

Heaping at Round Numbers on Financial Questions: The Role of Satisficing

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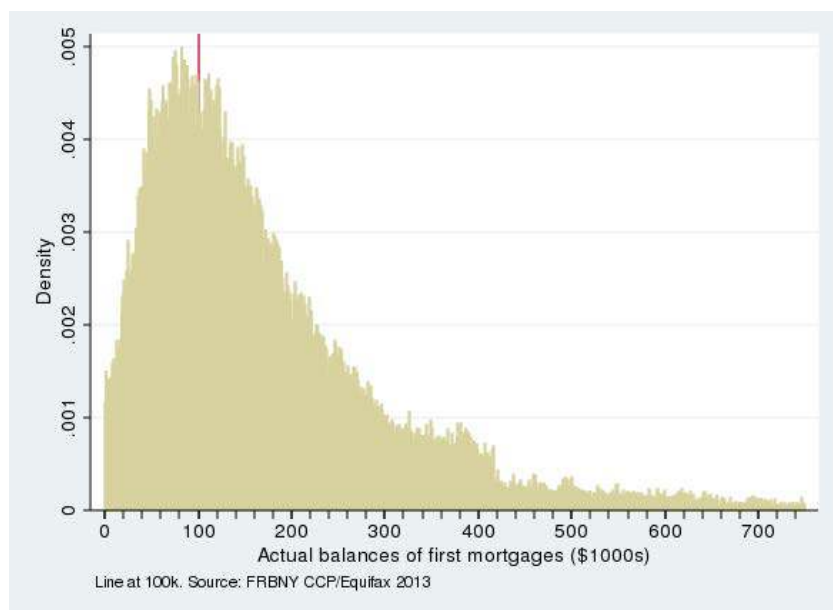
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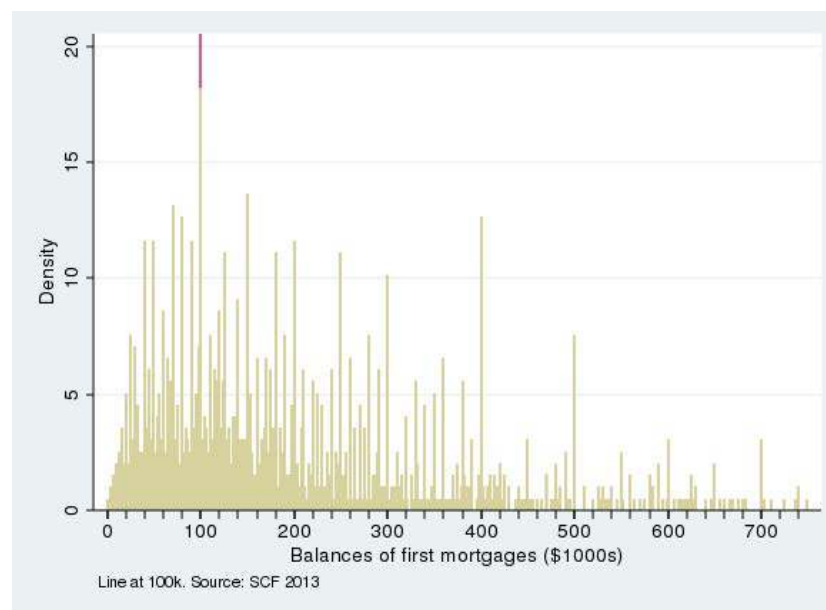
The analysis and conclusions set forth are those of the authors and do not indicate concurrence with other members of the research staff or the Board of Governors of the Federal Reserve System or any other institutions, including the U.S. Census Bureau.

Administrative vs. survey data: mortgages

Administrative (Credit reports)



Survey of Consumer Finances



Observation: “exact values” on survey data show a lot more heaping than administrative data

Background

- Self-reported financial data often treated as exact, true values.
- Evidence of heaping at round numbers
 - Earnings (Schwabish 2007)
 - Self-reported consumption expenditure (Pudney 2008)
 - Wealth questions in SIPP data (Eggleston 2015)
- Why do we care?
 - Inference using coarse data are sensitive to assumptions about coarsening mechanism (Heitjan and Rubin, 1990).
 - If you know something about the process, better inferences
 - Using thresholds, e.g. IRS determining non-filing rates using survey data

Research questions

1. Do patterns of heaping vary across questions and surveys?
2. Is heaping consistent with satisficing?

End goal: Do round “exact values” provide more or less precision than range/bracket alternatives in surveys? What is the impact of round “exact numbers” in applied analyses?

