Consumption Behavior Across the Distribution of Liquid Assets

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    - Understanding dynamics of individual household behavior.
    - At the core of any macro model.

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This Paper:

- ▶ Document relationship between liquidity and consumption responses.
  - ▶ Cannot fully account for consumption responses to predictable income.

- ▶ Relevant for policy analysis

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1. Document relationship in micro-data between liquidity and consumption responses.
   - Magnitude: significant responses amongst households with high liquidity.
   - Timing: highly front-loaded to receipt.

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   - ▶ Households averse to dissaving (mental accounts).
   - ▶ Nests standard buffer-stock and hand-to-mouth agents as limiting cases.
   - ▶ Data consistent with intermediate case, moderate level of dissaving aversion.

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   - Nests standard buffer-stock and hand-to-mouth agents as limiting cases.
   - Data consistent with intermediate case, moderate level of dissaving aversion.

3. Re-evaluate fiscal stimulus policies, compare to standard buffer-stock model
   - Redistributive stimulus to liquidity constrained households, $\approx 50\%$ less effective.

Contribution

- **Consumption Responses**: Hall (1978), Zeldes (1989), Campbell and Mankiw (1990), Shapiro and Slemrod (2003), Johnson et. al (2006), Parker et. al (2013), Keung (2018), Ganong and Noel (2019).
    - Document liquidity/excess sensitivity relationship in administrative data.

- **Structural Models**: Friedman (1957), Caroll (1997), Laibson (1997), Parker and Gourchinas (1999), Attanasio et. al (1999), Mankiw (2000), Cagetti (2003), Gabaix (2011), Kaplan and Violante (2014).
    - Jointly rationalize timing & magnitude of consumption responses in cross-section.

- **Mental Accounts**: Thaler (1985), Shefrin and Thaler (1988), Farhi and Gabaix (2018), Hastings and Shapiro (2012), Hastings and Shapiro (2018).
   - Evaluate class of models in consumption micro-data.

Data & Empirical Results

Data

Goal: Document relationship in micro-data between liquidity and excess sensitivity.

Administrative transaction & account-level dataset from large U.S. financial institution.

- **17.2 million** U.S. households from **2012 to 2019**.
- Includes:
  - **Expenditures**: deposit & credit transactions, associated to time of purchase.
  - **Income**: categorized by source.
  - **Balances**: checking, savings, credit card, non-transaction accounts.
- Aggregate accounts to primary account holder.
  - Working age households (24 to 64).
  - Active accounts (5+ deposit account outflows each month).

Summary Statistics   Expenditure Basket

Data, External Validation
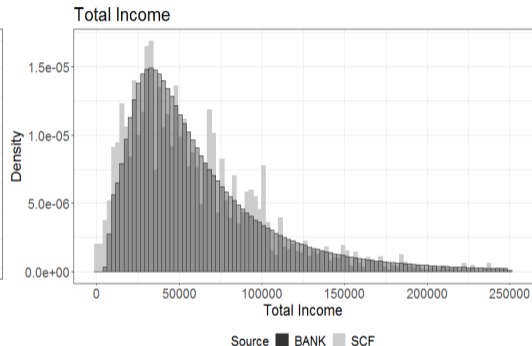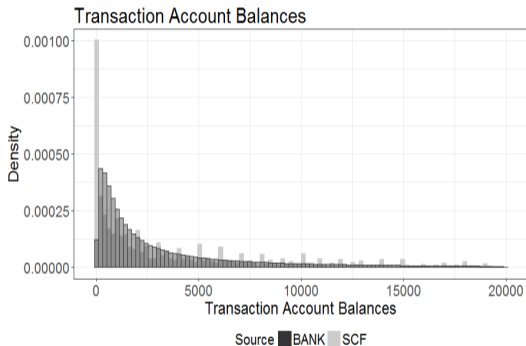
Income & Asset Benchmarking   Expenditure & Inflow Benchmarking   Account Frequency Benchmarking

Empirical Strategy

Estimate consumption responses to income at daily frequency. Standard distributed lags model:

$$c_{i,t} = \alpha_i + \lambda_t + \sum_{j=t-l}^{t+L} \delta_j \cdot Income_{i,j} + \epsilon_{i,t}$$

