

Impact of Round Number Bias on Gift Card Valuation

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Research Motivation

- Monroe (2003): people do not react strongly to small changes in price
- Flynn, Lynn & Helion (2013): people use round numbers when prompted to “name your own price”
- Thomas & Morwitz (2005): prices ending in 9 are perceived as cheaper than other numbers

15-inch from \$1999 **vs.** from \$2000

- Mathematically ***negligible*** difference: 0.05%
- Psychologically / cognitively: ???

Problem Statement

- Null Hypothesis: People value gift cards at whole numbers and ignore small decimals
- Alternative Hypothesis: People value gift cards at whole numbers but also take into consideration small decimals

Experiment Design - Craigslist #1

- A Google form is made to collect bid, along with 4 personal information (PI) as covariates:
 - year of born, education level, income, gender
- 4 groups of US cities are selected and designated as treatment and control candidates, assuming geographic proximity grand sample similarity, hence random assignment:
 - NYC (\$50.45) vs. Boston (\$50)
 - Dallas (\$50.08) vs. Houston (\$50)
 - San Diego (\$49.92) vs. Los Angeles (\$50)
 - Seattle (\$49.55) vs. Portland (\$50)
- Craigslist post is made for each city with a survey link

Experiment Design - Craigslist #2

- 4 groups of US cities are selected and designated as treatment and control candidates, assuming geographic proximity grand sample similarity, hence random assignment:
 - NYC (\$50.45) vs. Boston (\$50)
 - Dallas (\$50.08) vs. Houston (\$50)
 - San Diego (\$49.92) vs. Los Angeles (\$50)
 - Seattle (\$49.55) vs. Portland (\$50)
- Craigslist post is made for each city with a gift card offer:
 - Bidder is asked to respond to post owner by email with their bid
 - No PI collection, no external link

Experiment Design - Craigslist

You are bidding on an Amazon.com gift card valued at \$50.08



Thanks for your interest, please indicate your bid: *

Email address to receive the card if your bid wins: *

To make sure you are not a robot, please answer two simple questions:

In what year were you born?

Your gender?

- Male
- Female
- Other

sale - by owner > create posting

contact info

email
 CL mail relay (recommended)
 no replies to this email

users can also contact me:
 by phone by text phone number contact name

posting title price specific location postal code

posting body please enter phone numbers as contact info above, not in posting body below.
I have a gift card for Amazon.com worth \$49.55 that I don't want. If you are interested, please use the following form to submit a bid on what you would be willing to pay for it.
https://docs.google.com/forms/d/1y5nx4DguoyN_SLLWWOIiJ3zM8eq_1EUAA-VJdyC6g5I/viewform?usp=send_form

posting details

make / manufacturer model name / number size / dimensions
condition include "more ads by this user" link

show on maps
street optional
cross street optional
city

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Pilot Results - Craigslist Design

- Design #1: all posts are flagged for removal within ~30 minutes after activation.
 - Policy violation: "You agree not to collect users' personal and/or contact information ("PI")"
- Design #2: majority posts are flagged for removal, only 3 survived, received 15 responses
 - Craigslist users are flagging our post.
 - Some responses did not meet our requirements (not \$)
- Pilot failed. Design is unfeasible - need alternative!!!

Experiment Design - Qualtrics & AMT

- Qualtrics survey:
 - treatment / control: how much would you pay for an Amazon.com gift card valued at \$[x]?
 - [x]: a random value chosen between (49.55, 49.92, 50.00, 50.08, 50.45) at the survey time.
 - also ask 4 personal questions: gender, income, education level, and age
- Survey runs on AMT for one week:
 - title: 5 easy questions in 1 minute for \$0.25

Experiment Design - Qualtrics & AMT

How much would you pay for an Amazon.com gift card valued at \$49.92?

What is your gender?

- Male
- Female

Indicate total household income:

What is your highest level of education?

- Some High School
- Some College (no degree achieved)
- Associates Degree
- Bachelors Degree
- Graduate Degree (Masters, Doctorate, etc.)

What is your age?

