

Trends in Income Nonresponse Over Two Decades

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Survey data on personal and household income is usually associated with a large amount of item nonresponse. This article focuses on trends in income nonresponse over the past two decades in the Surveys of Consumers (SCA) conducted in the U.S. SCA asks respondents first to report their income in dollar amounts with an open-ended question. Those who do not provide an answer are followed up with a closed-ended question with income brackets. Analyses indicate that missing data on income has decreased over time, and the decline is related to respondents' overall willingness to participate in the survey and to answer survey questions once in the survey. The results suggest that, for questions on household income, there exists a trade-off between unit and item nonresponse, which may have implications for income estimates and economic modeling.

Key words: Income; nonresponse; longitudinal trend.

1. Introduction

Accurate and complete data on personal and household income are important for official statistics, governmental policies, and social science research in general. However, when income data are collected through surveys, they have been associated with a large amount of missing data. The presence of missing data for household income, or item nonresponse, can distort estimates of the distribution of income and can complicate analyses that use income as a covariate. The survey literature shows that the typical item nonresponse rate to income questions is between 20–40% (Moore, Stinson, and Welniak 1999; Juster and Smith 1997). By contrast, the typical range of missing data for other survey questions is between 1 and 4% (De Leeuw 1992). Given the importance of complete and accurate income data, systematic research on potential changes over time in the mechanisms and correlates of income nonresponse is needed.

Most of the current findings on income nonresponse come from cross-sectional studies. Even though some studies look at multiple time points of a survey (see Moore et al. 1999; Olson et al. 1999), we found no study taking on the longitudinal aspect of income nonresponse over time. Where income nonresponse over multiple time points in the same study was evaluated, the time periods were too short to detect trends in changes in income reporting. In addition, when income nonresponse is studied with cross-sectional data, it is difficult to infer what caused changes in income nonresponse at different points in time. Important factors such as survey cooperation rates change over time; as a result,

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characteristics of respondents may change, both in terms of measured variables (e.g., race, education, sex, and income) and unmeasured variables (e.g., sensitivity thresholds, motivation to respond, and cognitive sophistication) that are related to income nonresponse. Therefore, lacking in the literature is a dynamic, historical view of income nonresponse under the same essential survey conditions. This article supplements the traditional cross-sectional approach to the study of income nonresponse by focusing on a longitudinal understanding of the trend in income nonresponse over time.

Section 2 reviews existing literature pertaining to income nonresponse such as models accounting for income nonresponse and strategies for reducing income nonresponse. Section 3 specifies research questions developed through literature review. The dataset used for this analysis is described in Section 4 and results are shown in Section 5. We offer some conclusions and discussion points in Section 6.

2. Reviewing Relevant Literature for Income Nonresponse

2.1. Models for Income Nonresponse

As a general framework to explain item nonresponse, Beatty and Herrmann (2002) list three factors contributing to item nonresponse in surveys: (1) how much people know about the topic, (2) their judgments of the adequacy of what they know relative to the level of exactness or accuracy the question seems to require, and (3) their willingness to report their responses to the survey question. The first two factors are cognitive or informational while the third is motivational. This model, applied to income questions, predicts that respondents fail to report household income because they may not know their total family income, they may have a rough idea but believe that the question asks for an exact amount, or they may simply not want to provide their income to the survey interviewer, organization, or agency conducting the research. This model is consistent with what Juster and Smith (1997) and Moore, Stinson, and Welniak (1999) propose as factors affecting income nonresponse even though the model by Moore et al. (1999) is more extensive, covering factors relating to the interpretation and understanding of survey questions. Nonetheless, all three models converge in the sense that they all suggest that both cognitive and motivational factors contribute to income nonresponse.

Carrying the motivational factor leading to income nonresponse further, Tourangeau, Rips, and Rasinski (2000) describe one meaning of “sensitivity” as the *intrusiveness* of survey questions. Questions that are sensitive in this sense ask respondents to report about “taboo” topics that are deemed inappropriate in everyday conversation or out of bounds for casual acquaintances, including survey interviewers. Perceived sensitivity is largely determined by the content of the question, which is seen as an invasion of privacy. Questions asking about income fall into this category; respondents may feel that such questions are simply none of the researcher’s business. Similar to the Beatty and Herrmann’s framework, income nonresponse due to sensitivity is largely an issue of respondent motivation, and is driven by privacy concerns. This mechanism of income nonresponse predicts across-the-board nonresponse to income questions for all population subgroups.

Both cognitive causes of income nonresponse (knowledge of income, judgment of perceived accuracy requested) and motivational cause of income nonresponse (willingness to report) have been used to explain income nonresponse present in cross-sectional surveys at a single time point. However, they do not help predict or explain increasing or decreasing trend of income nonresponse over time.

2.2. *Techniques for Dealing with Income Nonresponse*

Income nonresponse can be reduced by employing certain survey design features and certain response formats. For instance, the mode of data collection affects the amount of income nonresponse. Körmendi (1988) reports higher income nonresponse in telephone interviews than in face-to-face interviews. Schräpler et al. (2006) compare income nonresponse rates across three modes – CAPI (Computer-Assisted Personal Interviews), PAPI (Paper- and- pencil Personal Interviews), and Mail. They found that the CAPI mode produced more missing values for income than PAPI and that the differences diminished after the first two waves of data collection. Mail surveys did not attract higher income nonresponse than CAPI across waves, contrary to the belief that self-administered modes produce more item nonresponse than interviewer-administered modes (De Leeuw 2001).

