

# Fintech Nudges: Overspending Messages and Personal Finance Management

Sung Kwan Lee

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- Failure to achieve their personal financial goals (Kuchler and Pagel, 2018)
- Wide spectrum of intervention to influence financial behavior
  - ▶ Direct government intervention (DeFusco et al., 2019)
  - ▶ Informational nudges; significant but small effects (Zwane et al., 2011)
- Use of money management applications & Fintech nudges
  - ▶ Tailored to each individual

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- Use of money management applications & Fintech nudges
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- **This paper:** Examines how individuals change financial behavior when receiving a tailored message about their past spending

- Effects of overspending messages on spending behavior
  - ▶ Margins of adjustment
  - ▶ Duration of impact
  - ▶ Heterogeneous effects across different users
- Spillover effects to family members
- Effects on future attention

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# Data & Empirical Strategy

- Money management app data from major commercial bank in Canada
- Daily transaction data at account level
  - ▶ Date, amount, merchant, and spending category
- Daily app usage data at user level
  - ▶ Log-in time and date
- Month-end financial and demographic information at user level
  - ▶ Bank account balance, bank account counts, age, gender, enrollment date, and tenure with the Bank
- From June 19, 2017 to January 24, 2018
- 55,586 app users
- 534,166 messages were sent, and recipients logged in 26,044 times on same day

# Overspending Message Feature

- Overspending message feature was introduced on June 19, 2017
- Daily average on same calendar date is computed
- If spending multiple exceeds threshold multiple of 2, this message is generated on following day [▶ Cutoff Choice](#)
- Only those who log in can see the message

# Research Design Illustration

## Charles

- Age: 30
- Checking account balance:  
C\$10,000
- Average spending on 16th: C\$100

## David

- Age: 30
- Checking account balance:  
C\$10,000
- Average spending on 16th: C\$100

## Charles

- Age: 30
- Checking account balance: C\$10,000
- Average spending on 16th: C\$100
  
- Spending on July 16, 2017: C\$199
- Spending multiple: 1.99

## David

- Age: 30
- Checking account balance: C\$10,000
- Average spending on 16th: C\$100
  
- Spending on July 16, 2017: C\$201
- Spending multiple: 2.01

# Research Design Illustration

## Charles

- Age: 30
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JULY 16, 2017

## David

- Age: 30
- Checking account balance: C\$10,000
- Average spending on 16th: C\$100
  
- Spending on July 16, 2017: C\$201
- Spending multiple: 2.01

JULY 16, 2017



2.01 x over daily average spend.



$$Y_{i,t+1} = \alpha + \beta * 1[X_{i,t} > cutoff] \\ + \gamma_1 * 1[X_{i,t} > cutoff] * f(X_{i,t}) + \gamma_2 * 1[X_{i,t} \leq cutoff] * f(X_{i,t}) + \epsilon_{i,t+1}$$

$$Y_{i,t+1} = \alpha + \beta * 1[\mathbf{X}_{i,t} > cutoff] \\ + \gamma_1 * 1[\mathbf{X}_{i,t} > cutoff] * f(\mathbf{X}_{i,t}) + \gamma_2 * 1[\mathbf{X}_{i,t} \leq cutoff] * f(\mathbf{X}_{i,t}) + \epsilon_{i,t+1}$$

- **X: Spending multiple**

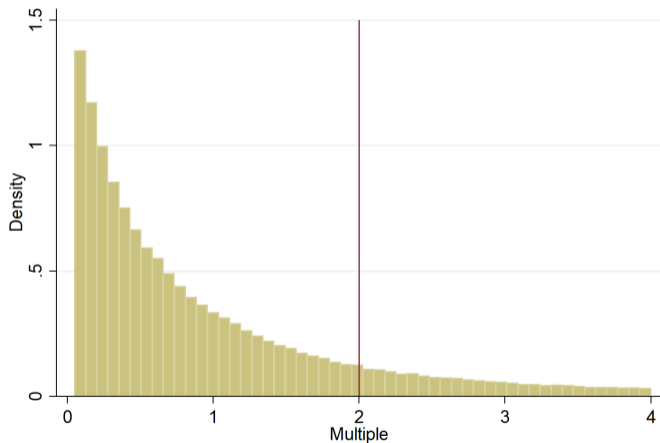
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- X: Spending multiple
- **Y: Outcome variables**
  - ▶ Rolling multiple (spending scaled by daily average over 365 days)
  - ▶ Dollar amount of spending
  - ▶ Number of purchases
  - ▶ Per-purchase spending

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- X: Spending multiple
- Y: Outcome variables
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- **Observations pooled across 219 days**

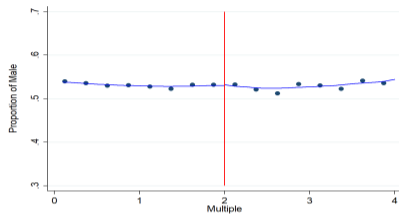
# Identifying Assumptions: Smooth Density



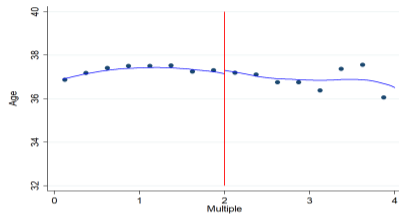
- No manipulation of spending multiples [▶ Dollar Amount Continuity](#)