Conceptual framework: Satisficing

- Response behavior that yields “good enough” response, but not the “optimal” response
- Krosnick (1991):

$$P(\textit{satisficing}) = \frac{(\textit{task difficulty})}{(\textit{ability}) \times (\textit{motivation})}$$

- If rounding is a result of satisficing,
 1. Higher ability & motivation → less rounding
 2. More difficult tasks → more rounding

Data

- Survey of Consumer Finances (2013)
 - Nationally representative of *all* American households. CAPI. Contains detailed data about household income, assets and debts. N~6000 in survey analysis N=2096. Sponsored by Federal Reserve Board, data collected by NORC.
- Cognitive Economics Study (2011)
 - National sample, *older* adults, panel (2008-). Self-administered, web and mail modes. Asset/debt questions about household level. Contains detailed data about income, assets and debts. Less-detailed than SCF. N~900; analysis N=304.
- Analyze question-respondent level data
 - Variety of questions about financial values
 - Restricted to value responses (excludes ranges and item non-responders)
 - Random effects regressions

Measurement: roundness of responses

$$rounding = \frac{(m - n)}{(m - 1)}$$

- n = # of significant digit reported
- m = max possible significant digit (magnitude)
- $rounding$ between 0 and 1
- more trailing zeros \rightarrow higher value of $rounding$