The response format of income questions also affects income nonresponse rates. Comparisons have been made between income nonresponse rates to open-ended questions, which directly ask respondents to report their actual income value, and income nonresponse rates to a series of bracketed income questions. The latter is called the “unfolding bracket” technique, which is now commonly used to help reduce income nonresponse rates (Heeringa et al. 1993; Juster and Smith 1997). The unfolding bracket technique presents income nonrespondents (or, in some cases, all respondents) with a series of bracketing questions that place a respondent’s income value within a specific range. This allows the researchers to collect partial information about income from survey respondents who are unwilling or unable to provide an exact income amount (see Appendix I for the bracketed income questions used in the analyses presented in this article).

Heeringa et al. (1993) and Juster and Smith (1997) both report that this strategy effectively reduced the amount of missing financial data by 50% or more. Other national surveys such as the National Immunization Survey and the Consumer Expenditure Quarterly Survey also demonstrated that the bracketing techniques reduced income nonresponse by 50% (Battaglia et al. 2002; Dixon 2005; McGrath 2005; Olson et al. 1999). The effectiveness of the unfolding brackets technique is dependent on the entry point and the number of brackets presented. Research on unfolding brackets suggests that they induce less bias in income responses when the entry point is in the middle of the income distribution than at the upper or lower ends (Cao, Hill, Juster, and Perry 2005). We refer interested readers to work conducted by Juster and colleagues (Cao, Hill, Juster, and Perry 2005; Juster and Smith 1997) for more information on technical issues of constructing effective unfolding brackets.

Empirical evidence also suggests that the unfolding brackets technique is more effective for cognitive or informational causes of income nonresponse than for motivational causes.

The brackets obtain substantive responses from most of the respondents who answered “Don’t Know” to the initial income question (e.g., initial or open-ended income nonrespondents), but not from as many respondents who refuse to answer (e.g., “I’m not going to give you that information”) the initial question (Juster and Smith 1997). It seems that unfolding brackets are effective in reducing income nonresponse because they lessen the cognitive burden of survey questions on respondents by offering a series of income brackets and reduce the perceived sensitivity of the questions by asking for ranges of income (instead of exact amounts). Unfolding brackets are less effective in persuading those who are unwilling to report income to do so.

Statistical methods such as imputation can also be employed to overcome income nonresponse after data collection (Little and Rubin 1987, 2002). However, income nonresponse is nonignorable; that is, the missing data pattern is correlated with the values of the variable of interest (income in this case). It has been shown in the survey methodology literature that income nonresponse is conditional on the value of respondents’ income, with higher nonresponse for those with higher income (Greenless et al. 1982; Lillard et al. 1986; Riphahn and Serfling 2005). In order to meaningfully impute income missing data and build appropriate analytic models, the mechanisms responsible for income nonresponse have to be understood and this nonignorable missing pattern has to be addressed.

Some demographic correlates of income nonresponse have been found, including age and race. Older respondents and White respondents are found to have more income item nonresponse than younger and non-White respondents (Bell 1984; Riphahn and Serfling 2005). When item nonresponse is considered more generally, age, sex, education, and race of respondents have been found to affect respondents’ likelihood to provide missing data in surveys (Bell 1984; Craig and McCann 1978; Ferber 1966; Riphahn and Serfling 2005).

3. Research Questions: The Longitudinal Perspective of Income Nonresponse

The review of literature on income nonresponse suggests that a key empirical question that has yet to be answered is simply whether income nonresponse has increased or decreased over time. In other words, given that unit response rates have fallen in the past decades, has income nonresponse increased or decreased? This is the first research question this article attempts to address.

A second research question has to do with the unfolding bracket technique. We examine whether the unfolding bracket technique becomes more or less effective over time at obtaining substantive results from respondents who fail to answer the open-ended questions given the increasing or decreasing trend of income nonresponse over time. It is an important task because survey methodologists strive to be flexible and adaptive in their approaches to measurement and inference, realizing that what worked in the past may not work in the future.

Furthermore, we attempt to fill in the missing time component in the models accounting for income nonresponse. As mentioned earlier, all existing models point to motivational and cognitive/informational causes of income nonresponse. What is missing is a longitudinal understanding of how cognitive and motivational causes of

income nonresponse contribute to the increase or decrease in income nonresponse across time. It is reasonable to assume that an increasing (or decreasing) trend of income nonresponse over time is the result of an increasing (or decreasing) level of motivation and information among respondents who participate in surveys. Comparatively speaking, the level of information regarding income may be less variable over time than the level of motivation (Atrostic et al. (2001); De Heer (1999)). As a matter of fact, many contemporary surveys experience falling response rates, suggesting a decreasing level of motivation or willingness on the part of potential respondents to agree to participate in surveys. The question then becomes whether, in the face of falling response rates, the remaining respondents are more likely or less likely to answer income questions. In other words, what is the effect of a decreasing general motivation/willingness on income nonresponse? It is possible that the remaining respondents are *more* likely to answer income questions since they start with a *higher* motivation than those who refuse to participate in the survey altogether. It is also possible that the same decreasing overall willingness or motivation causes respondents nowadays to be less likely to participate in surveys and to be less likely to answer survey questions including questions about income. If the former were true, a negative relationship between unit response rates and income nonresponse would be expected. But if the latter were true, a positive relationship between the unit response rates and income nonresponse would be observed. It is beneficial to the science of survey research to study this relationship between unit nonresponse and item nonresponse, which can shed light on the changing nature of the motivational aspects of income nonresponse.

4. The Surveys of Consumers

We used data from the Surveys of Consumers (SCA), which is a monthly household survey conducted by the University of Michigan in the U.S., to examine the trend in income nonresponse and the relation between respondent motivation and income nonresponse. For this article, we examined about 20 years of SCA monthly surveys from June 1986 (when SCA switched to an open-ended income question followed by bracket questions) to December 2005. Utilizing this database has advantages and disadvantages for our questions of interest. The main disadvantage is the lack of generalizability of the results to other survey designs or populations since they are based on only one survey. The advantages of using these data, however, are that the essential survey conditions (such as sample design and survey methodology) have been constant, reducing potential confounding when looking at trends over time.