# Identifying Assumptions: Continuous User Characteristics

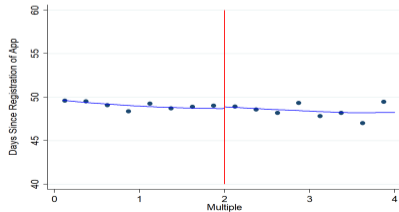
(A) Gender



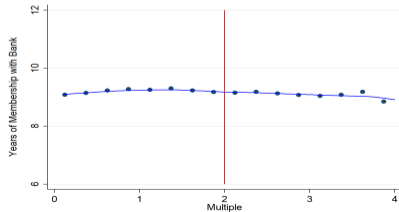
(B) Age



(C) App Experience



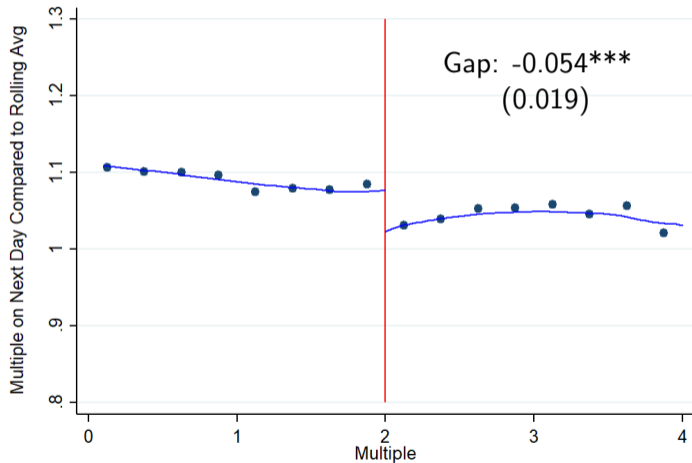
(D) Tenure



# Baseline Results

# Gap in Rolling Spending Multiple

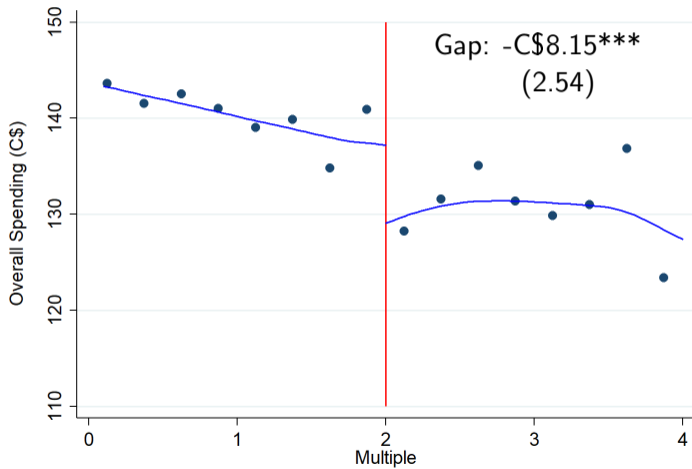
Among Users who Logged in





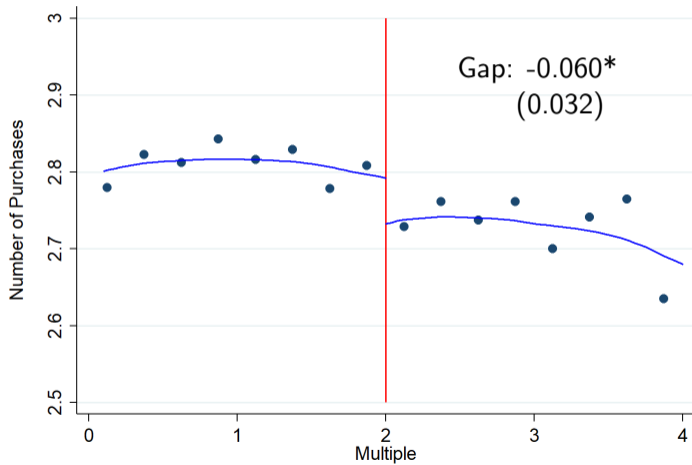
# Spending Gap in Dollars

Among Users who Logged in



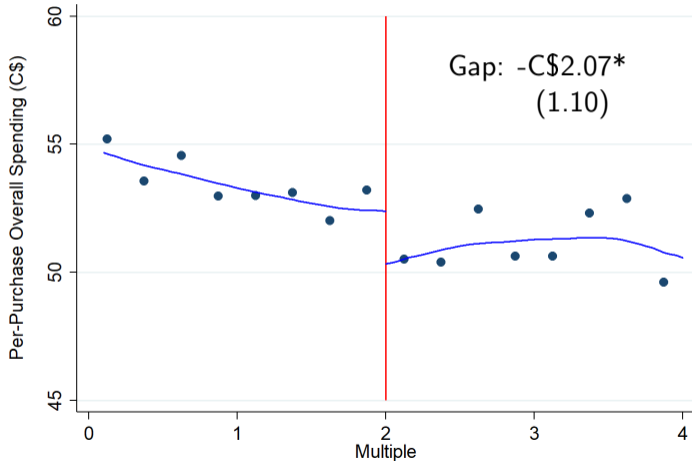
# Gap in Number of Purchases

Among Users who Logged in



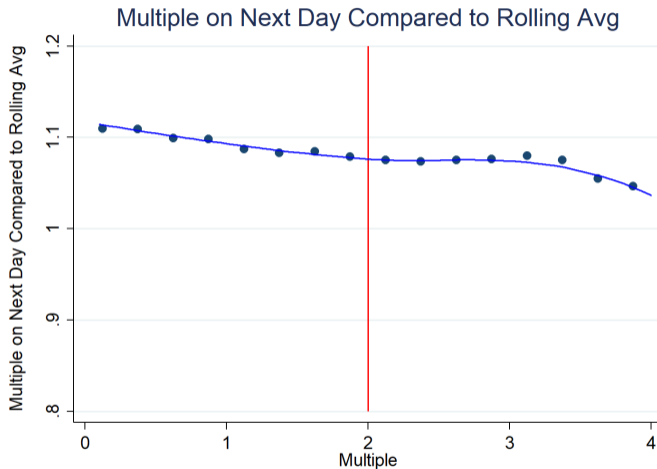
# Gap in Per-Purchase Spending

Among Users who Logged in



# Placebo Tests

# Placebo Tests on Days of No Log-in

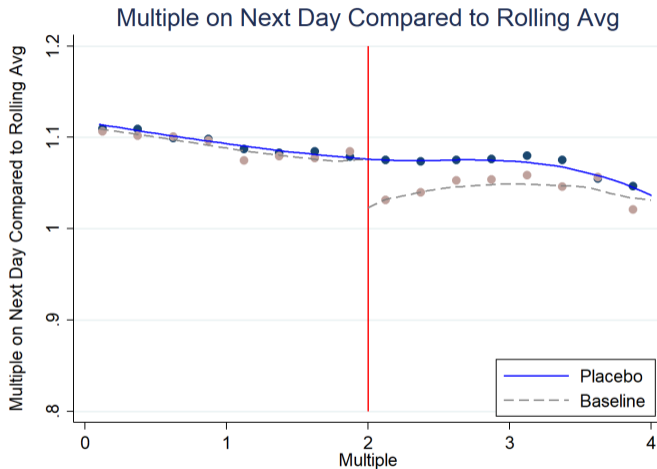


▶ Spending in Dollars

▶ Number of Purchases

▶ Per-Purchase Spending

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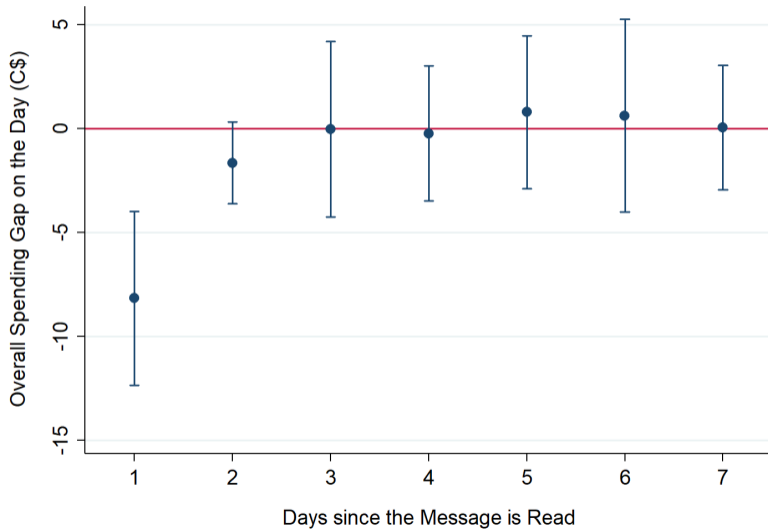
▶ Spending in Dollars

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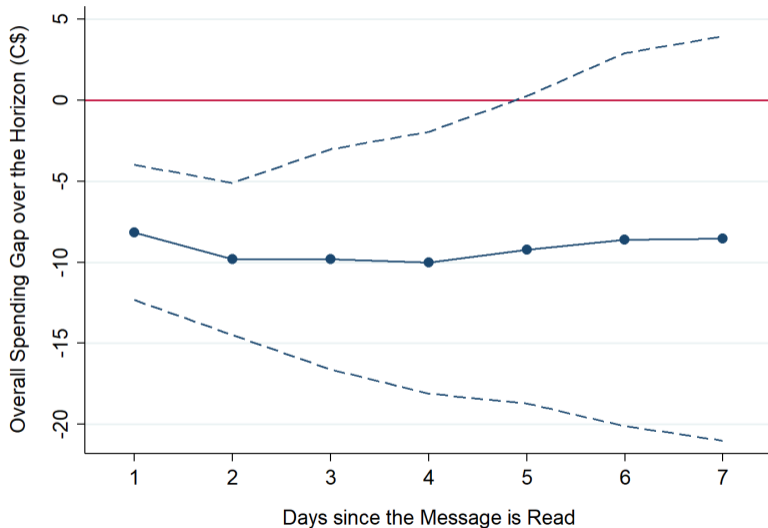
# Duration of Impact