Examples

Ex 1: response of \$3,000

$$rounding = \frac{(m-n)}{(m-1)} = \frac{(4-1)}{(4-1)} = 1$$

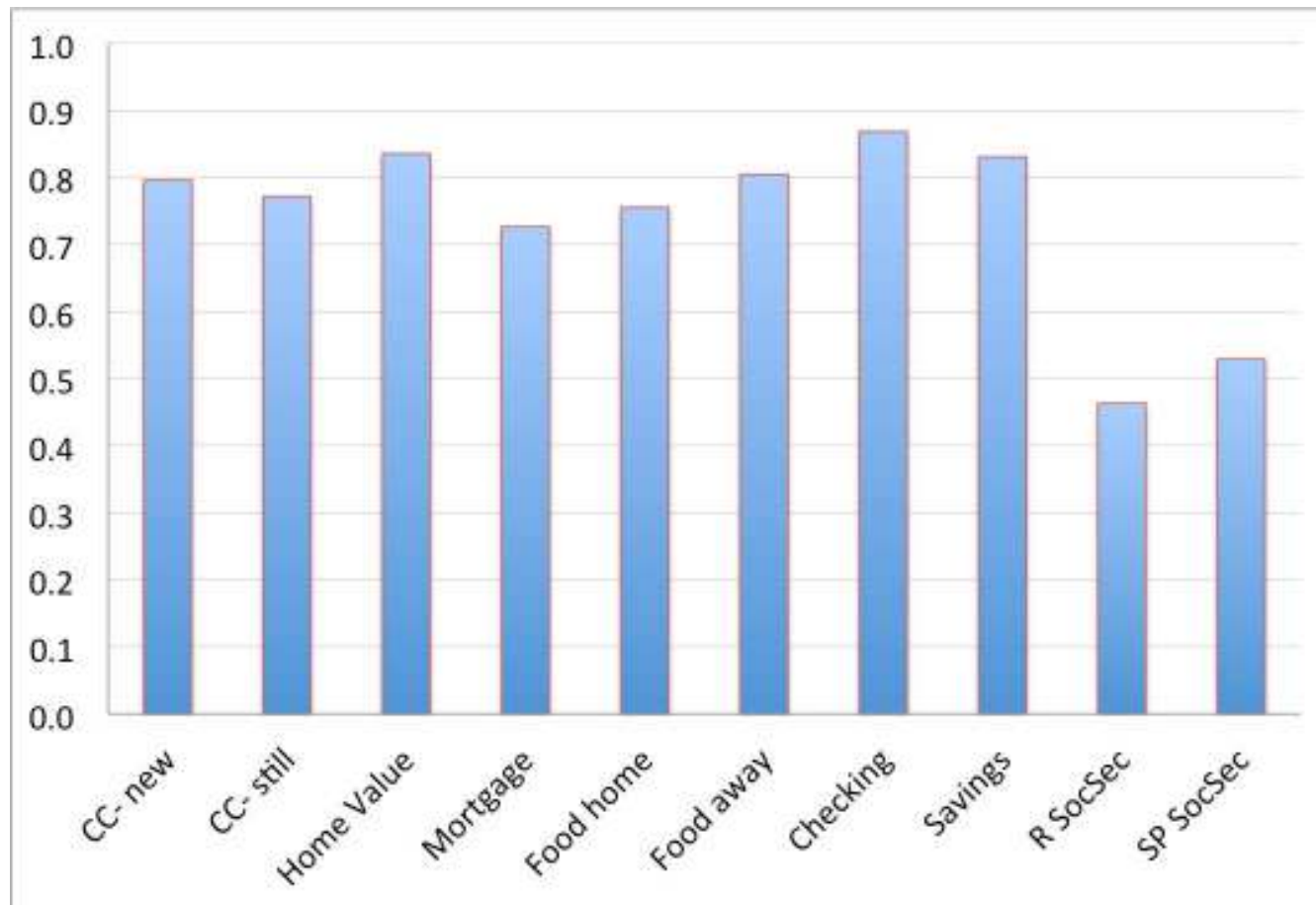
Ex 2: response of \$53,000

$$rounding = \frac{(m-n)}{(m-1)} = \frac{(5-2)}{(5-1)} = 0.75$$

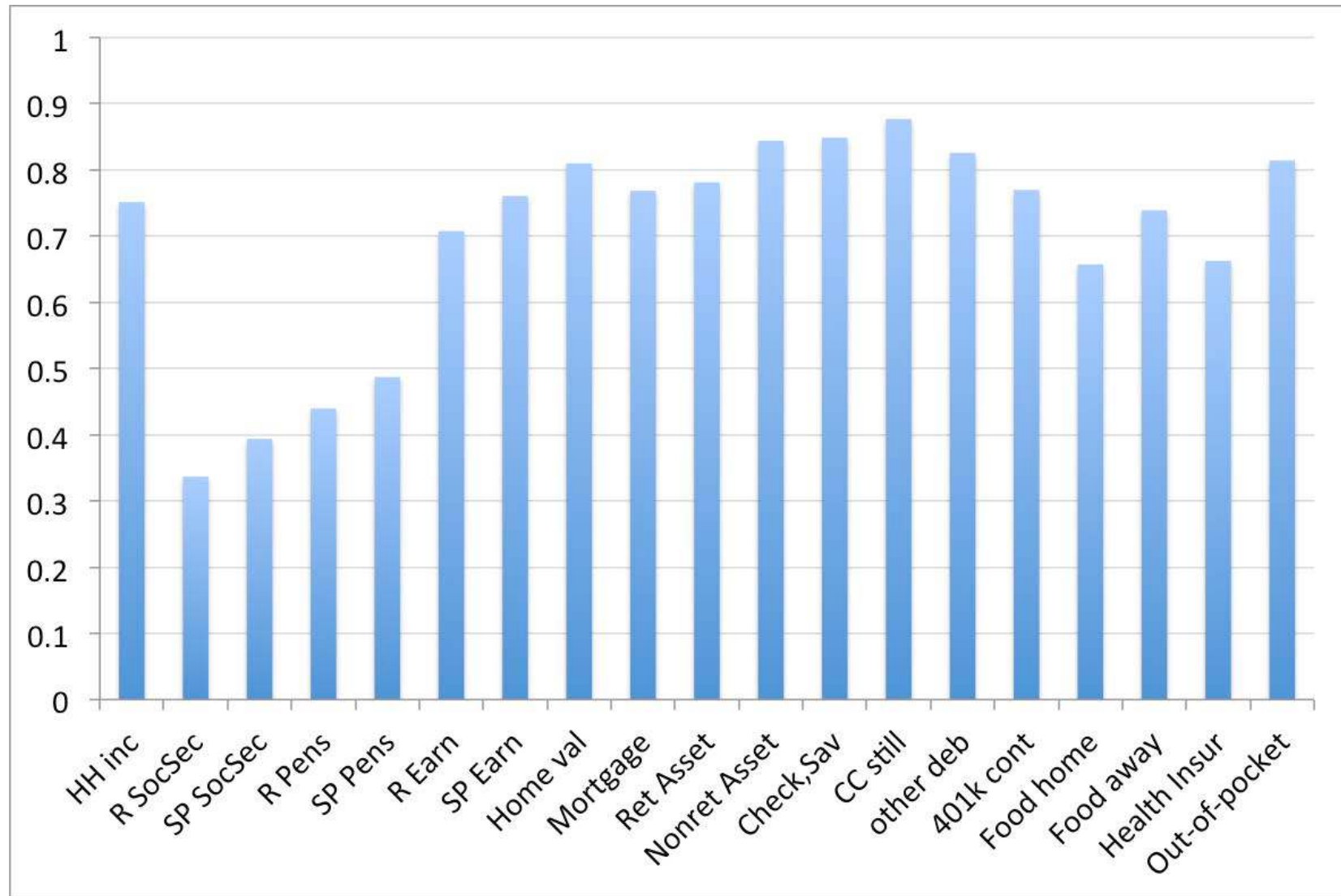
Ex 3: response of \$53,233