The Surveys of Consumers began as an area-probability sample with an in-home face-to-face interview in 1946, and was converted to a random digit dial telephone survey in 1976. The survey is conducted monthly and is based on a rotating panel design. The analyses presented in this article are restricted to the RDD portion of the sample to be consistent with published work on the survey (e.g., Curtin et al. 2000, 2005; Singer et al. 2000). The RDD cases were selected using the Mitofsky-Waksberg procedures until 1993 and since then using list-assisted procedures. From each household, one respondent is randomly selected from among all household residents aged 18 or older. About 300 interviews are now conducted each month. Except for the constraint imposed by the

month-long interviewing period, no limit is placed on the number of calls, and attempts are made to convert virtually all initial refusals. For information on the historical trend of unit response rates, see Curtin et al. (2000, 2005).

The income questions come from the core section of the Surveys of Consumers monthly household interview. This section of the interview assesses respondents' current and future financial situations as well as perceptions of current and future economic conditions, such as expectations for inflation, unemployment, interest rate, and attitudes toward buying conditions. When asked about household income, respondents are first asked to report their total family income in an open-ended amount. Those who do not provide a response are followed up with a series of closed-ended questions using income brackets. The exact question wordings for the open-ended question and the bracket question used in the January 2005 survey are displayed in Appendix I. The income anchor for the first closed-ended question (e.g., \$50,000 in the example) has been changed a few times over the years to reflect changes in the median household family income.

5. Results

5.1. *The Trend of Income Nonresponse*

To answer the first research question, we computed two income nonresponse rates. The first income nonresponse rate or "initial income nonresponse rate" refers to the percentage of respondents who did not answer the open-ended income question that asks respondents to report the exact amount of their household income. The second nonresponse rate or "final income nonresponse rate" is the percentage of respondents who responded to neither the open-ended nor the bracketed income questions; these are the respondents who remained income nonrespondents after the bracket question.

To examine the trend of income nonresponse over 20 years, we computed and plotted the yearly averages of both types of income nonresponse by year of the interview in Figure 1 (the bars represent the standard errors of the estimates). Consistent with the literature, income nonresponse ranged from 11.7% to 26.2% for the initial income question (the top line in the figure) and the final income nonresponse rates ranged from 5.2% to 15.4% (the bottom line in the figure). Compared to nonresponse rates reported in the survey literature, the SCA has somewhat lower income nonresponse rates than some prominent government-sponsored surveys.

For both definitions of income nonresponse, small declines were recorded in the 1980's, followed by much larger increases in the 1990's up until 2001, after which the income nonresponse rates have declined sharply. Furthermore, it seemed that initial nonresponse to the open-ended income question decreased faster than final nonresponse (e.g., after the bracket question). The downward trend after 2001 is quite intriguing, especially given that unit response rates have been decreasing on the SCA (e.g., Curtin et al. 2005). While the decrease in income nonresponse rates after 2001 is striking, it does not correspond with any obvious cause of changes in income nonresponse rates, such as changes to the study protocol, wording of income items, training of interviewers, et cetera. Conversations with SCA project managers confirmed that the training protocol has been consistent throughout the time period

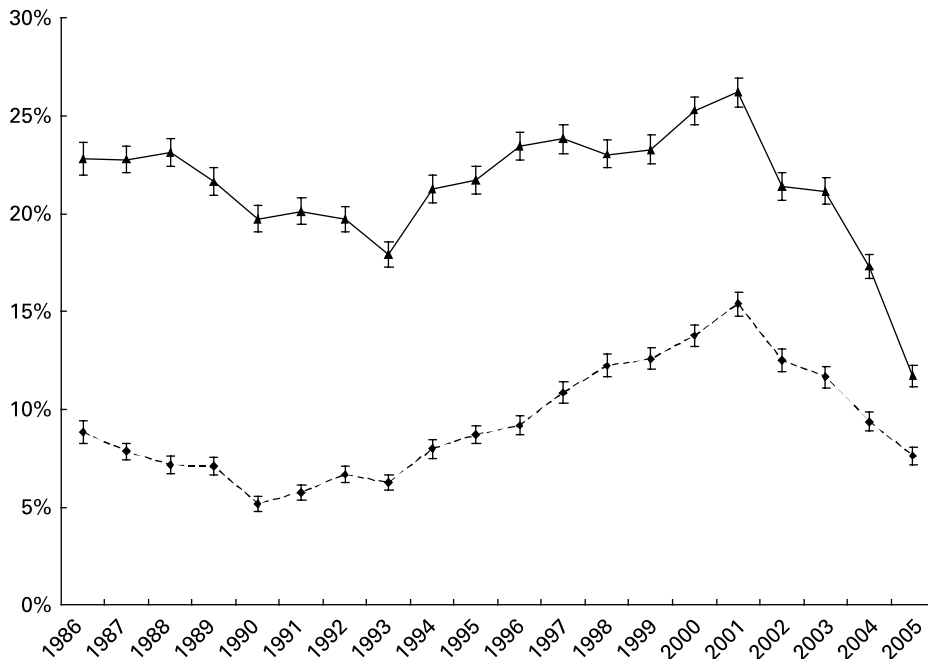


Fig. 1. Plot of Item Nonresponse Rates to Income Questions by Year of Interview. Note: The top line shows nonresponse to the initial open-ended income question and the bottom line is the percent of nonresponse to bracketed income questions

presented in this article. We suspect that the decrease in income item nonresponse is related to decreases in unit nonresponse across the same time period, an argument we develop further in the article.