# Spending Gap over Longer Horizon





# Cumulative Spending Gap over Longer Horizon



# Long-Term Effects of Fintech Nudges

- Effects are mostly on first day
- No sign of reversal

⇒ Messages resulted in temporary effect on flow spending and permanent reduction in cumulative spending

# Adjustments by Spending Category

# Spending Categories

- Transactions are categorized automatically by the app
- 12 different categories
  - ▶ Cash, DiningOut, Shopping, Entertainment, Travel, Fees, Groceries, Utilities, Transportation, Education, Health, Home

# Adjustments by Spending Category

	Cash	DiningOut	Shopping	Entertainment	Travel	Fees
1(Msg)	-1.27 (0.96)	0.17 (0.49)	-3.09*** (1.15)	-0.07 (0.38)	0.23 (0.61)	0.21 (0.30)
N	180,523	180,523	180,523	180,523	180,523	180,523
Mean Spending (C\$)	14.54	12.61	26.96	3.12	4.20	2.81

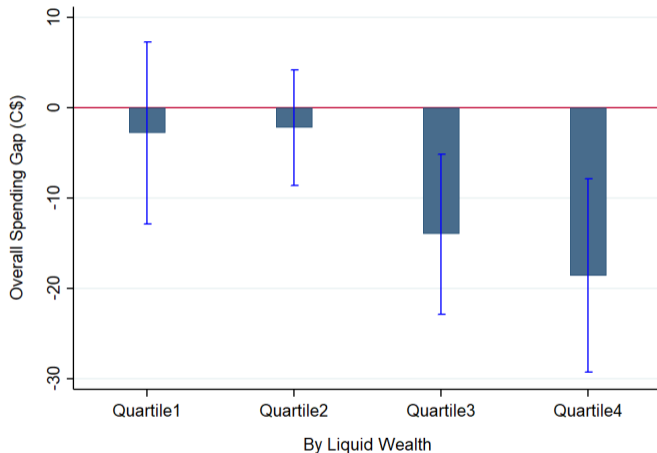
  

	Groceries	Utilities	Transportation	Education	Health	Home
1(Msg)	-0.78 (0.70)	-0.82 (0.79)	-0.22 (0.69)	-0.26 (0.33)	-0.43 (0.55)	-1.82 (1.15)
N	180,523	180,523	180,523	180,523	180,523	180,523
Mean Spending (C\$)	17.21	12.57	13.07	2.08	6.78	18.19

- Spending on Shopping was significantly reduced

# Heterogeneous Effects

# Subgroup Analysis: By Liquid Wealth



- Users with higher liquid wealth reduced spending more

▶ User Characteristics

Effects are more pronounced for

- Users with higher liquid wealth
- Users living in a city with highly educated population
- Relatively older users ▶ Age
- Users who are more finance-savvy (with greater money market exposure) ▶ Finance Savviness



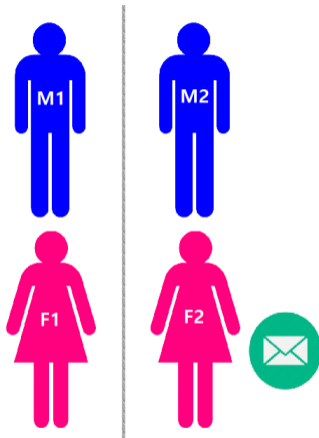
# Within-Family Spillover Effects

# Identification of Couples

I identify two app users as a couple if

- they share at least one account
- their age difference is 15 years or smaller
- they reside in same city

# Illustration of Spillover Effects



- I compare spending from non-shared accounts

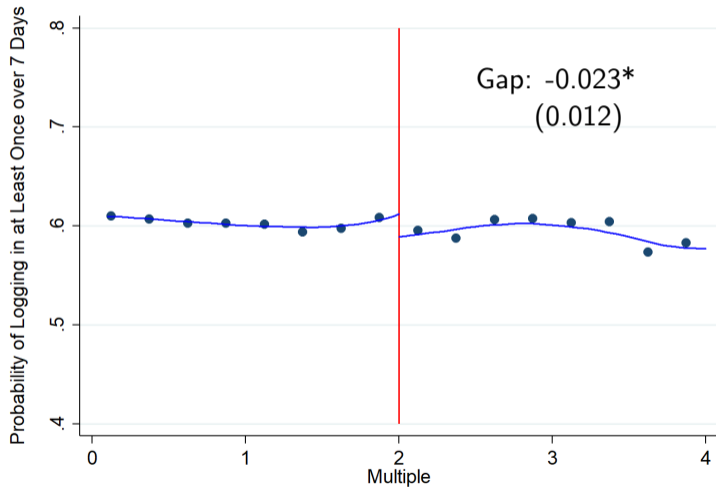
Table: Spending Adjustments by the Other Spouse

	Spouse	Gender Split	
		Male Spouse	Female Spouse
1(Msg)	-7.10* (3.95)	-10.63* (6.37)	-2.88 (4.46)
N	16,301	8,229	8,072

⇒ Suggestive evidence nudges spread to another member in households

Effects on Future Attention

# Log-in Probability over Subsequent 7 Days



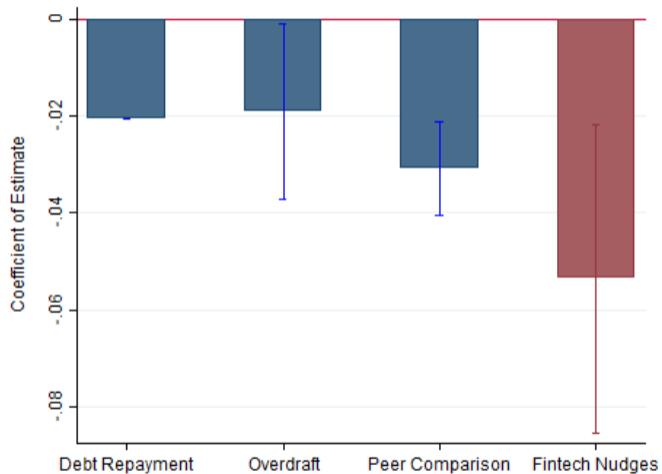
► Alternative Hypothesis

- Message feature induced changes in households' spending patterns
  - ▶ Message recipients reduced spending on following day
  - ▶ They reduced spending on Shopping
- Recipients did not compensate for reduced spending later on
- Effects are more pronounced for users with higher liquid wealth, users living in a city with highly educated population, older users, and users who are more finance-savvy
- Effects spread over from one app user to another in same family
- Reading an overspending message leads to lower likelihood of monitoring accounts in future

# Appendix



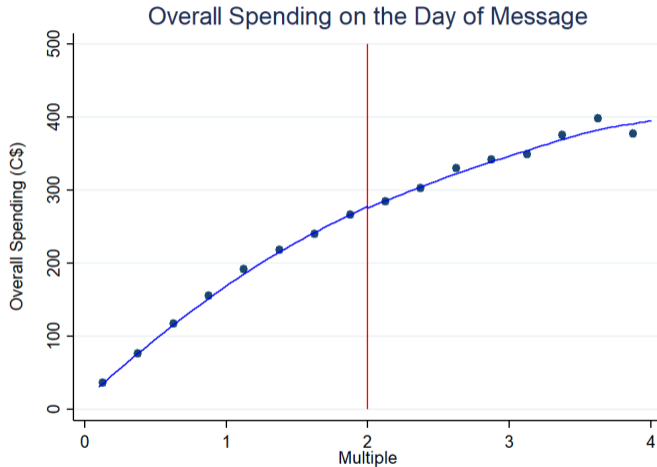
# Discussion on Magnitude: Spending Response in Literature