$$rounding = \frac{(m-n)}{(m-1)} = \frac{(5-5)}{(5-1)} = 0$$

Rounding across questions on SCF 2013



Rounding across Qs on CogEcon (2011)



Measurement: task difficulty by question type

- Knowable questions: single account
 - Value of a single checking account
- Knowable questions: aggregated
 - Total income (wages + interest + ...)
- Unknowable questions
 - Home values
- Differences can arise at any stage of response (Tourangea 1984)
 1. Comprehension
 2. Information retrieval
 3. Integration
 4. Response formulation

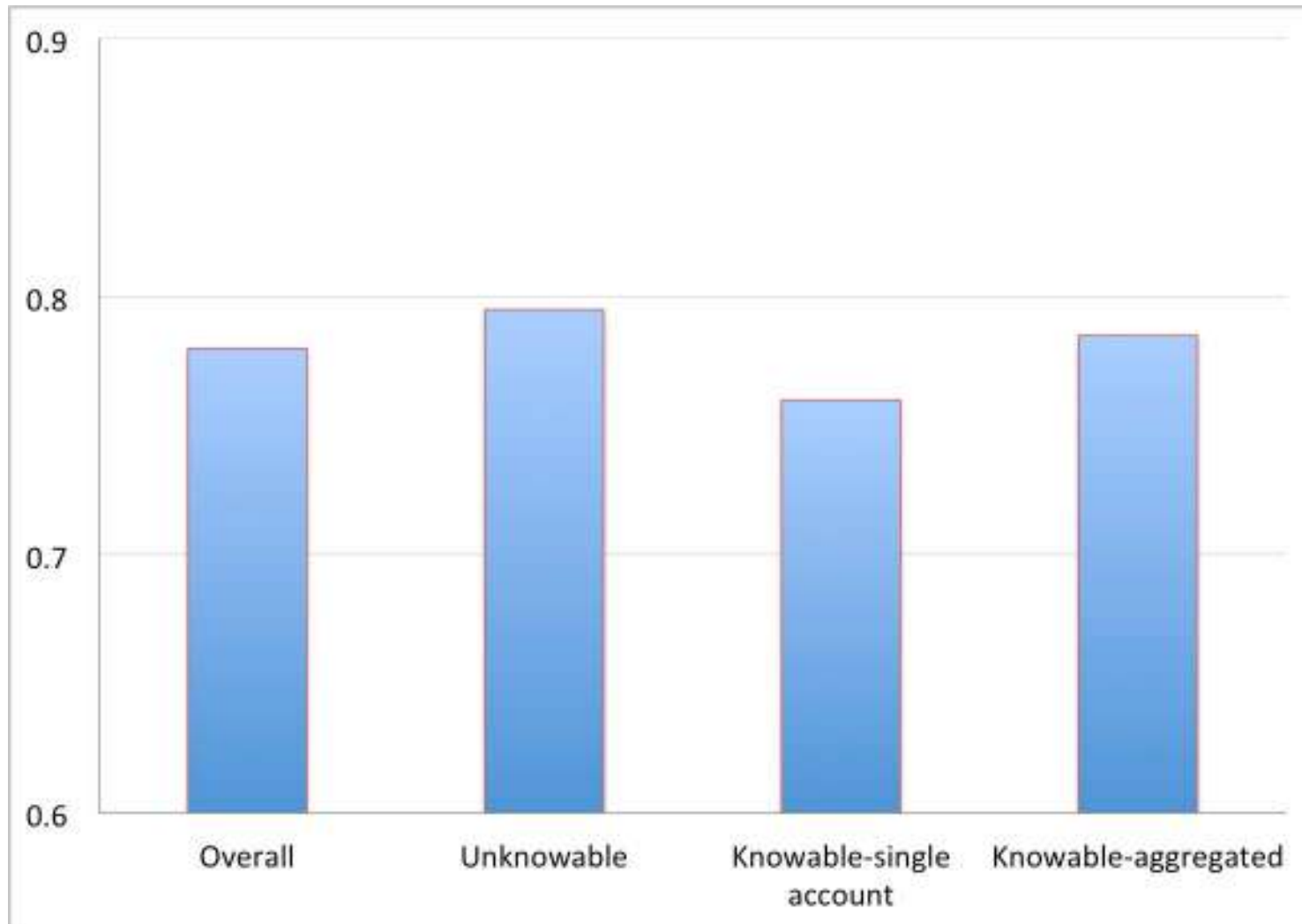
Measurement: task difficulty (2)

