# Experiments in Reducing Measurement Error Through Cross-Survey Imputation: Preliminary Findings for Diary to Interview Survey Imputations

by

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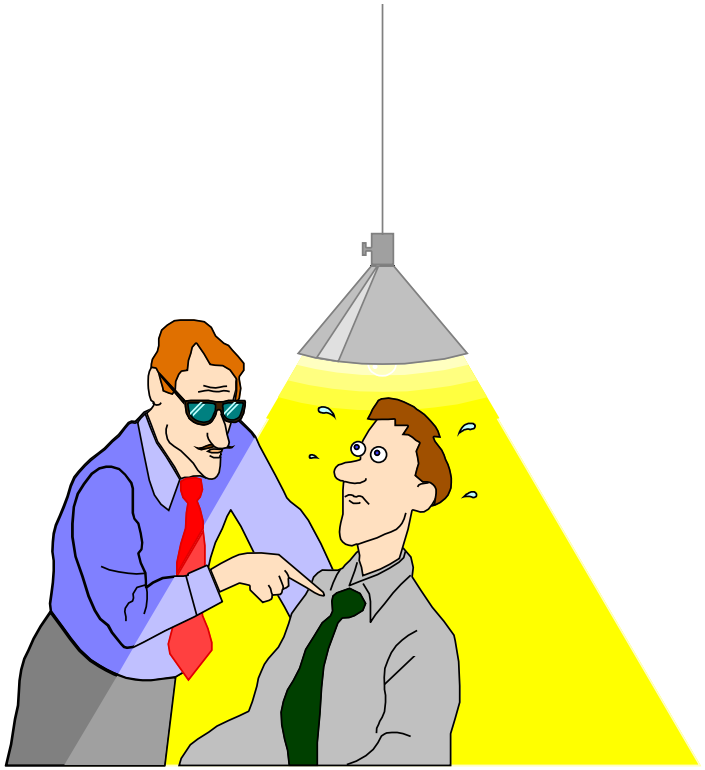
# Reducing respondent burden is an important goal…



…The average quarterly interview is one hour; 10 percent exceed 90 minutes.

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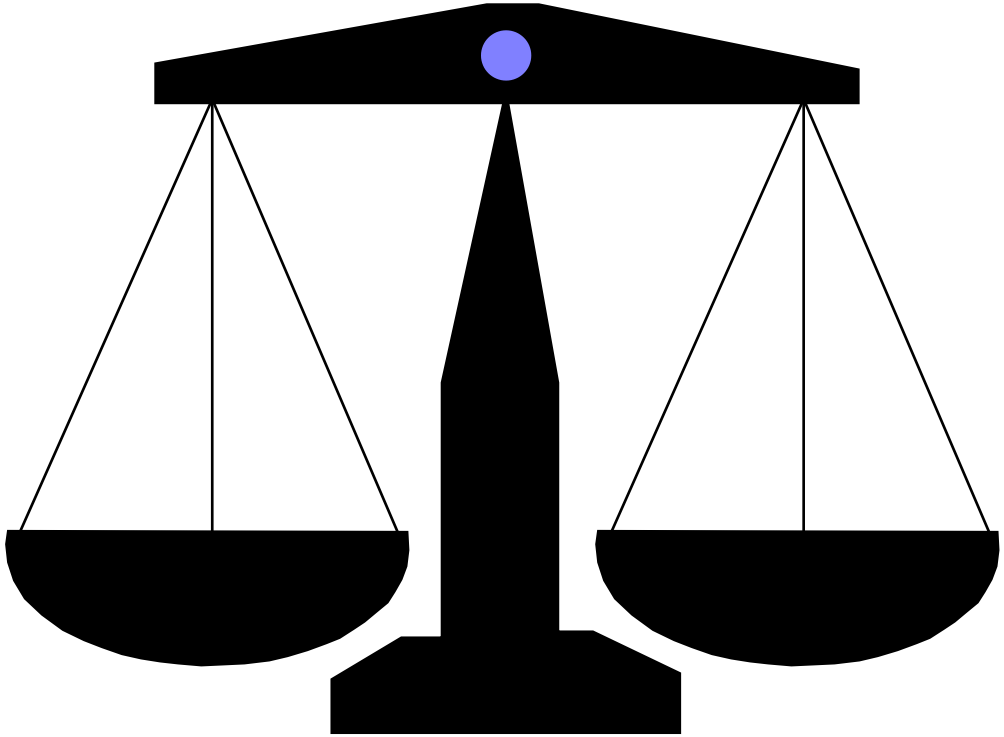
# However, this must be balanced with maintaining high quality of data.



