wave contact histories were from the third quarter of the CEQ. The comparison was made to the previous quarter where no contact histories were available to the interviewer. March, April, and May (the months included in quarter two data collection) may be more amenable to soliciting response than June, July, and August (quarter three's data collection period) when many American families travel because of school vacations.

While we did not find evidence that data from contact histories is definitively useful to interviewers on a case-by-case basis, we did use information collected from these cases to build a model to identify characteristics that may help predict future attrition.

Three models investigated different levels of information. First, we incorporated only the most basic paradata and found that the number of contact attempts and interview wave number were significant predictors of attrition. More contact attempts needed to solicit an interview at the first wave were correlated with an increased risk of attriting. The second through fourth interviews were more at risk of attrition when compared to the fifth and final interview. Second, we added in a count of the number of doorstep concerns expressed at the first interview. For each concern expressed, the odds of a household attriting increased by 25%. Third, we looked at each of the concerns recorded in the instrument. Five of the 22 concerns were significantly associated with attriting the panel

This information can be useful in practice. Cases that expressed specific concerns in an initial interview may be more likely to refuse follow-up requests. We can flag these cases and train interviewers to approach them using refusal conversion tactics. By targeting likely attriters before they have an opportunity to refuse, we may reduce this type of nonresponse.

The model may also allow us to develop propensity scores to adjust for nonresponse, as suggested by Meekins and Sangster (2004). With contact history data, we can assign a weight to each doorstep concern depending on its relationship to the household attriting later. We should replicate this analysis using a larger number of cases over a longer period of time before implementing this type of nonresponse adjustment. However, this paper may serve as a first step towards identifying the characteristics that could be used in this model.

5. Future Research

Data from the contact history instrument would be much richer if used in tandem with data from the Consumer Expenditure Survey. The CEQ collects a great deal of information on the household. This demographic data could be used to strengthen the predictive power of our models and to better understand attrition.

As in every survey, some households refuse the request and never complete an initial CEQ interview. Therefore, we also plan to merge the CHI data with CEQ sample frame data. The CEQ frame includes information such as region of the country, urbanicity, and the type of building structure. Because there is a contact history record for each contact attempt, we could investigate the characteristics associated with nonresponse even at the initial interview.

This would allow us to identify ways in which first wave refusals may be similar to later wave attriters. Because other researchers have found that panel attriters often differ from other nonrespondents, this analysis may identify additional characteristics to consider. This information should be provided to field representatives in order to prepare them for dealing with households likely to refuse. The ultimate goal would be to increase response rates in the CEQ and other surveys.

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Table 1. Distribution of wave 2 outcomes by availability of CHI data
(Base=Interviewed at Wave 1)

Wave 2 Outcome	No Contact Histories (%)	Contact Histories Available (%)
Interview	89.3	89.2
Attrited: Refusal	6.3	6.1
Attrited: Noncontact	1.7	1.6
Attrited: Other noninterview	2.8	3.1
Num. Wave 1 Interviews	1759	1726

$\chi 2=0.29$; df=3; p=0.96

Table 2. Distribution of wave 2 interviews by outcome category and availability of CHI data
(Base= Nonresponse at Wave 1)

Wave 2 Outcome	No Contact Histories (%)	Contact Histories Available (%)
Converted to Response	26.3	28.3
Refusal	54.3	56.7
Noncontact	10.8	7.3
Other noninterview	8.6	7.7
Num. Wave 1 Non-Interviews	501	453

Table 3. Average number of attempts to close out wave 2 interviews by outcome category by availability of CHI data
(Base=Interviewed at Wave 1)

Wave 2 Outcome	No Contact Histories (mean)	Contact Histories Available (mean)	t-statistic
Overall	3.86	3.94	-1.58
Interview	3.36	3.50	-1.35
Attrited:			
Refusal	6.36	7.19	-1.11
Noncontact	7.52	10.0	-1.56
Other noninterview	8.26	7.13	0.93
Number of Wave 1 Interviews	1759	1726	

Note: None of the t-tests for differences in means are statistically significant at p<0.10

Table 4. Refusal Rates by Wave and Availability of previous wave contact records

Wave Number	No Contact Histories (%)	Contact Histories Available (%)	t-statistic
2	16.8	16.2	0.55
3	19.4	18.2	1.08
4	18.4	19.6	-1.08
5	17.1	17.1	0.05

Note: None of the t-tests for differences in means are statistically significant at p<0.10

Table 5. Logistic regression coefficients predicting attrition due to refusal, by model

	Model I		Model II	
Predictor	Estimate	Odds Ratio	Estimate	Odds Ratio
Intercept	-4.18 (0.18)***		-4.39 (0.19)***	
Number of attempts to solicit previous wave interview	0.10 (0.02)***	1.11	0.06 (0.02)***	1.07
Interview Number=2 (comparison: 5)	1.12 (0.20)***	3.08	1.16 (0.20)***	3.21
Interview Number=3 (comparison: 5)	0.90 (0.21)***	2.47	0.88 (0.21)***	2.42
Interview Number=4 (comparison: 5)	0.69 (0.21)***	2.00	0.63 (0.22)***	1.88
Number of concerns at last wave			0.22 (0.02)***	1.25

* indicates p<0.10 ** indicates p<0.05 *** indicates p<0.01