	QUESTION TYPE		
STAGES OF RESPONSE	Knowable, Aggregate	Knowable, Single	Unknowable
(1) Comprehension	NA	NA	NA
(2) Information retrieval	Multiple pieces of information	One piece of information	Multiple uncertain pieces of information
(3) Integration	Concrete-difficult	Concrete-easy	Abstract-difficult
(4) Response formulation	Privacy less important	Privacy more important	Privacy less important

SCF: Categorizing questions into types

- Unknowable: Home value; Food at home; Food away from home
- Knowable, single account: Mortgage; Checking; Savings; Social Security income
- Knowable, aggregate: Credit cards (new charges); credit cards (balance outstanding)

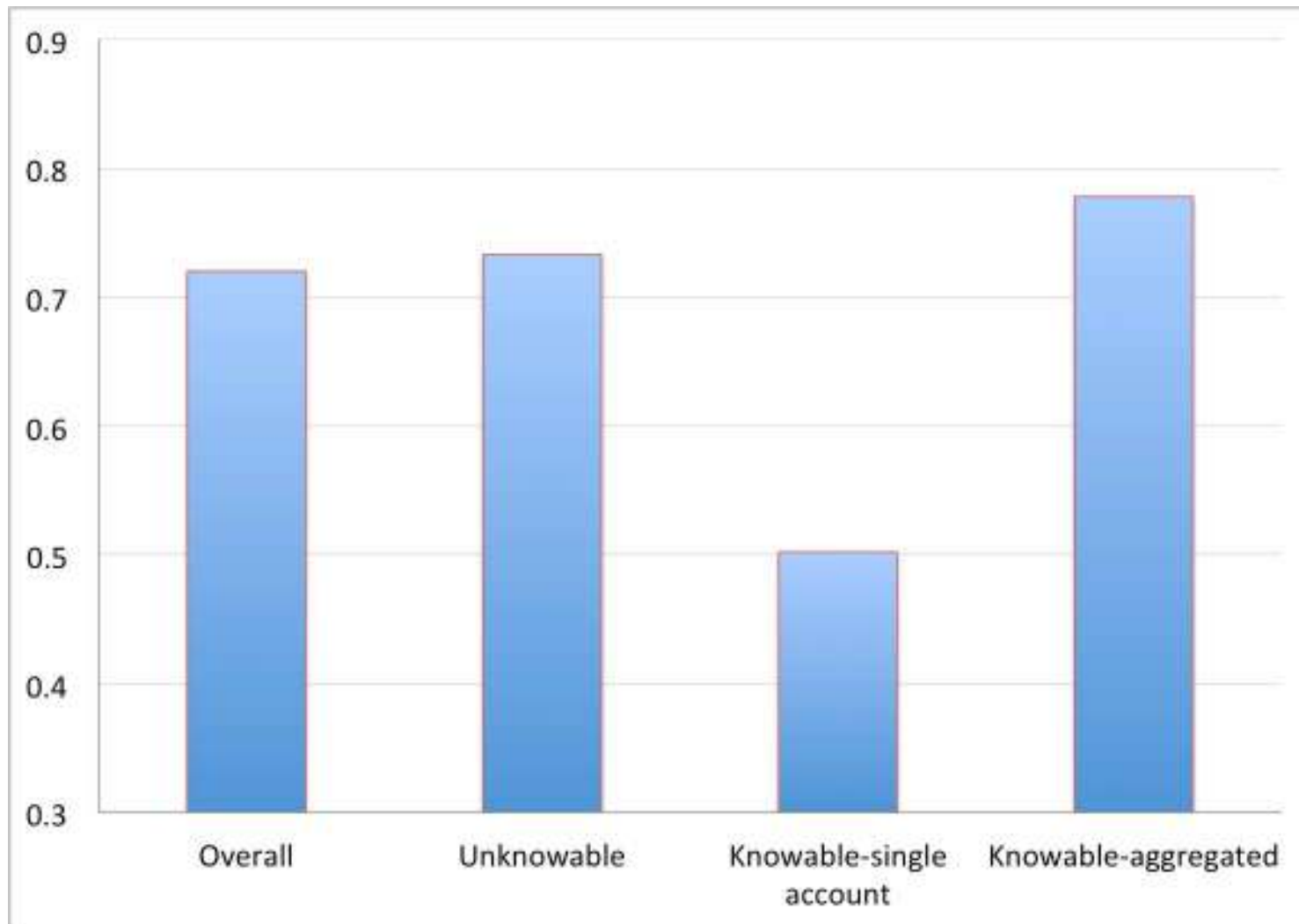
Rounding across Q type: SCF



CogEcon: Categorizing questions into types

- Unknowable: Home value; Food at home; Food away from home
- Knowable, single account: Social Security income; Pension income; Mortgage
- Knowable, aggregate: Total household income; Earnings; Assets in tax-favored retirement accts; Assets outside tax-favored ret accts; Check, Savings, CDs; credit card (balance outstanding); other non-housing debt; 401(k) contributions; health insurance; health spending out-of-pocket

Rounding across Q type: CogEcon



Rounding as a response strategy

- Run random effects regressions for all questions, then for each question type
- Intraclass correlation tells us the level of correlation in rounding within respondents
- Results:
 - Higher for knowable and single-account questions
 - Lower correlation when we include the individual specific predictors, evidence that observable characteristics explain some but not all of the correlation within respondents.

Measurement: ability & motivation

- Ability
 - Proxy with education (SCF and CogEcon)
 - Direct measures of cognition: Number Series; memory score (CogEcon)**
 - CFO—most knowledge person in household (CogEcon)
- Motivation
 - Need for Cognition (CogEcon)**
 - Consulting records (SCF and CogEcon)
 - Response latencies (CogEcon)