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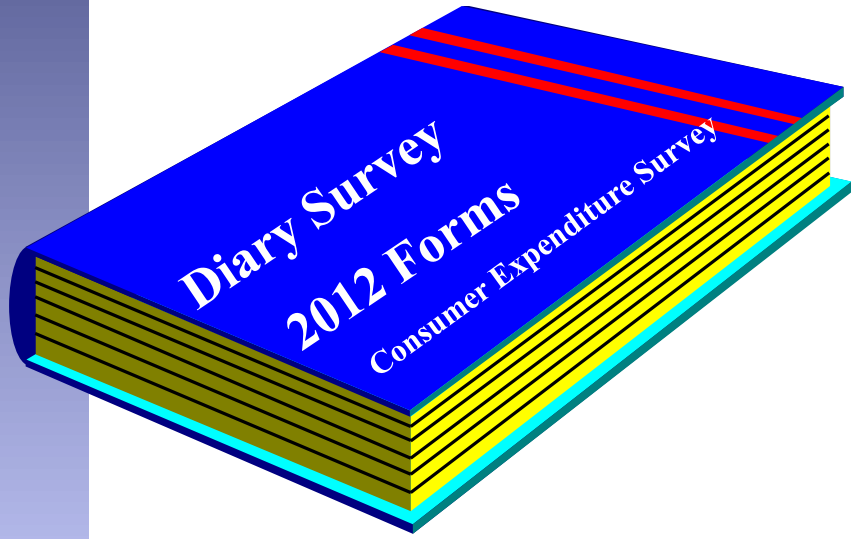
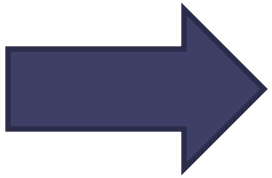
# To achieve this, the CE program is investigating the feasibility of imputing Diary expenditures to Interview.



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# This presentations includes:

1. The conceptual framework currently being investigated
2. Problems encountered or anticipated
3. A request for comments

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# At present, there are three basic categories of expenditure under consideration:

1. Those for which Interview respondents are asked are about "usual" weekly/monthly expenditures
2. Apparel
3. Items collected only in Diary (non-prescription drugs, personal care)

# 1. Respondents asked about "usual" weekly/monthly expenditures

- Food at home
- Food away from home (except on trips)
- Alcoholic beverages at home
- Alcoholic beverages away from home (except on trips)

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# Reasons for considering:

- More detailed information is available in the Diary Survey than the Interview Survey. Example: Interview asks how much was spent in total during a usual week; Diary collects specific items each week (e.g., lettuce, potatoes, rice).
- A "usual" question is also asked for food at home in the Diary. Preliminary research shows that the answers are qualitatively similar to those obtained from the Interview, but different from the weekly responses.
- Confusion caused by the global question (what constitutes a "usual" week?) are eliminated in Diary, which records actual expenditures as they happen.

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# 2. Apparel

Reasons for considering:

- Burden reduction.
  - In 2010, 77 percent of respondents reported expenditures for apparel and services (Section 9). In these cases:
    - Section 9 accounted on average for 7 percent of total interview time (4 minutes), and increased with family size.
    - 25 percent of reporters required more than 5 minutes to complete the section; 10 percent required nearly 9 minutes.
- Many items collected in both surveys are selected from the Diary for integrated publications.

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# 3. Items collected only in Diary (non-prescription drugs, personal care)

Reasons for considering:

- To improve quality of supplemental poverty measures
- Positive externality (side benefit) for public use microdata users

# The first item considered is food at home.

Thought to be the simplest item to model.

- Nearly 99 percent of all consumer units in the Interview Survey reported food at home expenditures in 2010.
- Percent reporting weekly expenditures in the Diary Survey was presumed to be similar.

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# Until…

# REALITY CHECK ☑

- While large, percent reporting each week is much lower—about 81 percent in 2010.
- A two-stage approach (stage 1: predict probability of purchase this week; stage 2: predict level of expenditure if shopping occurs) is needed.