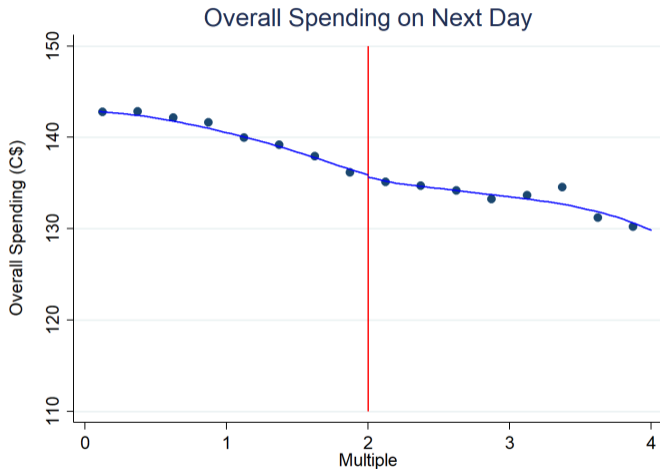
- Bank's business strategy
  - ▶ Win trust from customers, retain them, and introduce new financial products
- Based on user experience principles
  - ▶ Transaction volume and variance of spending per user

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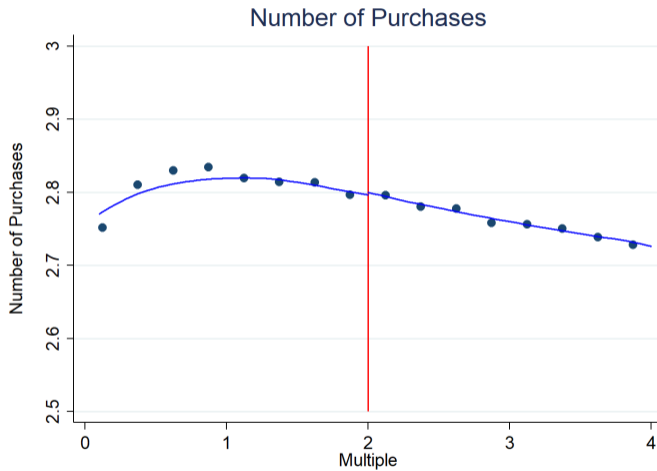
# Identifying Assumptions: Continuity of Dollar Amount Spending



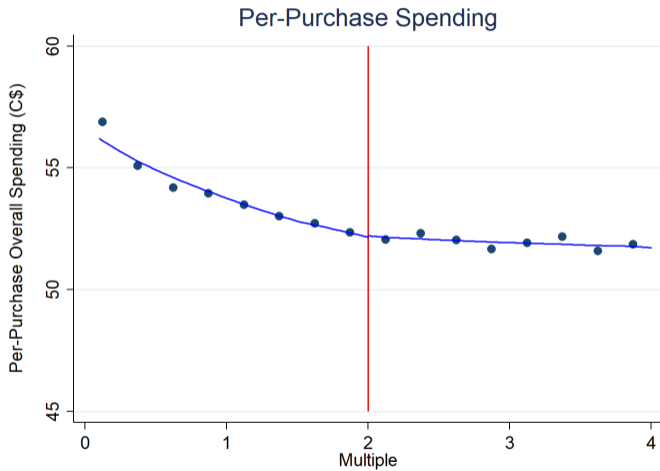
# Placebo Tests on Days of No Log-in



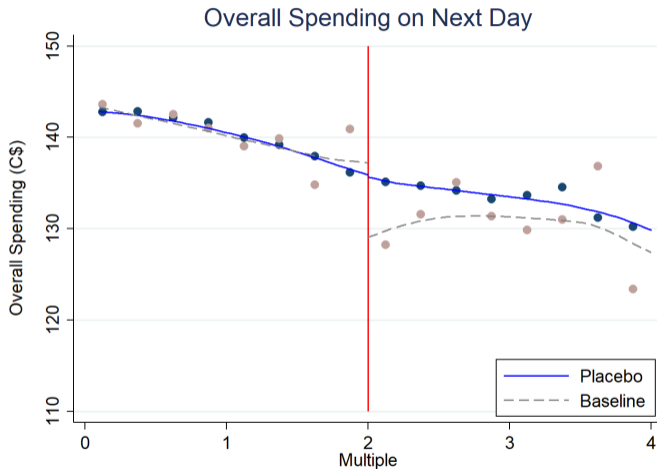
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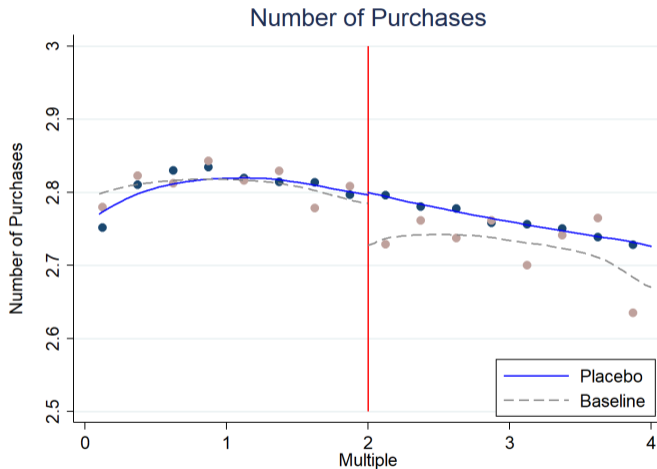
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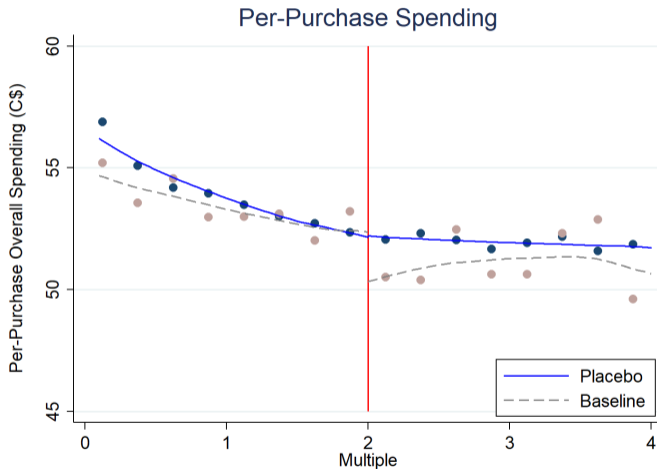


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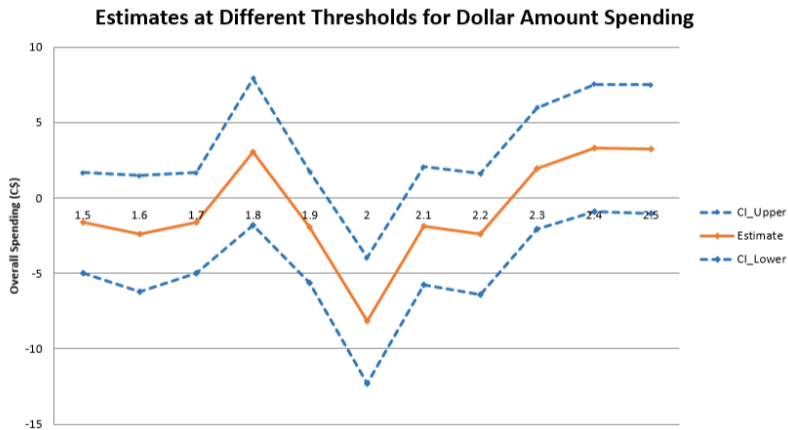