**All CogEcon respondents also completed a comprehensive personality and cognitive assessment (CogUSA)

Ability

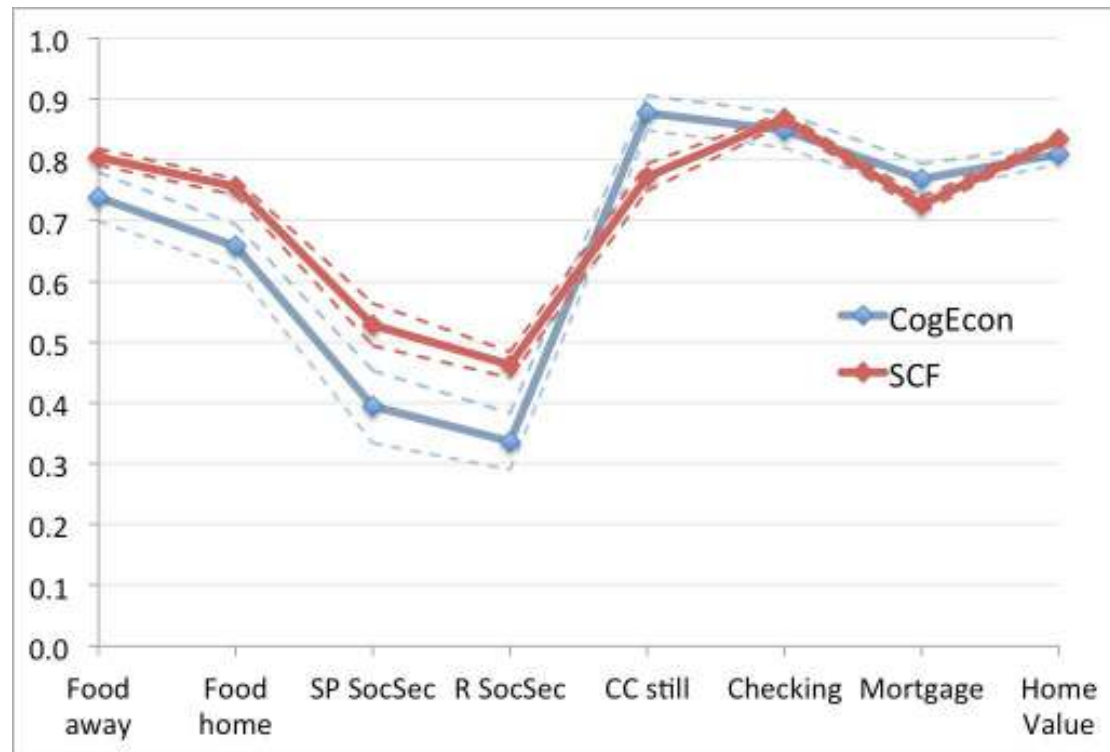
- Education: no clear relationship (SCF, CogEcon)
- Household CFO: most knowledgeable person in the household → round less (CogEcon)
- Number Series: no clear relationship (CogEcon)
- Episodic Memory: better memory → less rounding (CogEcon)
- Bottom line: Not all forms of ability contribute equally to response process

Motivation

- Need for Cognition: higher motivation → less rounding (CogEcon)
- Respondent consulted records → less rounding (SCF, CogEcon)
- Consulting records has larger effect for knowable questions
- Records only help increase precision when they contain information needed to answer the question

Motivation (2)

- Question order: motivation may wane as survey progresses



- Similar questions in completely different order, but exhibit similar rounding patterns

Alternative hypothesis: sensitivity?

- Another explanation: people round to blur answers to sensitive questions
- Analyze response times by question (CogEcon)
 - Satisficing: round answers take shorter time (cognitive shortcut)
 - Sensitivity: round answers do not take shorter time (blur answers at final stage of response)
- Results: Longer time → less rounding.
 - Consistent with rounding as a cognitive shortcut

Alternative hypothesis: sensitivity? (2)

- Single vs. aggregated amounts:
 - Satisficing: least rounding for single-account Qs
 - Sensitivity: most rounding for single-account Qs, since aggregation shields amount in individual accounts
- Results: Single-account Qs → less rounding
 - Consistent with rounding as a cognitive shortcut.
- Caveat: analysis mostly on variation within respondent.
 - Need further analysis to assess variation across respondents (more sensitive types of people)

Conclusion

- Rounding largely consistent with satisficing
 - More difficult questions → more rounding
 - Motivated → less rounding
 - Higher ability: mixed results
- No evidence that rounding is related to sensitivity/privacy
 - Mode could matter
- Endogenous choice of info retrieval strategy?
 - Memory vs. consulting records: Related to ability and motivation

Next steps

- SIPP 2008 and redesigned 2014 to unpack question difficulty
- Use time on survey before presented with a Q to test whether fatigue is associated with greater rounding
- Implications for survey design: trade-off between precision and respondent burden?

Thank you!

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