5.2. Performance of the Unfolding Bracket Technique

It is obvious from Figure 1 that the unfolding bracket technique has successfully reduced nonresponse to the initial open-ended income question at every year of data collection. In Figure 2, we plotted the percent of reduction in income nonresponse due to the unfolding bracket technique over the same period of 20 years. On average, the unfolding bracket technique produced a reduction of 56% in item nonresponse to the initial income question. The average reduction over 20 years is comparable to the reductions to be found in the literature on the unfolding brackets technique (Heeringa et al. 1993; Juster and Smith 1997). However, the percent reduction found in the SCA shows a decreasing trend after a peak at 1990.

Given that the overall effect of the unfolding bracket technique for reducing income nonresponse has changed over time, it is worth examining whether or not the change in effect is identical across demographic subgroups. Age, sex, education, and race of respondents have been found to affect respondents' likelihood to provide missing data in surveys (Bell 1984; Craig and McCann 1978; Ferber 1966; Riphahn and Serfling 2005). We believe household heads are more likely to have a better knowledge of the

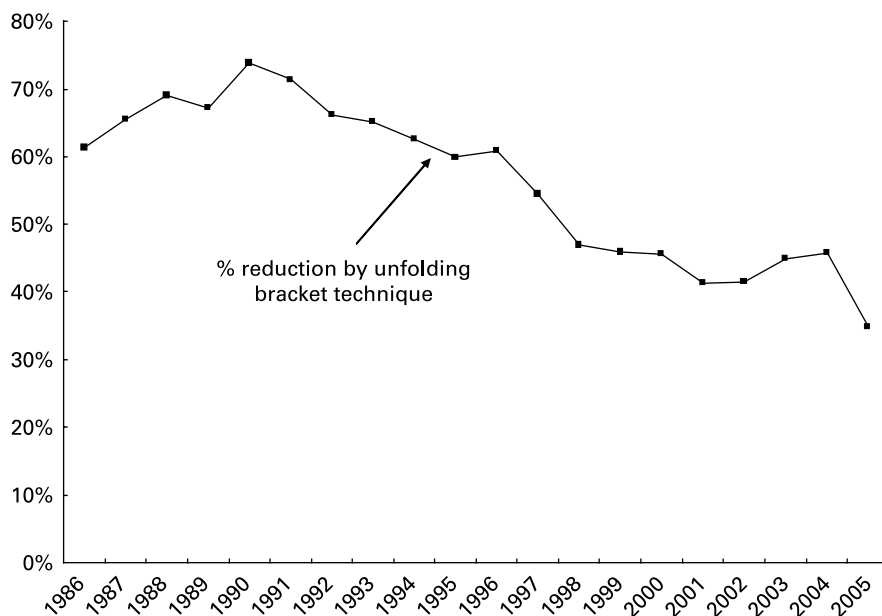


Fig. 2. Percent Income Nonresponse Reduction due to Unfolding Bracket Technique

household income than those household members who are not the head of the household. As a result, we examined the percent of bracket users among these demographic subgroups. We found that a declining trend in the rate of use of the bracket question across all demographic groups; for each demographic breakdown, the subgroup which had used the bracketed questions more frequently at the start of the period converges toward the other subgroups by the end of the period (analyses not shown here). For instance, females, the less educated, and older respondents used the bracketed questions much less frequently over time, although the use of the bracketed questions was also somewhat less frequent on the part of males, the more educated and younger respondents. This means that the initial differential nonresponse to the income question in the late 1980's disappeared by 2005. While it is possible that the interviewers became more adept at obtaining answers to the initial income question, it is more likely that respondents' willingness and ability to provide answers to the initial question has changed. Presumably these observed changes reflect the effect of the theoretically derived explanatory variables of item response models (i.e., informational causes and motivational causes). However, as argued before, we do not expect the level of knowledge about household income to increase over time. We examined variables associated with the level of knowledge about household income and found that the proportion of household heads, the proportion of males, the proportion of married respondents in the samples remain fairly constant over the 20 years (see Figure 3). The proportion of less educated respondents exhibits more variation than the others. Therefore, we speculate that it is the decreasing level of overall motivation and willingness on the part of respondents that produces the trend of income nonresponse as observed here, which is formally tested in the section below.

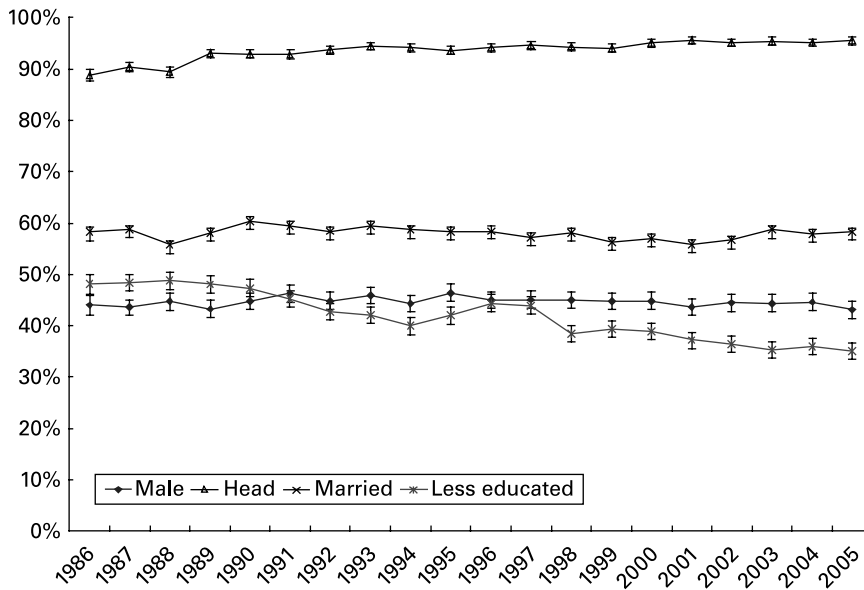


Fig. 3. Demographic Characteristics of Sample by Year of Interview

5.3. The Relationship Between Unit Response Rates and Income Nonresponse

To explain the decreasing trends in income nonresponse observed in Figure 1, we fit regression models on monthly data with a focus on changes over time in motivational causes of income nonresponse. Data from 231 monthly surveys were included in the aggregate analyses. Four monthly survey data were excluded because of missing data on refusal conversion rates.