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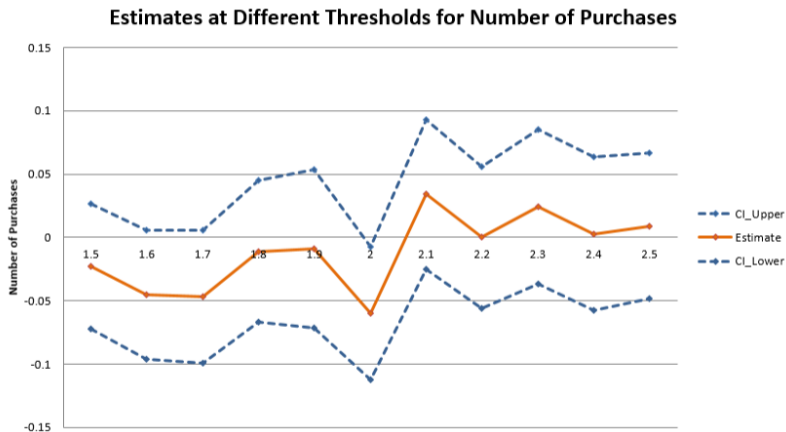


# Placebo Tests on False Thresholds



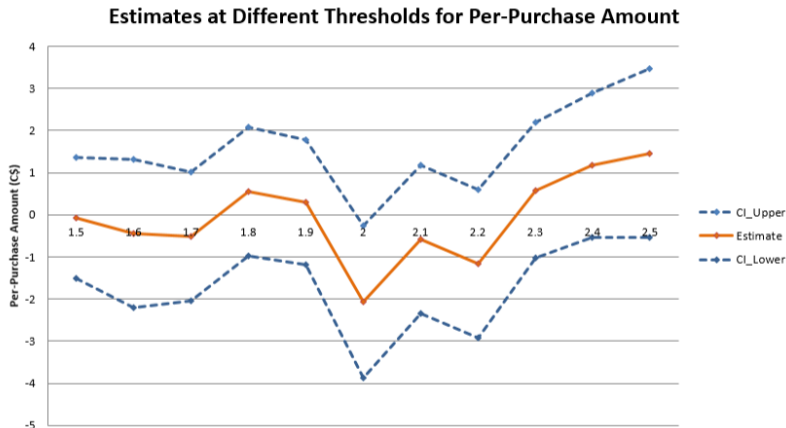
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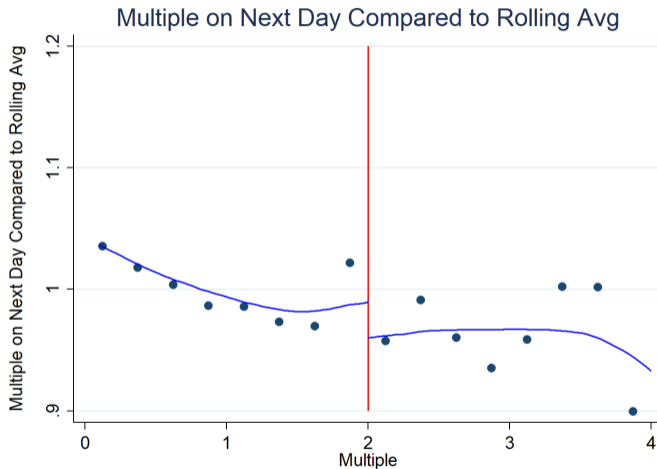
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# Placebo Tests on False Thresholds



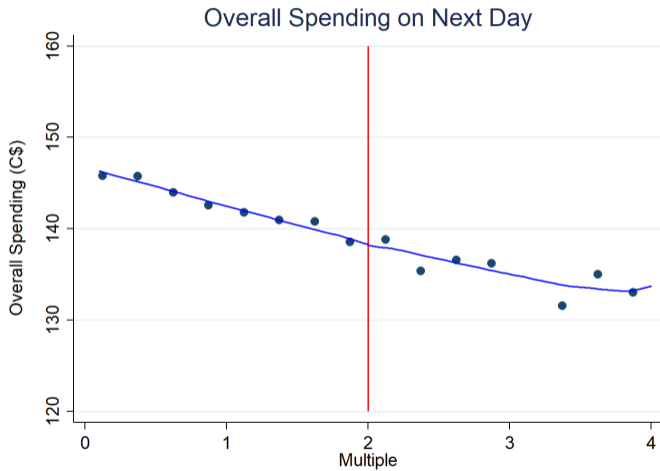
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# Placebo Tests for Users with Old App: Most Recent Month



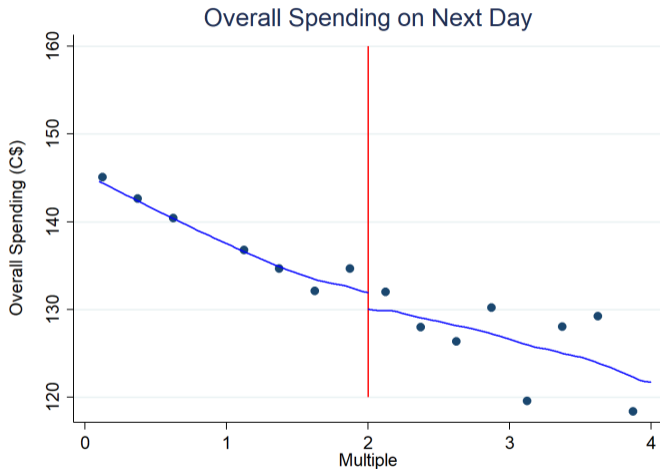
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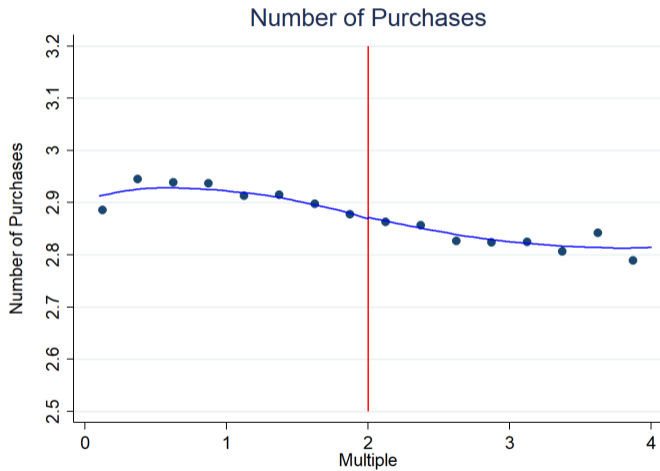
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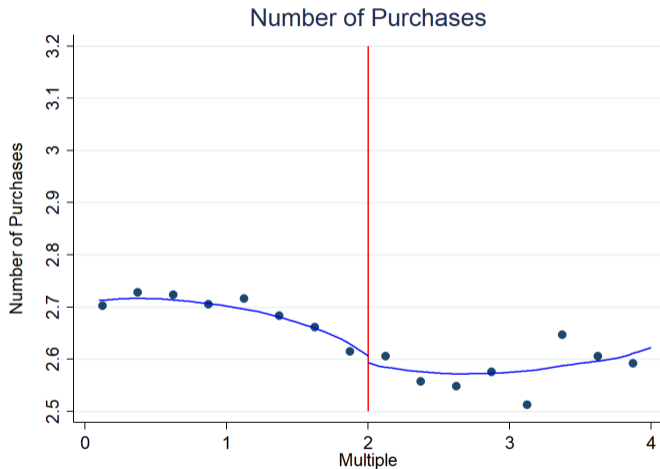
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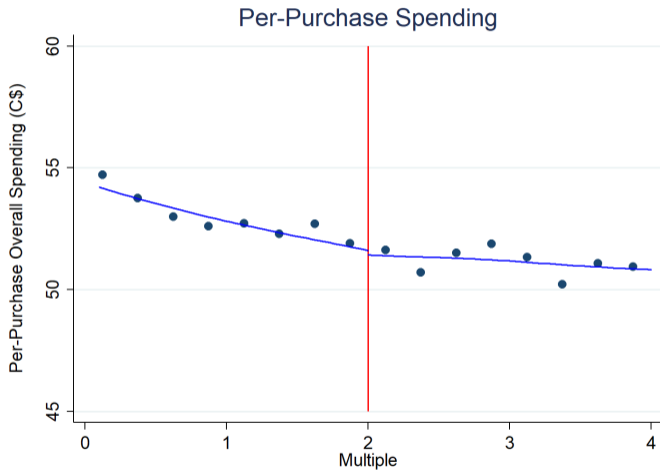