Responses

- Received 433 responses in total,
- 23 (5.3%) empty entries: mainly from outside of US, and only a small fraction, thus no *differential attrition* concern,
- 36 duplicate IP addresses, due to extending survey with name change to collect more data,
- Using Google Maps API to obtain timezone info and create region covariate.

Responses

How much would you pay for an Amazon.com gift card valued at \$50?	How much would you pay for an Amazon.com gift card valued at \$50.08?	How much would you pay for an Amazon.com gift card valued at \$50.45?	How much would you pay for an Amazon com gift card valued at \$49.55?	How.much would you pay for an Amazon.com gift card valued at \$49.92?
Min. :20.00	Min. : 0.00	Min. :10.00	Min. : 4.00	Min. :15.00
1st Qu.:40.00	1st Qu.:40.00	1st Qu.:40.00	1st Qu.:35.00	1st Qu.:39.99
Median :45.00	Median :40.00	Median :45.00	Median :40.00	Median :45.00
Mean :42.36	Mean :40.55	Mean :41.54	Mean :40.28	Mean :41.73
3rd Qu.:50.00	3rd Qu.:49.00	3rd Qu.:50.00	3rd Qu.:49.00	3rd Qu.:47.50
Max. :50.00	Max. :50.08	Max. :50.45	Max. :50.00	Max. :50.00
NA's :352	NA's :351	NA's :334	NA's :352	NA's :366

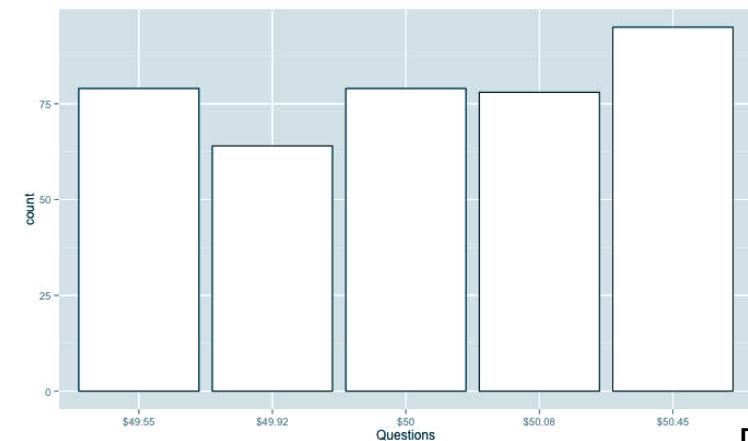
Really clear there are outliers: from \$0 value to some gift card valuations higher than value dollar amount.

Data Analysis

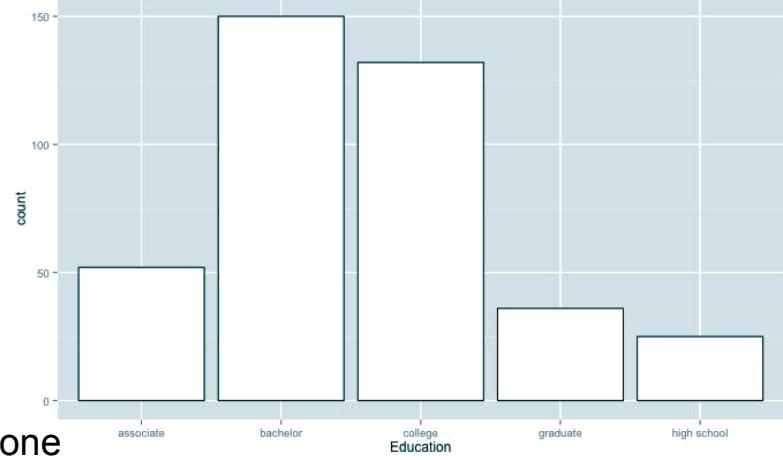
- Cleanup:
 - remove 23 incomplete entries, and only keep 4 US time zones
 - remove 36 second entries from the duplicate IP addresses to eliminate potential *spillover* effect
 - remove 14 entries with <\$20 response (considered not serious)
 - create dummy variables for **treatment conditions** and covariates (**region**, **education**, gender)
 - total 357 valid entries
- Run linear regression (lm):
 - card value ~ **is.49.55 + is.49.92 + is.50.08 + is.50.45 + is.female + age + income + is.college + is.associate + is.bachelor + is.graduate + is.CST + is.MST + is.PST**

