

# Rotation Group Bias in Reporting of Household Purchases in the U.S. Consumer Expenditure Survey

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## Abstract

We find rotation group bias in reports of spending in the U.S. Consumer Expenditure Survey. Contrary to our expectations, the more waves respondents complete, the higher the quality of their responses. Respondents become more likely to report the amount of money spent on purchases and less likely to report rounded amounts. There is no change over waves in the number of purchases reported or the average amount of money spent on the purchases.

**Keywords:** Consumer expenditure; Rotation group bias; Misreports; U.S. Consumer Expenditure Survey

**JEL codes:** C83; D12

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## 1. Introduction

The Consumer Expenditure Survey (CE), an important source of information about consumer spending and income in the U.S., interviews households repeatedly about household expenditures. CE respondents are interviewed every three months over ten months. Every month, a new *rotation group* is interviewed for the first time. This design creates a rotating structure where, in each month, some households are interviewed for the first time, others for a second time, and so on (National Research Council, 2013; U. S. Bureau of Labor Statistics, 2016).

In each wave, CE respondents report household expenditures for the three months before the interview. Reports of purchases trigger follow up questions (e.g., the amount of money spent). This questionnaire structure in combination with respondents being interviewed several times raises concerns that respondents may misreport expenditures in subsequent rounds to avoid the follow up questions. Such respondent techniques to reduce survey length or burden are called motivated misreporting (Eckman et al., 2014). Respondents may learn during the first wave that reporting fewer purchases makes the survey shorter and therefore under-report purchases in later waves (National Research Council, 2013, pp. 84-85).

Changes in reporting behavior over time-in-sample (TIS) are called *rotation group bias* (RGB) (Bailar, 1975). RGB occurs in the Current Population Survey (CPS), which has a similar design and questionnaire to the CE. The CPS interviews households repeatedly about the labor force status of all persons 15 and over; each time unemployment is reported, follow up questions about job search behavior are triggered. With increasing TIS, respondents

tend to report that they are out of the labor force rather than unemployed, to avoid the follow up questions (Halpern-Manners and Warren, 2012).

The structure of the CE questionnaire parallels that of the CPS questionnaire. However, the CE interview is longer than the CPS and contains many more questions that trigger follow ups. Thus, we worry that RGB in the reporting of purchases occurs in the CE. RGB could also affect responses to the follow up questions themselves. When reporting about purchases in later waves, respondents might take cognitive shortcuts by rounding the amount spent or not reporting the amount.

We briefly describe the CE in more detail in the next section, before we present our identification strategy. Our results demonstrate that RGB occurs in the CE. Contrary to our expectations, however, CE respondents tend to give higher quality responses with increasing TIS.

## **2. Data and Identification**

The rotating design described above supports the identification of RGB in the CE. Since all four rotation groups are sampled from the same population and with the same sample design, the only difference between the four groups (in expectation) is their experience with the survey (U. S. Bureau of Labor Statistics, 2016). We consider each month as a quasi-experiment: each rotation group is treated with increasing levels of treatment intensity (that is, survey experience). To control for potential confounding due to panel attrition (respondents dropping out without completing four waves) in the estimates of RGB, we restrict the sample to cases that responded to all of their four waves. We use data collected from April 2017 to March 2018.

However, we use information about the previous and subsequent nine months to determine which cases were interviewed four times. For example, consider a case that responded for the first time in March 2018. It is included in our data if and only if it went on to respond three additional times. However, only data from the case’s first wave are included, because only that wave falls into our time window. This process leaves us with a sample of 6,826 cases and 15,553 interviews.

We analyze RGB in four outcomes: the number of purchases reported, the mean amount spent on a purchase, the number of reports where the reported amount is rounded (as defined in Wilson and Abdirizak (2017)), and the number of reports for which the amount spent is missing. Table 1 gives descriptive statistics for the four outcome variables. We include expenditures from six sections of the CE (clothing, memberships, utilities, vehicle licensing expenses, vehicle operating expenses, and miscellaneous). We expect RGB, if present, to be most easily identified in these sections because they had the highest ratio of reported purchases to items asked about. If RGB and motivated misreporting are present, we should see fewer purchases, more rounded amounts and more missing values with increasing TIS. Moreover, we should see an increase in the mean amount spent on a purchase over TIS as respondents become less likely to report small expenses.