There are at least two different dimensions of respondent motivation as it relates to causes of item nonresponse to income questions. The first dimension involves an individual respondent’s overall willingness to answer survey questions once he or she has been recruited into a survey. To look at this dimension, we created a missing data index by summing the total number of items for which each respondent did not provide an answer before he or she was asked the initial income question and dividing that sum by the number of items he or she should have answered (i.e., all items less those the respondent was skipped by design). Appendix II displays a list of survey items prior to the income question that were included in the missing data index. We assume that the lower a respondent’s overall motivation to answer survey questions, the higher the number of items with missing data. Respondents may refuse to answer individual survey items for a number of reasons, including privacy concerns, cognitive complexity of the question (and inability to come up with an answer), or unwillingness to exert cognitive effort to provide complete and accurate data (e.g., “satisficing”). Given that the questions on which we based the missing data index are mostly attitudinal, we consider the missing data index a measure of respondent motivation rather than a measure of respondent knowledge. This approach has been used by others in a similar fashion, and has been found to be linked to attitudes toward surveys (Singer, van Hoewyk, and Maher 1998; Stocke 2006), with higher item

nonresponse rates correlated with negative attitudes toward surveys. We hypothesize that this missing data index will predict higher income nonresponse rates.

In addition, unit response rates and refusal conversion rates collectively reflect the general population's cooperativeness (or resistance) with regard to agreeing to the survey request. Refusal conversion rates are calculated by using the number of respondents who ever refused to participate in the survey but were later converted to complete the interview as the numerator and the number of respondents who ever refused to the survey request as the denominator. Changes in either or both of the rates affect the composition of the sample that was interviewed. More cooperative individuals (or more reluctant individuals) could be included in the interviewed sample as a result, leading to an increased (or reduced) likelihood of responding to income questions.

We fit regression models to monthly data with the income nonresponse rates as the dependent variable. An AR(1) autoregressive model was fit to correct for autocorrelated errors resulting from the use of time series data. Two separate models were constructed, one for the initial item nonresponse to the open-ended income question, and one for the final income nonresponse. To statistically control for the heterogeneity of the sample composition across monthly surveys, the average age of respondents in each monthly survey, and the percent of male respondents, White respondents, respondents with high school diploma or less education, married respondents, and respondents who reported they were the head of the household in each monthly sample were entered into the final models. (These demographical variables were included in the model because of their differential effect on respondents' likelihood to provide missing data to income questions, as noted earlier.) Table 1 displays the unstandardized regression coefficients from the final models.

The time index based on the year of the interview (from 1 to 20) is a significant predictor of the final income nonresponse rate; an increase of one unit in the time index is associated with about one-third of a percentage point increase in the final income item

Table 1. Unstandardized Coefficients from Aggregate Level Regression Models

Explanatory variables	Nonresponse rate to initial income question		Final nonresponse rate (after bracket question)	
	Coefficient	Pr > t	Coefficient	Pr > t
Time index	0.06	0.62	0.38	<0.01
Overall missing data index	1.39	<0.01	1.28	<0.01
Unit response rates	0.11	0.10	-0.01	0.87
Refusal conversion rates	0.09	0.02	0.12	<0.01
Average age of respondents	0.11	0.56	0.08	0.54
Proportion of male respondents	-0.05	0.50	0.02	0.72
Proportion of White respondents	0.04	0.64	0.04	0.53
Proportion of married respondents	-0.12	0.08	-0.03	0.52
Proportion of respondents with high school or less education	0.02	0.73	-0.04	0.46
Proportion of household head	-0.03	0.84	-0.14	0.18
R^2	0.47		0.63	

nonresponse rate. Of course, over the 20-year period, even small coefficients produce sizeable changes. The time index does not seem to have a significant relationship with initial income nonresponse. The univariate correlation between the time index and the initial income nonresponse is about -0.17 ($p = .02$) and the univariate correlation between the time index and the final income nonresponse is about 0.54 ($p < .0001$). The univariate and the multivariate relationships suggest that there is not a strong relationship between time and income nonresponse in general (specifically open-ended income questions).

The overall missing data index (i.e., missing data rate prior to the income question) is a significant predictor of both types of income nonresponse. When the index increases by one percentage point, the initial income nonresponse rate increases by about 1.39% and the final nonresponse rate increases by about 1.28%. Because this missing data index shows the amount of missing data to survey questions that come *before* the income question in the survey, the significant regression coefficients suggest that income nonresponse rates are closely linked to respondents' overall willingness to answer survey questions once recruited. If respondents tend to give missing data to other survey items, they are more likely to give missing data to income questions. We take this to mean that income nonresponse is largely a motivational issue.

The univariate correlation between unit response rates and income nonresponse rates is 0.36 ($p < .0001$) for the initial income nonresponse rates and -0.28 ($p < .0001$) for the final income nonresponse rates. However, the regression models show that unit response rates did not seem to be related to either of the income nonresponse rates after statistically adjusting for sample heterogeneity. This may have been due to the collinear relationship between the time index and unit nonresponse rates. When the regressions were estimated omitting the time index, the effect of the unit nonresponse rate on the final income item nonresponse rate was significant ($p < .03$), but it did not change the estimates in the initial income item nonresponse rate regression. While the overall fit of the equations that included the time index was superior, our rejection of this relationship was not robust and deserves further research.