Results - Covariate Balance Check

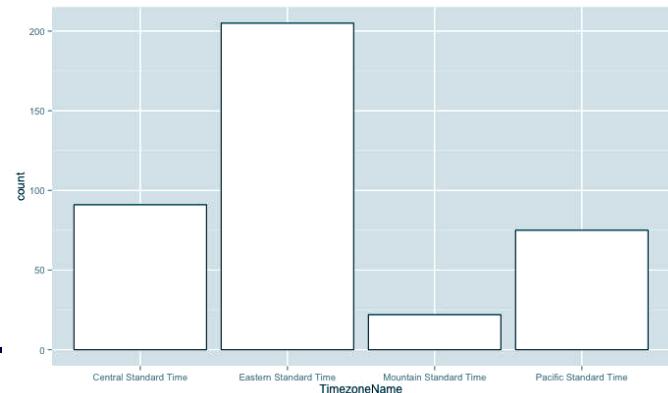
Distribution of Gift Card Value



Distribution of Education Level



Distribution of Time Zone

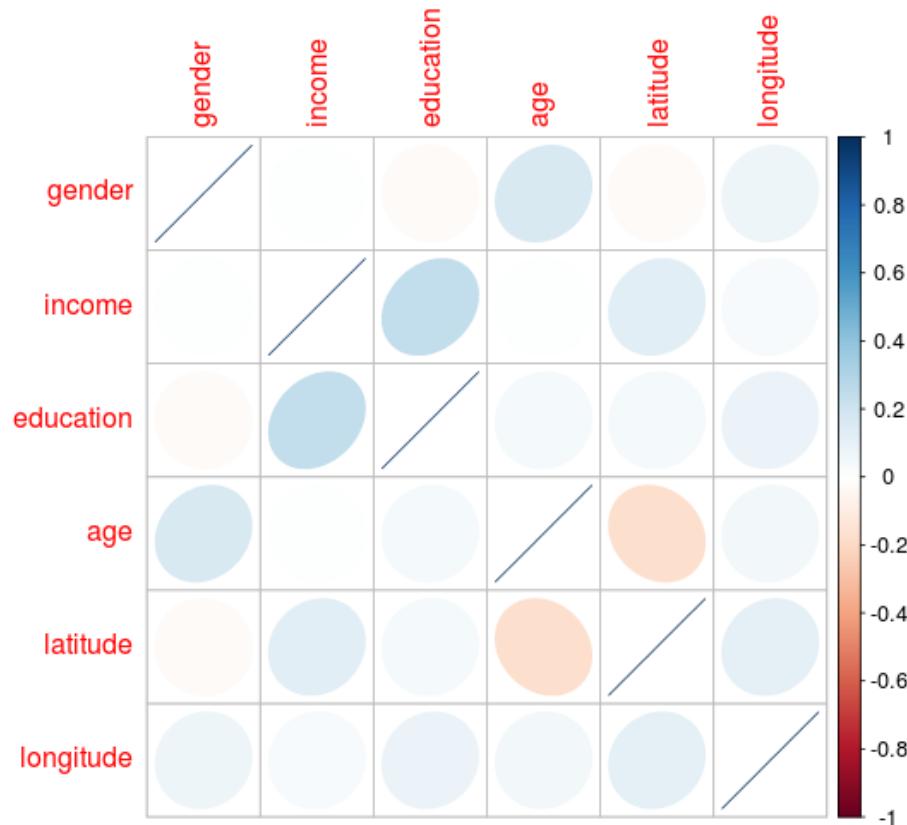


Results - Covariate Correlation Check

No strong correlations between any of the covariates we included in the study.

There is a weak positive correlation between income and education.

There is a weak negative correlation between age and latitude.



Results - ATE Estimation

Baseline:

- treatment: \$50.00

No statistically significant results...

Numbers close to the round number had a positive effect, but numbers farther from the round number had negative effects... but those could just be due to random variation.