- ▶ Household (α_i) and time (λ_t) fixed effects (day of week, day of month, year)
- ▶ $Income \in \{$Tax Refunds, Bonuses, Paychecks$\}$
- ▶ $Income_{i,j}$: magnitude of inflow received by household i at lead/lag j days
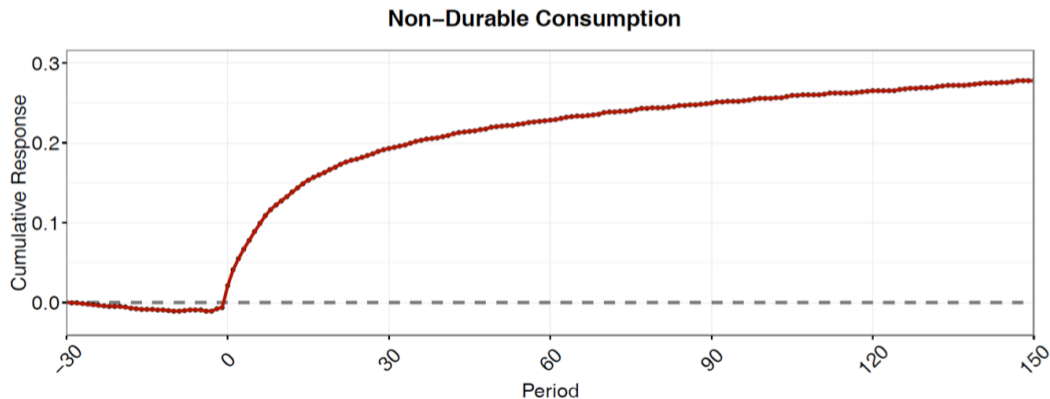
Summary Statistics, Refund Recipients   Summary Statistics, Bonus Recipients   Refund Arrival   Bonus Arrival

Non-Durable Consumption Responses, Tax Refunds

n = 882,360,496

Non−Durable Consumption

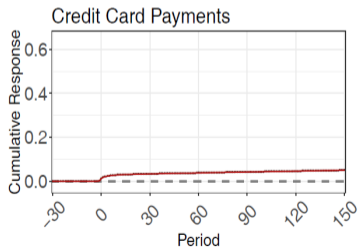Average tax refund: \$2072
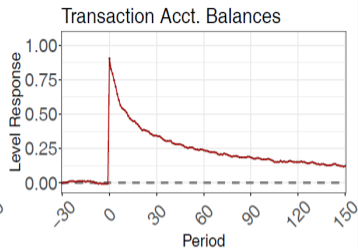
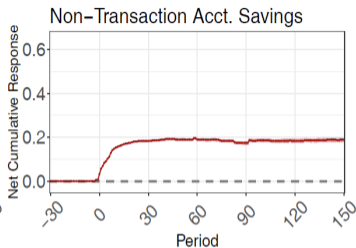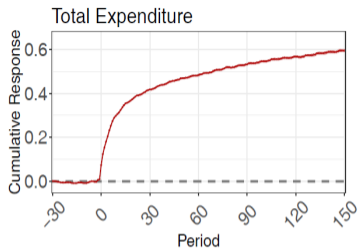Summary Statistics   Non-Durable Measure   Expenditure Basket   Durables   Sub-Categories
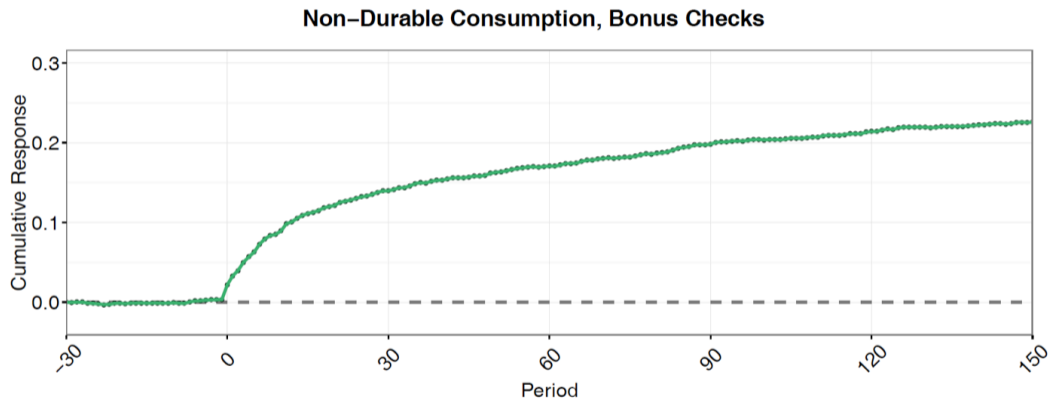
Balance Sheet Responses, Tax Refunds
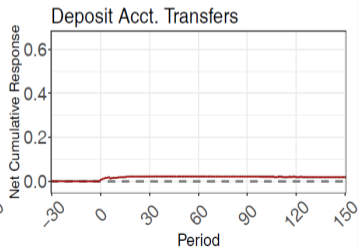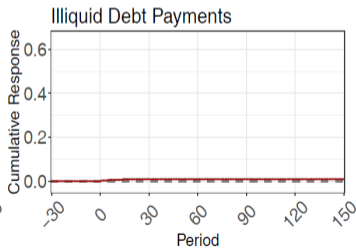
Average tax refund: $2072