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# Still, a general framework is constructible.

- Using Diary data, estimate a binary variable (shopping occurred=1, shopping did not=0) and separately model level of expenditures for those who shopped.
- Because there are 13 weeks in a quarter, predict 13 binary outcomes for each consumer unit in the Interview Survey, by applying parameter estimates from the Diary model.
- Similarly, predict level of shopping 13 times, if it occurred.
- Multiply the binary and level variables.
- Sum the 13 results, each of which is $0 or positive. The outcome is the estimated quarterly expenditure for food at home.

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# REALITY CHECK

## Survey nonresponse plays a role.

- A sizeable minority (8 to 10 percent each year since 2006) participate for only one of the two Diary weeks.
- In publication, each week (whether or not two are present) is treated independently. However: Those who participate in both Diary weeks were different than those who participated in only one.
  - 83 percent of two-week participants report food at home expenditures each week, compared to 74 percent of second-week-only participants, and 51 percent of first-week-only participants.
  - Even among purchasers, week-one-only participants spend far less on average on food at home ($49) than week-two-only participants ($75) or both-week participants ($85).
  - Conclusion: Not only are one-week only participants different from both-week participants, but first-week-only participants are different than second-week-only participants!

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# Additionally, there is no reason to presume *a priori* that the lack of reports of purchase are invalid…

**…The qualities that cause the respondent to participate only one week (e.g., too busy) may also explain why they did not purchase food during the week of participation.**

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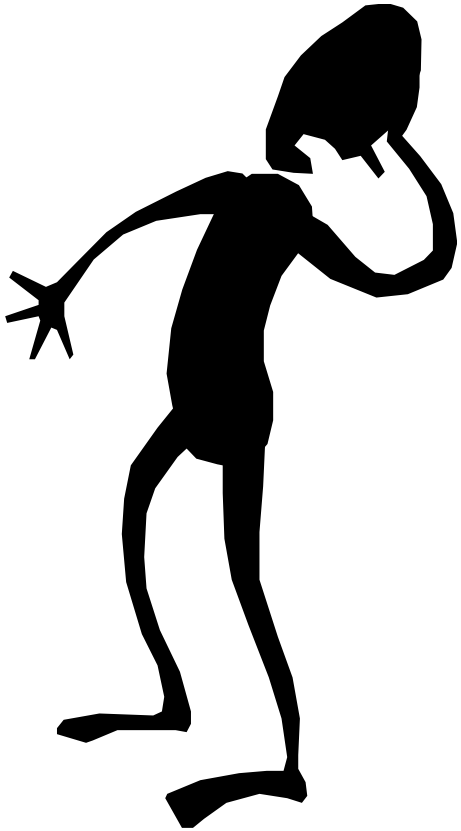
# Another complication:



Last one, I promise…

# Temporary Absence

- According to Diary Survey methodology, even two-week participants can have at least one week counted as a valid Diary, yet be temporarily absent (out of town, in the hospital, or away for another reason).
- By definition, a temporarily absent consumer unit cannot have expenditures for food at home. (Apparel, yes. Food at home, no.)

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# Taking into account all these factors, the following construct is being tested:

- Use multinomial logit on Diary data to predict participant type (first-week only, second-week only, or both weeks) for each Interview family;
- Predict, 13 times, the probability of temporary absence during the week;
- Using only those present, model probability of purchase, and apply to Interview 13 times per record;
- Using only those who purchased food at home, model expenditures and apply to Interview 13 times per record.

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# Status:

- A working prototype of the system is producing results for all consumer units. It is flexible to allow for different models by family type, as the age, income, and other effects for single persons is expected to be different than that for married couples, families with children of different ages, etc.
- Results of the prototype are being evaluated for quality assessment.
  - Predicted probabilities at each stage are compared to actual frequencies.
  - Mean Absolute Deviations (model predicted food expenditures compared to actual reported food expenditures) are being analyzed.
  - Differences between final estimates (once four stages are combined) and reported values are being compared using standard univariate and t-tests.