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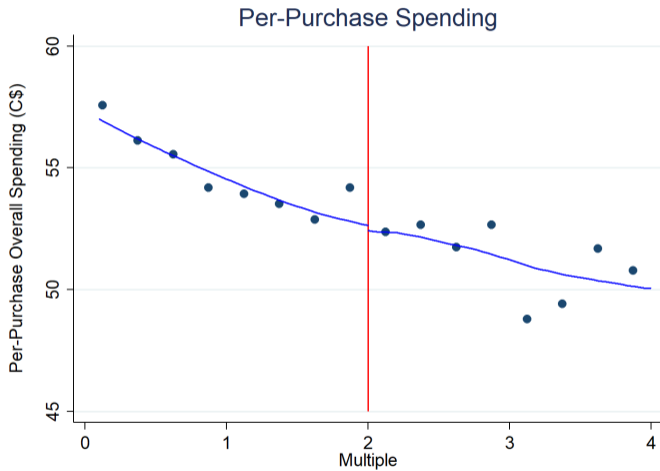
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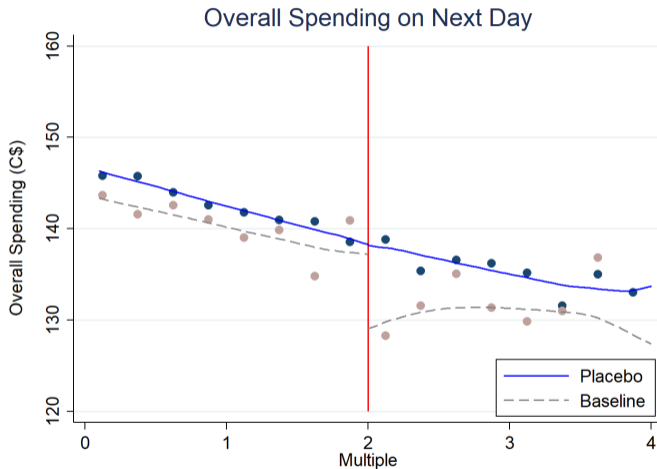
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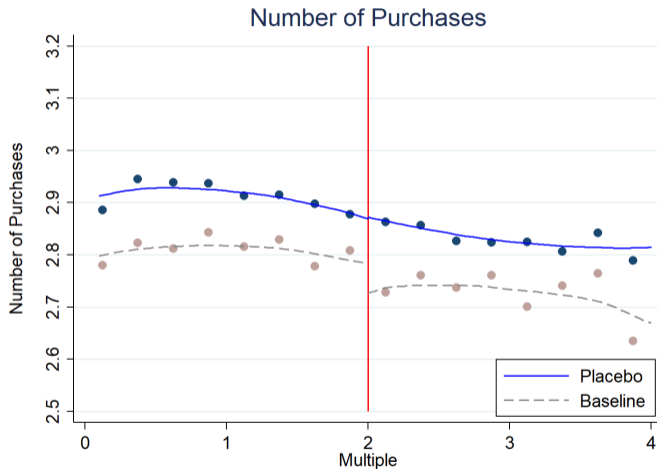
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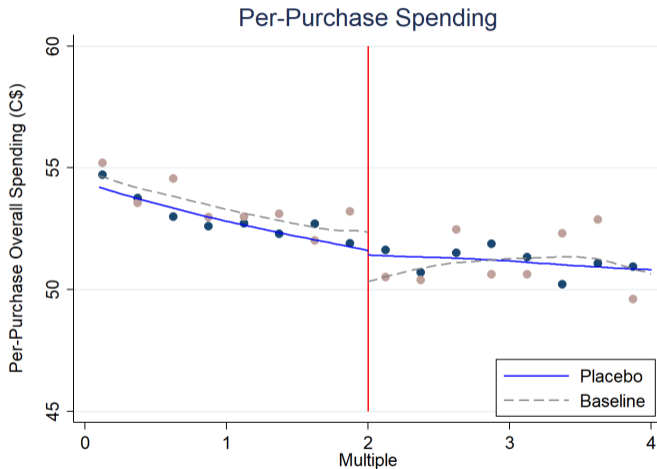
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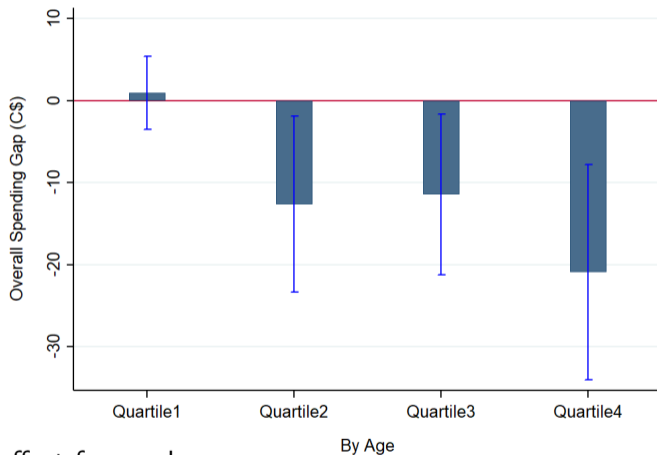
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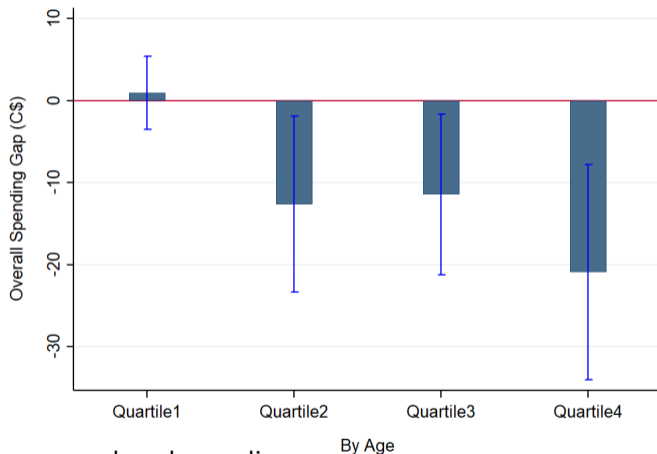
# Subgroup Analysis: By Gender