Summary Statistics   Expenditure Basket

Non-Durable Consumption Responses, Bonus Checks

n = 71,223,781

Non–Durable Consumption, Bonus Checks

Average bonus check: $11,445

Non-Durable Consumption Responses, Tax Refunds

Cross-Section

Decile	1	2	3	4	5	6	7	8	9	10
$\frac{Liquid\ Assets}{Income}$	0.21	0.36	0.49	0.64	0.80	1.0	1.35	1.91	3.09	5.11
Total Income	4348	4860	5163	5420	5680	5909	6026	6088	6017	5840
Tax Refund	2049	1999	2020	2029	2096	2132	2161	2154	2110	2097

Distributions Expenditure Baskets

Non-Durable Consumption Responses, Tax Refunds

Cross-Section

Liquid Assets / Income Deciles

Legend: 1 Month, 2 Months, 3 Months, Anticipatory Spend
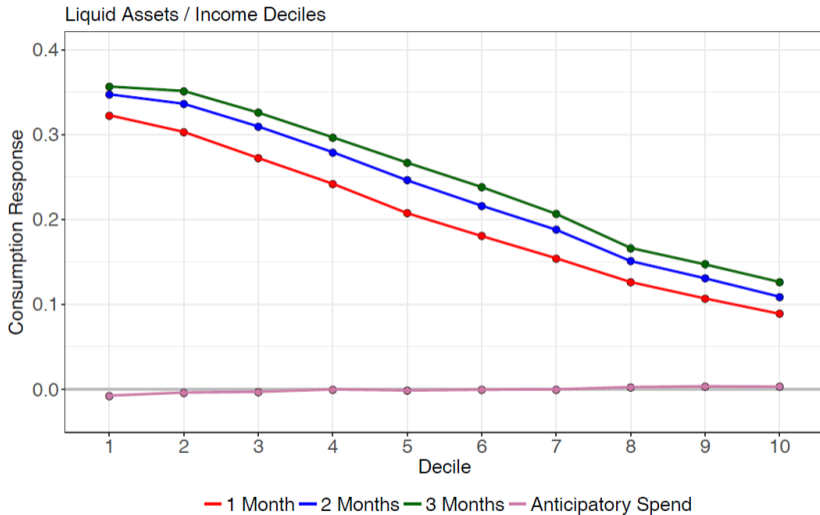
Dynamic View | Total Expenditure | Baseline Measure | Expenditure Baskets | Bonuses

Consumption Responses
Robustness

Results are robust to measures of income, expenditure, and liquidity.

- ▶ Income: form (Regular Paychecks and Bonus Checks) and Magnitude .
- ▶ Expenditure: Categories (durables, groceries, food services, retail goods).
- ▶ Liquidity: in Levels of assets, relative to expenditure, $\frac{Liquid\ Assets}{Total\ Income}$ by income .

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Additionally, robust to sampling and income events.

- Hold in Cross-Sections of age, levels of income & income volatility
- Responses of highly liquid not driven by self-selection. (Self-Selection)
- Persist when one large inflow comes shortly after another (Two Refunds).
- Are restricted to receipt as opposed to the date of Tax Filing .

Model of Mental Accounts

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  - Break fungibility of otherwise interchangeable resources.