The refusal conversion rates, in contrast, do show a positive relationship with both of the income nonresponse rates; a 1% increase in the refusal conversion rate leads to 0.09% increase in the initial income nonresponse rate and 0.12% increase in the final income nonresponse rate. The significant relationship between the refusal conversion rates and the income nonresponse rates seems to suggest that the sampled persons' resistance to participating in the survey plays an important role in income nonresponse rates as well. The monthly sample varies in the proportion of respondents who resist an interview request and resist answering individual survey questions. Presumably higher refusal conversion rates are indicative of samples containing more respondents with a higher resistance to the survey requests in general, leading to higher income nonresponse rates. Even though we could not conclude that those who refused the survey were the ones who would have refused answering income questions, the evidence suggests that those who were hard to recruit are more likely to refuse individual items once recruited into the sample. Again, it seems to suggest that income nonresponse is mostly motivational.

The aggregate level models also show that the sample composition (such as the proportion of males, the proportion of household heads, and so on) is not related to either

dimension of income nonresponse. Specifically, those variables that are indicative of knowledge of income information (e.g., the proportion of household heads, the proportion of respondents with high school or less education, the proportion of married respondents and the proportion of males) are not statistically related to income nonresponse, confirming our speculation that the information level regarding income is rather constant across time and does not contribute to the trend of income nonresponse rates over time. Rather, the trend of income nonresponse is related to the change of motivation and willingness on the part of respondents.

5.4. Individual Level Correlates of Income Nonresponse

The time series analysis paints a macro picture of the relation between income nonresponse and respondents' resistance to survey requests and unwillingness to answer survey questions. To avoid perpetrating an ecological fallacy by drawing conclusions about the behavior of individuals from aggregate statistics, we explored whether the same relations between income nonresponse and respondent cooperativeness observed at the aggregate level would be borne out at the micro level. Using individual-level data, we examined how a respondent's propensity to respond to the income questions is related to his/her propensity to agree to the survey request and to answer previous survey items. We modeled the propensity to answer the income questions through two logistic regressions with the dependent variable being whether or not a sample respondent provided an answer to the initial income question, and whether or not a sample respondent provided an answer to the initial open-ended questions or the bracket questions.

We tried to include individual-level predictor variables corresponding to the key predictor variables in the aggregate analyses. A sampled person's individual-level response rate is unknown. However, the number of call attempts required for a respondent to complete the interview is usually associated with a respondent's contactability and thus eventual response, where a higher number of call attempts signals a lower likelihood of contact. Thus, we included the number of call attempts to each sampled person before an interview was obtained as a dummy variable that indicated whether it took more than the median number of calls to complete the interview. We decided on the dummy variable rather than the continuous number of calls because we believe the number of call attempts itself is meaningless unless situated in a context; for instance, five call attempts today has a very different meaning and implication than five call attempts ten years ago. Therefore, we think the dummy variable captures the difficulty of contactability and response propensity better than the absolute number of call attempts.

The micro-level variable corresponding to refusal conversion rates is an indicator variable identifying whether or not a respondent ever refused the interview request and was subsequently convinced to participate (i.e., a refusal conversion case). This indicator variable measures the respondent's conditional propensity to participate in the survey given contact. Refusal conversion cases are assumed to have a lower propensity to agree to the survey request. In fact, if no refusal conversions were attempted, they would not have participated. Both the refusal conversion and likelihood of contact variables are hypothesized to be negatively related to a sampled person's propensity to answer the income questions.

An individual-level missing data index (i.e., missing data rate within the survey prior to the income question) was also included to indicate each respondent's overall motivation to answer survey questions. Recall that a higher index score represents more missing data to questions prior to the income questions and people with higher index scores are hypothesized to be less likely to answer income questions. Finally, the same demographic covariates (including age, race, education, marital status, and whether or not the respondent was the household head) were also included as explanatory variables to adjust for idiosyncratic differences. Furthermore, these variables are shown to have an effect on item nonresponse in general (Bell 1984; Craig and McCann 1978; Ferber 1966; Riphahn and Serfling 2005).

As shown in Table 2, respondents are more likely to refuse to answer the initial open-ended income question and/or the bracket questions when they have more survey items with missing data (i.e., are less motivated to answer survey items in general), when they require more than the median number of call attempts (i.e., are more difficult to contact), and if they ever refused the survey request (i.e., are reluctant respondents). Thus, the logistic regressions suggest that income nonresponse is related to respondents' propensity to agree to the survey request and to answer survey questions. The micro-level conclusions (Table 2) regarding income nonresponse and unit nonresponse are consistent with the macro-level conclusions (Table 1).

Table 2 also presents demographic profiles of respondents who have a lower propensity to answer income questions. Males, Whites, and household heads are more likely to answer income questions than females, non-Whites, and those who are not household heads. By contrast, married respondents and respondents with high school or less education are more likely to refuse to answer income questions. Furthermore, older

Table 2. Unstandardized Regression Coefficients of Logistic Regression Models Predicting Income Response Propensity

Explanatory variables	Propensity to refuse initial open-ended question		Propensity to refuse both initial and bracket income questions	
	Coefficients	Pr > $ \chi^2 $	Coefficients	Pr > $ \chi^2 $
Time index	-0.01	0.0002	0.05	<.0001
Overall missing data index	4.70	<.0001	5.09	<.0001
Ever refused survey request	0.34	<.0001	0.41	<.0001
More than median number of call attempts	0.09	<.0001	0.09	<.0001
Age of respondents	0.02	<.0001	-0.02	<.0001
Male	-0.42	<.0001	-0.26	<.0001
White	-0.09	0.0010	-0.04	0.3300
Married	0.26	<.0001	0.22	<.0001
High school or less education	0.17	<.0001	0.24	<.0001
Household head	-1.20	<.0001	-1.32	<.0001
Max-rescaled pseudo- R^2	0.10		0.11	

Note: The case count for these individual level models is on the magnitude of 72,000 since a monthly survey generates about 300 completed interviews on new cases and the model includes about 20 years.

people are more likely to provide missing data to the open-ended income question than younger people. Findings on the effect of age, gender, and education on income nonresponse are consistent with the past literature on demographic profiles of item nonrespondents (Bell 1984; Craig and McCann 1978; Ferber 1966; Riphahn and Serfling 2005). From a policy perspective, however, such demographic characterizations of income nonrespondents are important to survey practitioners because survey organizations can target these potential income nonrespondents and apply customized strategies to increase their propensity to answer survey questions on income.