- No differential effect for gender

▸ User Characteristics

# Subgroup Analysis: By Age



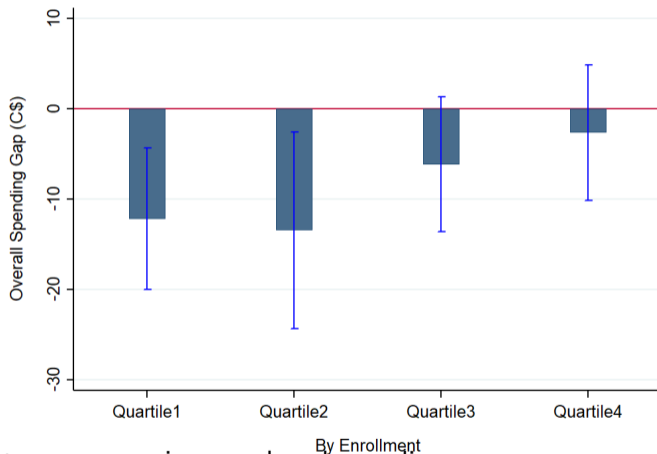
- Relatively older users reduced spending

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[▶ User Characteristics](#)



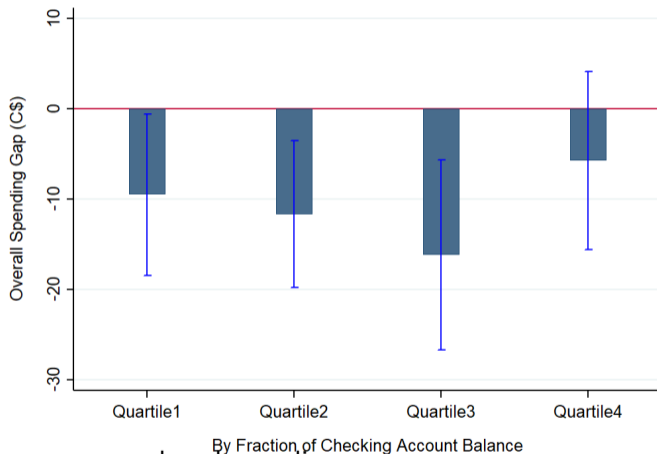
# Subgroup Analysis: App Experience



- Users with shorter app experience reduced spending

▸ User Characteristics

# Subgroup Analysis: Financial Savviness



- More finance-savvy users reduced spending

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▶ User Characteristics

# Subgroup Analysis: By Gender

Table: Subgroup Analysis for Gender

	Gender	
	Male	Female
1(Msg)	-8.61** (3.59)	-7.94*** (2.99)
N	96,093	84,288
Median Spending	74.32	81.33

- No differential effect for gender

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# Subgroup Analysis: By Age

Table: Subgroup Analysis for Age

	Age (Years Old)			
	Quartile1	Quartile2	Quartile3	Quartile4
1(Msg)	0.95 (2.71)	-12.62* (6.51)	-11.45* (5.94)	-20.92*** (7.96)
N	67,231	31,182	44,106	37,909
Median Characteristics	22	32	42	57
Mean Characteristics	24.2	32.6	41.8	58.5
Median Spending	48.78	83.47	107.54	118.48

- Relatively older users reduced spending

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# Subgroup Analysis: By App Experience

Table: Subgroup Analysis for App Experience

	Days since Registration			
	Quartile1	Quartile2	Quartile3	Quartile4
1(Msg)	-12.18** (4.76)	-13.45** (6.64)	-6.14 (4.54)	-2.62 (4.56)
N	45,141	42,827	44,282	44,194
Median Characteristics	1	25	62	106
Mean Characteristics	3.16	28.58	64.42	104.80
Median Spending	76.38	79.31	80.04	74.58

- Users with shorter app experience reduced spending

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# Subgroup Analysis: By Liquid Wealth

Table: Subgroup Analysis for Liquid Wealth

	Liquid Wealth (C\$)			
	Quartile1	Quartile2	Quartile3	Quartile4
1(Msg)	-2.77 (6.12)	-2.19 (3.91)	-13.99*** (5.40)	-18.61*** (6.51)
N	45,210	45,068	45,136	45,030
Median Characteristics	-2,728.20	972.34	6,545.85	30,009.21
Mean Characteristics	-4,542.36	1,111.68	7,032.18	59,131.65
Median Spending	84.1	62.75	74.17	92.46

- Users with higher liquid wealth reduced spending

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# Subgroup Analysis: By Financial Savviness

Table: Subgroup Analysis for Finance Savviness

	Fraction of Checking Account Balance			
	Quartile1	Quartile2	Quartile3	Quartile4
1(Msg)	-9.51*	-11.68**	-16.21**	-5.76
	(5.431)	(4.96)	(6.40)	(5.99)
N	43,287	43,171	50,473	35,871
Median Characteristics	0.054	0.529	0.975	1
Mean Characteristics	0.082	0.530	0.948	1
Median Spending	69.42	78.61	80.00	82.78

- More finance-savvy users reduced spending

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# Subgroup Analysis: By Education Level

Table: Subgroup Analysis for Education

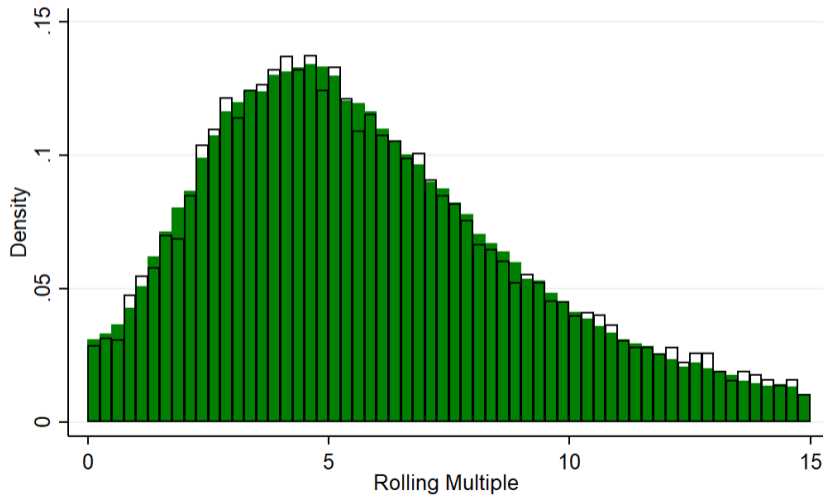
	Fraction of Population with a Diploma or a Degree			
	Quartile1	Quartile2	Quartile3	Quartile4
1(Msg)	-7.60 (5.35)	-3.85 (5.25)	-15.76*** (6.00)	-13.86** (6.92)
N	35,642	36,402	33,563	35,192
Median Characteristics	0.481	0.556	0.591	0.632
Mean Characteristics	0.477	0.550	0.588	0.643
Median Spending	81.64	79.73	69.06	79.33

- Users living in a more educated region reduced spending

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# Distribution of Rolling Multiple over 7 Days



# Overspending Message Feature

Table: Overspending Message Thresholds

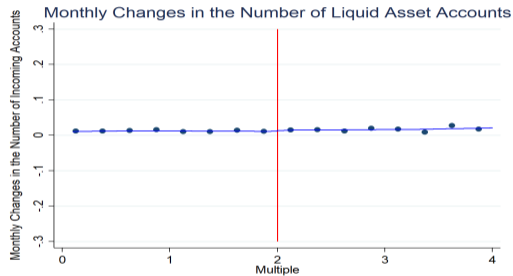
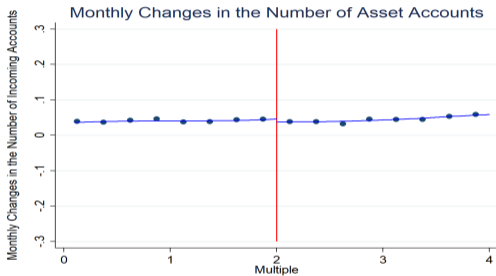
Overall Spending	2x
<hr/>	
Wants	
Cash	5x
Dining Out	4x
Shopping	4x
Entertainment	4x
Travel	4x
Fees	4x
<hr/>	
Needs	
Groceries	6x
Utilities	5x
Transportation	8x
Education	5x
Health	6x
Home	7x