** 0.01; * 0.05

variable	ATE
\$49.55	-1.555 (1.185)
\$49.92	0.111 (1.250)
\$50.08	0.081 (1.180)
\$50.45	-0.089 (1.140)

Results - ATE Estimation with Covariates

Baseline:

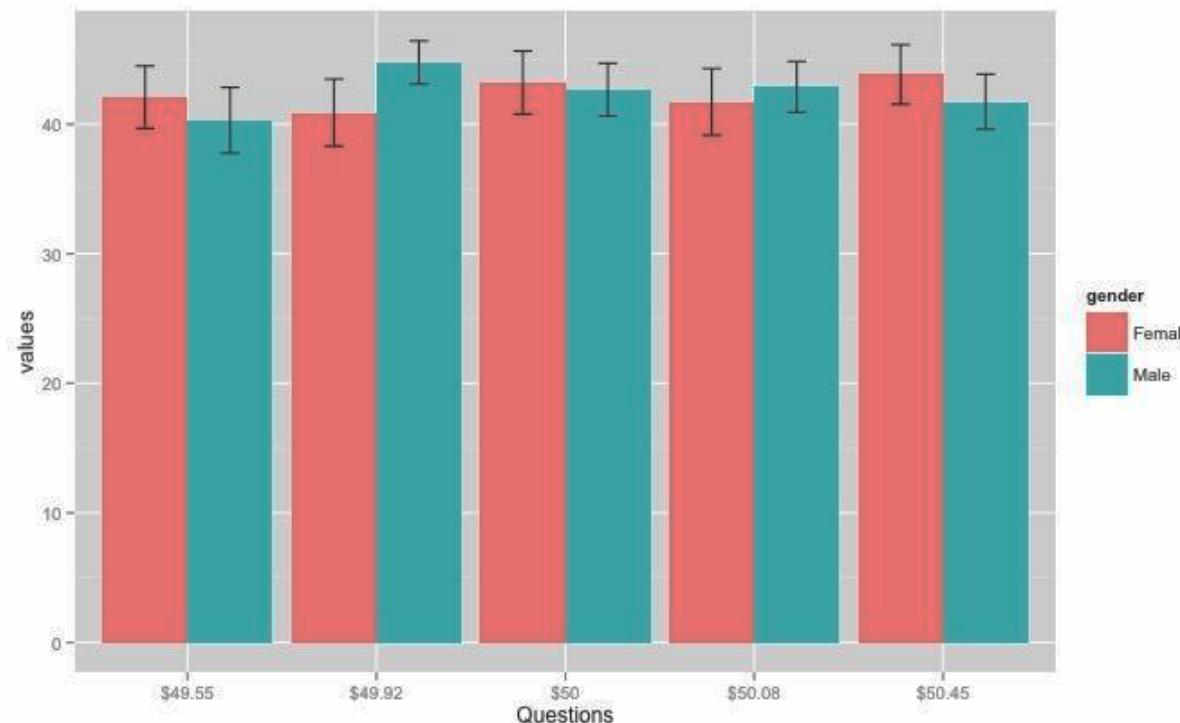
- treatment: \$50.00
- gender: male
- education: high school
- region: EST

variable	ATE
\$49.55	-1.587 (1.181)
\$49.92	0.272 (1.262)
\$50.08	0.307 (1.187)
\$50.45	0.444 (1.145)

	** 0.01; * 0.05
is.female	0.287 (0.760)
age	-0.0687 (0.0375)
income	* 1.956e-05 (8.681e-06)
is.College	** 4.705 (1.665)
is.Associates	2.662 (1.873)
is.Bachelor	* 3.338 (1.677)
is.Graduate	3.759 (2.007)
is.CST	0.0320 (0.939)
is.MST	1.788 (1.670)
is.PST	1.697 (1.047)