6. Discussion

This article takes an historical perspective by examining income nonresponse over time in one study. We find that nonresponse to initial open-ended income questions that ask for a specific dollar amount has declined. The use of an unfolding bracket technique reduced income nonresponse, although the amount of reduction has declined over time as well. Initial nonresponse rates to the open-ended income question and the final response rates after the bracketed follow-up questions both fall within the range of income nonresponse rates reported for other surveys that are very different from the SCA in questionnaire content, mode of data collection and the organization conducting the survey. Table 3 displays a small collection of published income

Table 3. Income Nonresponse Rates Reported on Other Surveys

Survey (all U.S. government- sponsored)	Income nonresponse rate		Mode of data collection	Income definition
	Open- ended	Bracketed		
CPS* March 1990 ^a	18.4%	Not reported	In-person and phone	Ask amount; multiple income types
CPS March 1996 ^b	26.2%	Not reported	In-person and phone	Ask amount; multiple income types
CPS March 2000 ^a	27.2%	Not reported	In-person and phone	Ask amount; multiple income types
CPS (2002–2003) ^c	14.2%		In-person and phone	Ask amount; multiple income types
NIS [†] 4/97-1/98 ^d	17.1%,	14.2%	Phone	Ask amount, bracket follow-up
NIS 2/98-3/98 ^d	32.0%	13.9%	Phone	Ask amount, bracket follow-up
NIS 2000 ^e	27.8%	14.2%	Phone	Ask amount, bracket follow-up
CEQ [‡] (2002–2003) ^c	19.9%		In-person	Ask amount, bracket follow-up
CEQ 2003 ^f	35.0%	19.0%	In-person	Ask amount, bracket follow-up

Note: *Current Population Survey; [†]National Immunization Survey; [‡]Consumer Expenditure Quarterly Survey; ^aAtrostic and Kalenkoski (2002); ^bMoore et al. (1999); ^cDixon (2005); ^dOlson et al. (1999); ^eBattaglia et al. (2002); ^fMcGrath (2005).

nonresponse rates on surveys at multiple time points. In some years, the SCA obtained rates much lower than those commonly reported in the literature, but in other years they were on par with reported rates. Even though none of the surveys presented in Table 3 has enough data points to show a statistical trend of income nonresponse, it appears that income nonresponse rates increased across the decade of the 1990s for both the Current Population Survey (CPS) and the National Immunization Survey (NIS). This is consistent with the trend observed for the SCA. The CPS also shows a lower income nonresponse rate in the post-2000 era, again consistent with the SCA trend.

Furthermore, the SCA data show extreme variability in income item nonresponse rates across time, similar to the income nonresponse rates displayed in Table 3. Such variability in income nonresponse rates is itself an interesting finding, and we encourage other researchers with access to longitudinal data on income to examine and publish trends in income nonresponse over time to enlarge the literature on the longitudinal aspects of income nonresponse.

Our analysis shows that the trend of income nonresponse is closely related to changes in respondents' cooperativeness with regard to agreeing to a survey request and to answering survey questions once recruited. Regression models at the aggregate level showed that refusal conversion rates are significantly and positively associated with income nonresponse, suggesting that the resistance level of respondents interviewed in each monthly survey has a great effect on the income item nonresponse. Those that are converted from refusals provide more missing data to income questions once they are recruited to the survey. In addition, we found that lower motivation to answer survey items in general (shown as higher missing data rate) is linked with increased income nonresponse, suggesting that income nonresponse is closely related to respondents' general willingness to respond. The individual-level analyses further confirmed that income nonresponse is significantly related to respondents' propensity to agree to the survey request and to answer survey questions.

These findings have important implications for overall survey quality. First, the level of missing data to sensitive and difficult questions (in this case, income questions) may decline with lower unit response rates. Income nonresponse rates have fallen since 2001 as unit response declined. If lower unit response rates mean that respondents recruited and retained are, on average, more cooperative, then decreased item nonresponse may be a result of having more cooperative individuals in the sample.

Second, the open-ended income question produced less missing data in the last five years or so and its downward trend is sharper than that of the final income nonresponse rate. In other words, the amount of reduction by the use of the unfolding bracket technique seems to be decreasing, suggesting a diminishing return from having unfolding bracketed income questions. Given that the administration of every survey question takes time and adds costs, survey researchers should continue monitoring the effectiveness of bracketed income questions and make necessary adjustments as they are justified. While bracketed income questions may currently be just as effective as they have been in the past for any given respondent, their overall effect might be diminished by having more cooperative respondents in the sample. However, it is unclear what kind

of income question can obtain better income measurement in light of the diminished returns from unfolding brackets. Some researchers, primarily analyzing face-to-face data collections, present a series of income brackets to respondents on a show card and ask them to choose (Stocke 2006). We encourage researchers to continue assessing longitudinal trends in the effectiveness of bracketed income questions on their own data and to investigate alternative income questions.

Third, our findings reiterate that causes of income nonresponse are complex. While it has been suggested that item nonresponse can be caused by respondent characteristics, question characteristics, or survey design features, we find more support for respondent-level causes than survey design or survey question level causes. To be sure, we did not specifically test survey design and survey question level causes because they are held constant in our analyses. Nonetheless, we did find evidence that respondent motivation to answer survey items in general is a characteristic of individual respondents rather than mainly an effect of question content or survey context given that individuals who did not report income tended to refuse other nonsensitive attitudinal questions as well. Furthermore, higher income nonresponse rates tend to be seen more with individuals who were convinced to participate after an initial refusal, suggesting that individual-level motivational factors that affect unit nonresponse could affect income nonresponse as well. Additional research, preferably with factorial experimental manipulations of unit nonresponse rates, item complexity, item sensitivity, and perhaps other factors, needs to be done in order to disentangle the various respondent-level and design-level causes of income item nonresponse.