# Categorical Overspending Messages

Table: Effects of Categorical Overspending Messages

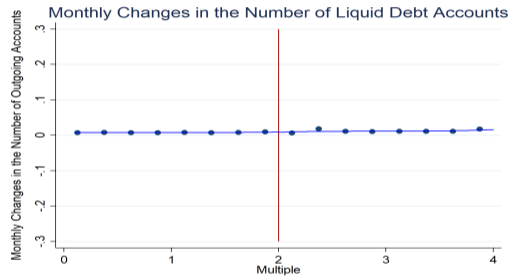
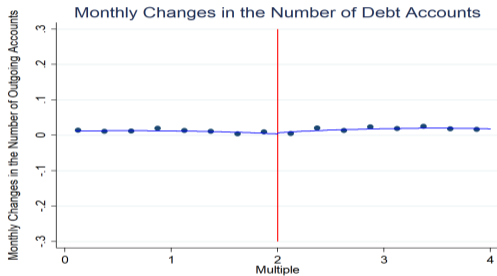
Panel A: Wants Category						
	Cash	DiningOut	Shopping	Entertainment	Travel	Fees
1(Msg)	-4.08 (14.58)	-1.75* (0.97)	-8.01* (4.55)	7.44 (10.57)	-0.43 (19.84)	1.09 (1.30)
N	8,009	87,965	41,681	1,756	2,504	11,895
Panel B: Needs Category						
	Groceries	Utilities	Transportation	Education	Health	Home
1(Msg)	-5.93** (2.41)	1.44 (5.38)	0.63 (4.28)	-6.83 (12.98)	1.59 (5.41)	-4.52 (23.94)
N	45,721	11,460	25,127	728	4,767	13,090

# Account Management



- No differential increase in number of cash-inflow accounts

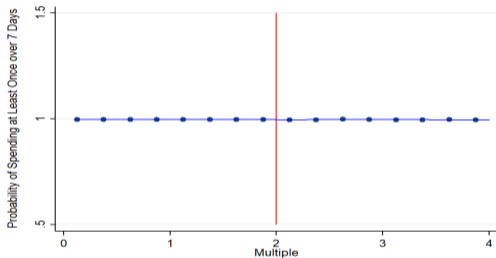
# Account Management



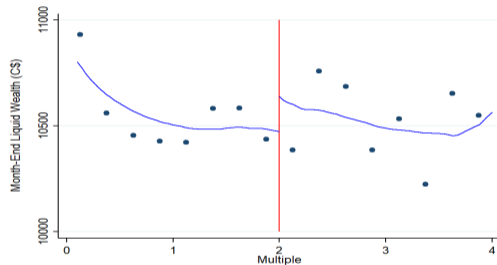
- No differential decrease in number of cash-outflow accounts

# Alternative Hypothesis: Running down on Liquidity

(A) Use of Accounts

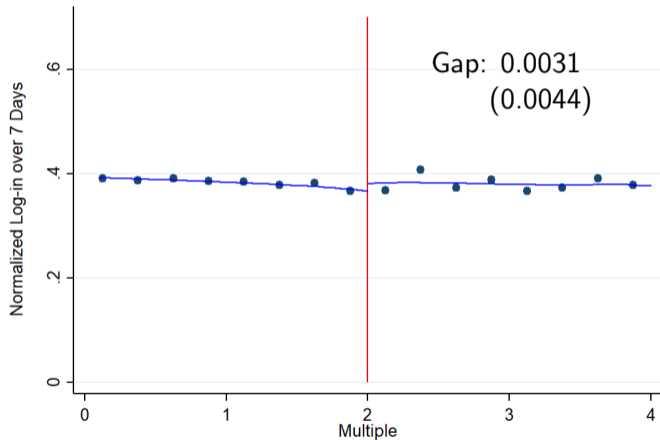


(B) Month-End Liquid Wealth



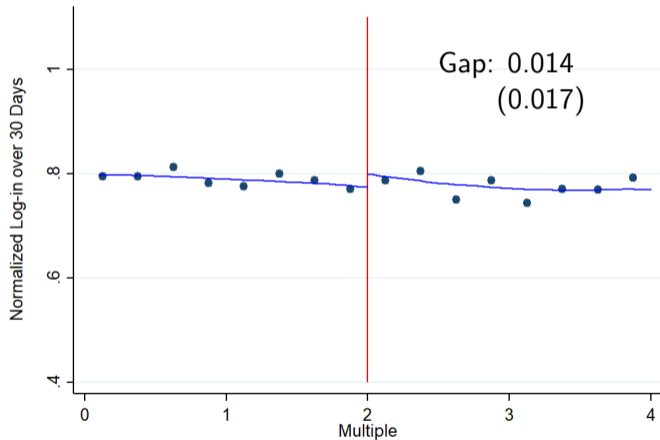
- This hypothesis is ruled out

# Normalized Log-in Frequency over 7 Days (Conditional)



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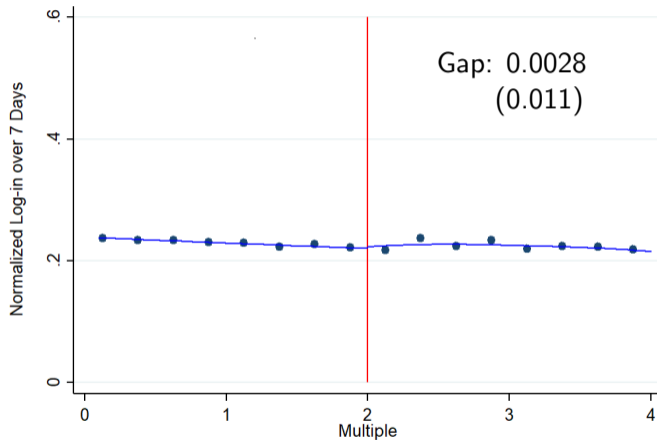
# Normalized Log-in Frequency over 30 Days (Conditional)



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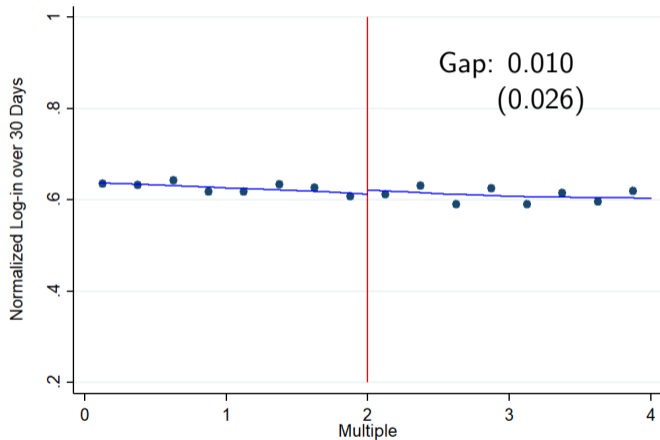


# Normalized Log-in Frequency over 7 Days (Unconditional)



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# Normalized Log-in Frequency over 30 Days (Unconditional)



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# Robustness Check: Including Users without a Credit Card