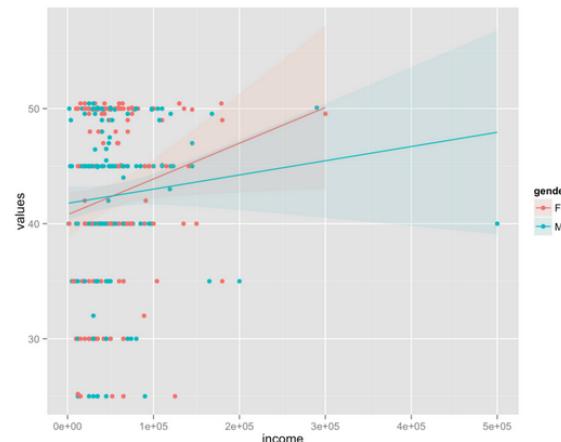
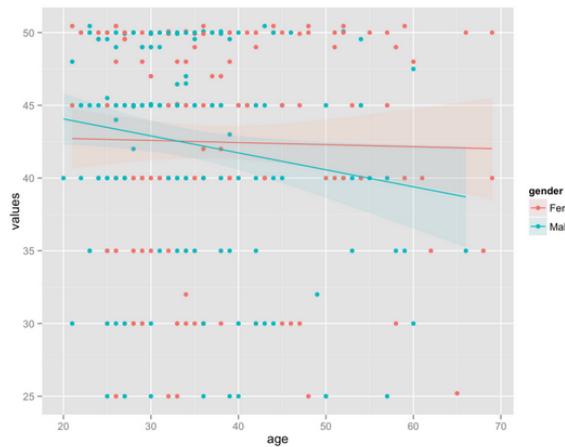
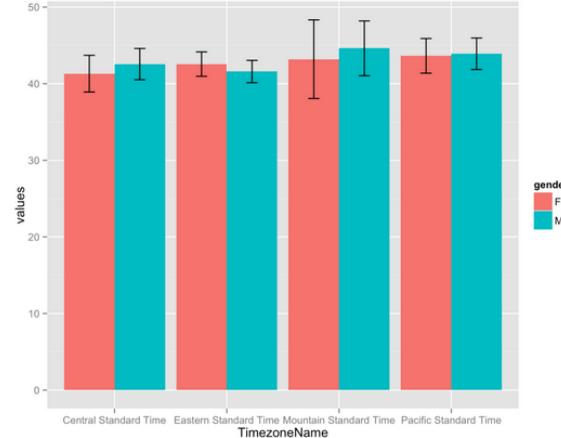
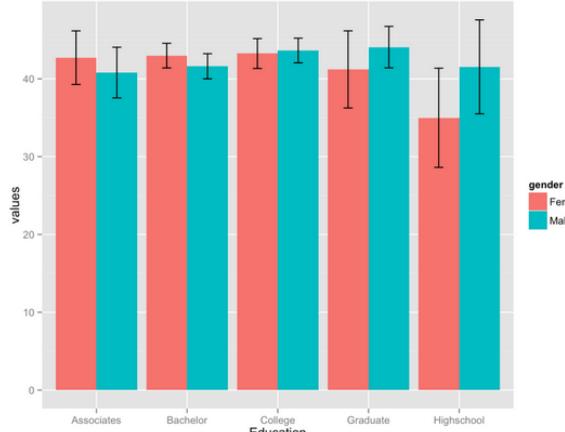
Results: value vs. treatment

Grouped by gender to evaluate potential heterogeneity effect



Results: value vs. covariates

- Covariates:
 - Education
 - Region
 - Age
 - Income
- Grouped by gender to evaluate potential heterogeneity effect



Experiment Conclusion

- Unlike Thomas & Morwitz, we found no significant round number effect on gift card valuation
 - May be very slight discount towards numbers farther from round number, perhaps due to evolving to recognize bias?
- observed average 20% off valuation → regular discount expectation for any merchant sale?
- negligible positive effect size from income
- a couple significant effects from education level: college w/o degree and bachelor value significantly higher than high school group

Lesson Learned

- Limitations:
 - unbalance in a couple covariates
 - simple survey design, can't avoid non-serious takers
- What could be done differently given infinite time and resource?
 - to salvage auction design:
 - use eBay or other platform instead of Craigslist
 - simulate auction in a more realistic setting
 - partner with gift card selling companies for experimentation
 - to improve AMT survey:
 - subtle effect needs more data: survey needs to run longer without causing spillover
 - normalize response: use multiple choice in \$5 intervals instead of text input
- What have we learned?
 - pilot is important
 - it's an *iterative and deliberative* process before a sound design takes shape