Moreover, studies on income nonresponse should not be limited to income items per se. Other design parameters might have an effect as well. For instance, survey recruitment protocols affect response rates, and refusal rates may affect the level of motivation among respondents to provide income data.

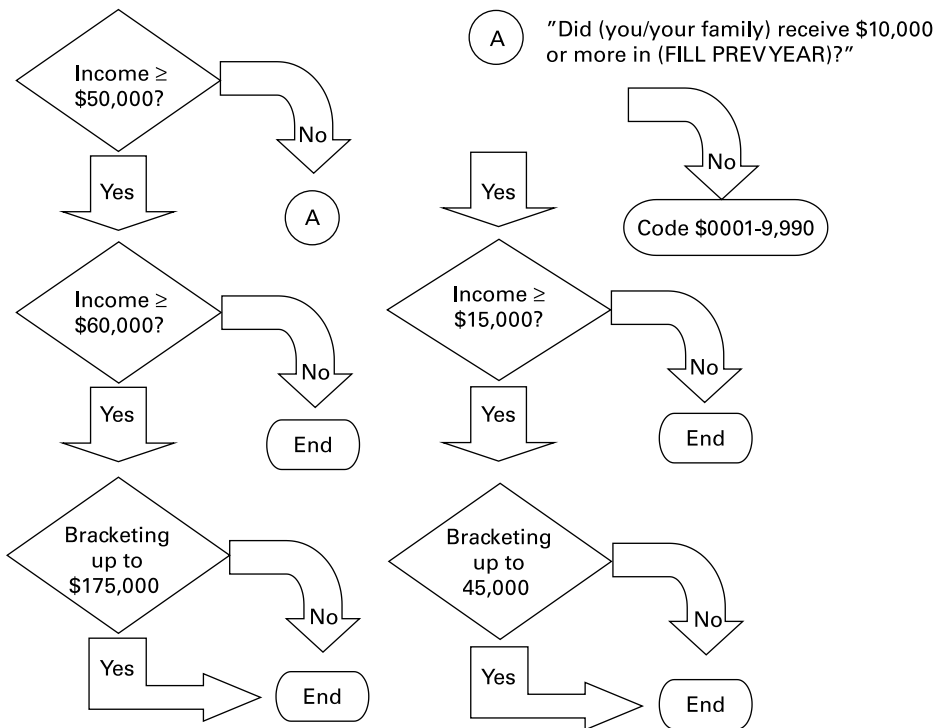
We acknowledge that item nonresponse rates may not be a good indicator of the quality of income data, just as unit nonresponse rates alone are not a good indicator of the overall quality of a particular survey (Groves 2006). It cannot be assumed that having more complete income data is a good thing. This article did not address accuracy of income reports, but we hope that future research on this question addresses the relationship of item nonresponse rates and bias in reported income.

Appendix I: A Flow Chart of the Open-ended Income Question and the Series of Brackets Used in the March 2006 SCA

Open-ended Income Question:

“To get a picture of people’s financial situation we need to know the general range of income of all people we interview. Now, thinking about (your/your family’s) total income from all sources (including your job), how much did (you/your family) receive in (FILL PREVIOUS YEAR)?”

IF REFUSAL OR DON’T KNOW: “Did (you/your family) receive \$50,000 or more in (FILL PREV YEAR)?”



Appendix II: SCA Items Used in Missing Data Index

1. (PAGO) We are interested in how people are getting along financially these days. Would you say that you (and your family living there) are better off or worse off financially than you were a year ago?
2. (PEXP) Now looking ahead—do you think that a year from now you (and your family living there) will be better off financially, or worse off, or just about the same as now?
3. (BUS12) Now turning to business conditions in the country as a whole—do you think that during the next 12 months we'll have good times financially, or bad times, or what?
4. (BAGO) Would you say that at the present time business conditions are better or worse than they were a year ago?
5. (NEWS1) During the last few months, have you heard of any favorable or unfavorable changes in business conditions?
6. (BEXP) And how about a year from now, do you expect that in the country as a whole business conditions will be better, or worse, than they are at present, or just about the same?

7. (GOVT) As to the economic policy of the government—I mean steps taken to fight inflation or unemployment—would you say the government is doing a good job, only fair, or a poor job?
8. (UNEMP) How about people out of work during the coming 12 months—do you think that there will be more unemployment than now, about the same, or less?
9. (RATEX) No one can say for sure, but what do you think will happen to interest rates for borrowing money during the next 12 months—will they go up, stay the same, or go down?
10. (PX1Q1) During the next 12 months, do you think that prices in general will go up, or go down, or stay where they are now?
11. (RINC) During the next year or two, do you expect that your (family) income will go up more than prices will go up, about the same, or less than prices will go up?
12. (INEXP1) During the next 12 months, do you expect your (family) income to be higher or lower than during the past year?
13. (HOM) Generally speaking, do you think now is a good time or a bad time to buy a house?
14. (DUR) About the big things people buy for their homes—such as furniture, a refrigerator, stove, television, and things like that. Generally speaking, do you think now is a good or a bad time for people to buy major household items?
15. (CAR) Speaking now of the automobile market—do you think the next 12 months or so will be a good time or a bad time to buy a car?
16. (INCOME) To get a picture of people's financial situation we need to know the general range of income of all people we interview. Now, thinking about (your/your family's) total income from all sources (including your job), how much did (you/your family) receive in (filling in time)?

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Received August 2007

Revised August 2009