We estimate the magnitude of RGB using the Krueger et al. (2017) method, also used by Hirsch and Winters (2016): Separately for each of the 12 months in our data set (April 2017 to March 2018), we divide the sample mean of each outcome in a given rotation group by the average across all four rotation groups and multiply the result by 100. Let  $p_{i,t,m}$  be the number

Variable	N	Mean	Median	Std Dev	Min	Max
No. of reported purchases	15,553	9.18	8	6.75	0	59
Mean amount spent on a purchase	15,306 <sup>a</sup>	210.41	172.5	172.84	0 <sup>b</sup>	5,100
No. of rounded values in amount question	15,371 <sup>c</sup>	2.56	2	2.37	0	26
No. of missing values in amount question	15,371 <sup>c</sup>	0.10	0	0.45	0	9

<sup>a</sup> Purchases with missing amounts dropped from calculation.

<sup>b</sup> Six participants reported costs of zero for all of their purchases. Excluding those cases from the analyses does not affect results substantially.

<sup>c</sup> Amount question not asked when no purchases reported.

Table 1: Descriptive Statistics for Outcomes

of reported purchases by respondent  $i$  with TIS  $t$  in month  $m$ . RGB in the number of reported purchases among the TIS 1 cases in month  $m$  is:

$$RGB_{1,m}(p) = \frac{\bar{p}_{\cdot,1,m}}{\bar{p}_{\cdot,\cdot,m}} \times 100 \quad (1)$$

where  $\cdot$  indicates the groups over which the averages are taken.

The interpretation of these values is straightforward: any substantial deviation from 100 indicates RGB. Values smaller than 100 indicate that respondents in a specific TIS report fewer purchases than the average across all TIS interviewed in the same month. RGB is defined and interpreted similarly for other TIS, months, and outcomes.

### 3. Results

Results for the four outcome measures are shown in Figure 1. Looking first at the graph for the number of purchases, the thin lines show RGB by TIS, separately for each month. There is no clear trend in RGB over TIS and no evidence that respondents report fewer purchases with each additional wave. The average trend across all twelve months, shown by the thick solid line, confirms this finding. The second outcome, the mean amount spent on a