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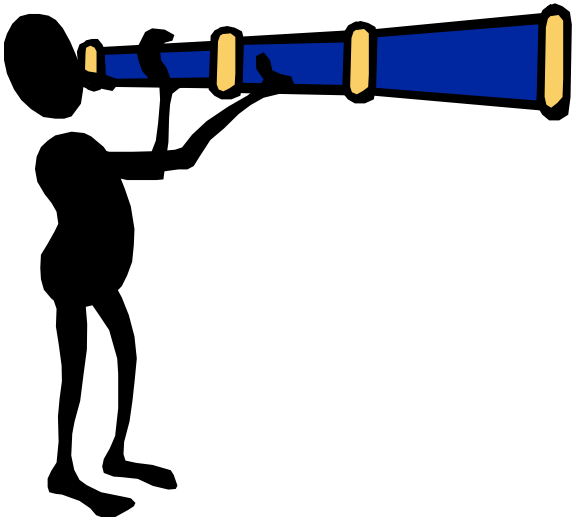
# Looking ahead:



# Apparel

# Anticipated questions

- While a person who is temporarily absent can buy apparel while away from home, it cannot be observed in the Diary.  How frequently does this occur, and what is its effect on outcomes?
- Given that, unlike food at home, many apparel items are likely to be purchased at most one time per quarter, does the 13-week-by-week estimation still make sense?
  - How many consumer units in Interview will be predicted to purchase these items once, twice or more, or not at all each quarter?
  - What will the sample size required to model levels of expenditures using purchasers only?

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# General questions

- Quality assessment:  Once acceptable results are obtained for Diary participants, how do we demonstrate that the imputed values in Interview are better than—or at least as good as—those actually reported?
- What are the unintended consequences of replacing reported with imputed data?
  - Can/will covariate relationships be preserved (e.g., food at home with apparel)
  - If not, what are the implications for the supplemental poverty measures, and other important uses of the data?

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# Technical Questions

- Should single or multiple imputation be used?
- If multiple imputation is used, what is the proper way to use income, which is itself multiply imputed?
  - Use average imputed income for each consumer unit the same way as a non-imputed variable would be used, generating five imputations of the Interview expenditure variable
  - Obtain a regression estimate using the five imputed income values; shock; repeat four times. In this way, 25 regressions yield 5 imputed expenditure values per consumer unit.

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# Next Steps:

- Continue refining food at home model and assessing quality of results
- Receive and incorporate comments and suggestions from experts like you(!)
- Prepare proposal for next phase by September 28, 2012

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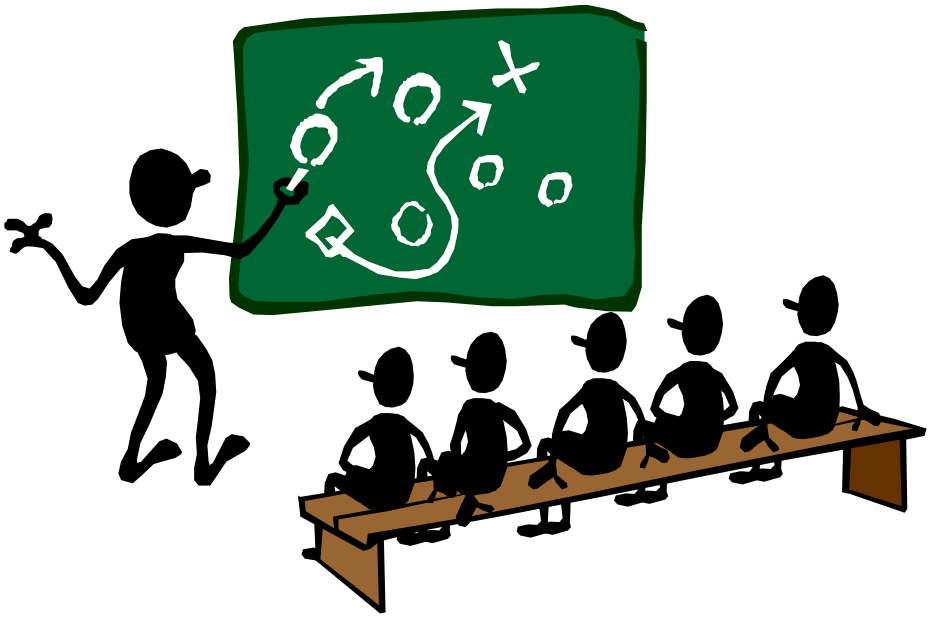
# If you have any suggestions, comments, or questions of your own…



…The team looks forward to hearing from you.

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# Contact Information

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