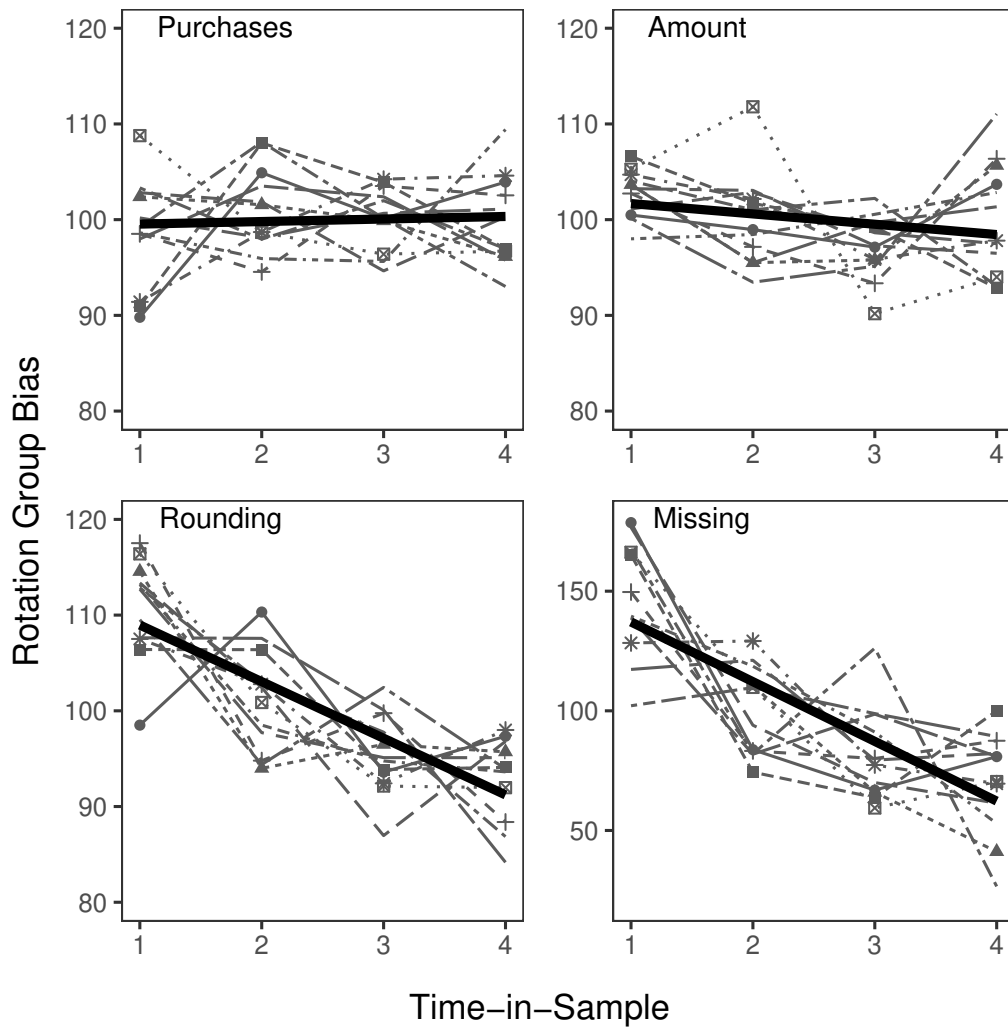


Figure 1: RGB in the four outcome variables, by TIS and month. The thick solid line indicates the average RGB over TIS.

purchase, also does not show a clear trend. That is, the mean amount spent on a purchase seems to be constant over TIS. Repeating this analysis with the median amount spent on a purchase produces similar findings (results not shown). Regarding the third outcome, the number of rounded amounts, the figure tells a different story. Contrary to our expectations, there are fewer missing amounts over TIS in almost every month. The average trend is downward. The fourth panel is similar. Respondents report fewer missing amounts over TIS in almost every month. The average trend is again downward.

Overall, we find no evidence that data quality declines over TIS. Instead, for two of the four outcomes (rounded amounts and missing amounts), respondents become better reporters over the four waves.

#### **4. Discussion**

We have demonstrated that the CE, one of the most important sources of information about consumer spending in the U.S., is impacted by RGB, though not in the expected direction. To estimate RGB, we used the rotating structure of the CE as a quasi-experimental design. Because panel attrition can easily be mistaken for RGB (see Bach and Eckman, 2019, for a discussion of this point), we limit our data set to respondents who completed four waves. There is no evidence of RGB in reports of purchases: respondents do not seem to underreport purchases in later waves to shorten the survey. Furthermore, there is no change in the average amount spent per purchase. Bach and Eckman (2018) also found no evidence of increased motivated misreporting over waves in a monthly web panel. However, our analyses also show that

RGB does exist in the reporting of amounts spent: respondents are less likely to report rounded and missing amounts with each additional wave.

We can think of several possible explanations for these unexpected findings. One is that respondents become more engaged with the interviewing task over time. After the first wave, respondents may realize how important it is that they give accurate reports of their spending. Respondents in later waves are more likely to consult records as they respond to the survey (Edgar, 2010), which may decrease rounded and missing responses (Edgar and Gonzalez, 2009). Another possible explanation is that participating in the first survey makes participants more attentive to subsequent spending, resulting in more precise answers in later waves. Previous research has shown, for example, that participating in a labor market panel survey stimulates respondents to change their labor market behavior by raising their awareness of the behaviors under study (Bach and Eckman, 2019). Similarly, participating in the CE may raise respondents' awareness of their spending behavior, resulting in more accurate reports in the survey. A third explanation is that respondents who found the survey particularly burdensome do not participate in four waves; that is, motivated misreporting may manifest as attrition rather than RGB. Our current approach cannot detect this effect, but we encourage future research to do so. Separating out attrition due to the burden of the survey from other types of attrition will be difficult, however.

Another avenue for future research is estimation of heterogeneous effects – there may be some respondents who do report fewer purchases over TIS. We also encourage additional investigation into when RGB due to motivated misreporting occurs and when it does not: that is, why the CPS and CE,



which have similarly structured questionnaires and sample designs, elicit different response behavior.

Increasing data quality over waves is preferable to decreasing data quality. However, the resulting RGB may still introduce bias in some analyses of CE data, particularly estimates of change over time. Reduction in measurement error over time may be misinterpreted as substantive changes in household consumption. Researchers should carefully think through how RGB affects analyses using CE data.

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