- Households behave as if self-constrained.
  - Current income (y_t) and current assets (a_t) considered separately.
  - Households averse to spending out of savings.

Model of Mental Accounts
Utility

$$\nu(c) \equiv u(c) + \psi \cdot d(a', a^d)$$

- a^d some default level of savings, $\psi \in [0, 1]$ dissaving aversion parameter
- Savings deviation function:

$$d(a', a^d) \begin{cases} = 0 & \text{if } a' \geq a^d \\ < 0 & \text{if } a' < a^d \end{cases}$$

- Allocation at default: $c^d = y + a(1 + r) - a^d$

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Impose following structure:

1. Default guided by current level of savings: $a^d = a(1 + r)$
2. Functional form:
$$d(a', a^d) = -\big[u(c) - u(c^d)\big] \cdot \mathbb{I}_{a' < a^d}$$

Model of Mental Accounts

Utility

Mental Accounts, Utility Function

- $\psi = 0$: $\nu(c) = u(c)$, agents are **buffer-stock**.
- $\psi = 1$: $\nu'(c) = 0$ when $c > y$, agents are **hand-to-mouth**.
- $\psi \in (0, 1)$: agents are **dissaving averse**.

Perfect Foresight

▶ Agent lives T months, $a_0 = 0$, period 0 income only ($y_0 > 0$, $y_t = 0 \ \forall \ t > 0$).

$$\max \sum_{t=0}^{T} \beta^t \left[\frac{c_t^{1-\gamma}}{1 - \gamma} + \psi \cdot d(a_{t+1}, a_t(1 + r)) \right] \qquad st. \quad \begin{array}{l} c_t + a_{t+1} \leq y_t + a_t(1 + r) \\ a_{T+1} \geq 0 \end{array}$$

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▶ **Solution:** period 0 response

$$\frac{\partial c_0}{\partial y_0} = \left(1 + \left(1 - \psi \right)^{\frac{1}{\gamma}} \cdot \left[\frac{\beta^{\frac{1}{\gamma}}(1+r)^{\frac{1-\gamma}{\gamma}} - (1+r)^{-T}(\beta(1+r))^{\frac{T}{\gamma}}}{1 - \beta^{\frac{1}{\gamma}}(1+r)^{\frac{1-\gamma}{\gamma}}} \right] \right)^{-1}$$

and $\frac{\partial c_{t+1}}{\partial y_0} = \frac{\partial c_t}{\partial y_0}[\beta(1+r)]^{\frac{1}{\gamma}} \; \forall \; t > 0$.

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and $\frac{\partial c_{t+1}}{\partial y_0} = \frac{\partial c_t}{\partial y_0}[\beta(1+r)]^{\frac{1}{\gamma}} \ \forall \ t > 0$.

Cases:

- $\psi = 1$: $\frac{\partial c_0}{\partial y_0} = 1$ (hand-to-mouth)
- $\psi = 0$: $\frac{\partial c_0}{\partial y_0} \to 0$, (permanent income).

Structural Estimation, Model

Discipline preference parameters with data by performing structural estimation.

$$v_t(y_t, a_t) = \max_{c_t} \left\{ \frac{c^{1-\gamma}}{1-\gamma} + \psi \cdot d(a', a(1+r)) + \beta \cdot \mathbb{E}_t[v_{t+1}(y_{t+1}, a_{t+1})] \right\}$$

$$st.$$

$$c_t + a_{t+1} \leq y_t + a_t(1+r)$$

$$a_{t+1} \geq \underline{a}$$

$$v_{T+1}(a_{T+1}) = \kappa \frac{(a_{T+1})^{\gamma}}{1-\gamma}$$

- Income follows AR(1), unemployment risk, deterministic growth profile
- Monthly frequency, 40 years of working life

Structural Estimation, Parameters

	Parameter	Symbol	Value	Source
Preferences	Time Preference	β	0.9344	SMM
	Risk Aversion	γ	2.48	SMM
	Bequest Motive	κ	239	SMM
	Dissaving Aversion	ψ	0.346	SMM
Primitives	Rate of Return	r	0.78%	60-Month CD
	Initial Endowment	a_0	-	SCF
Income	UI Replacement	u_i	0.463	OUI
	Job-Finding Probability	p_e	0.48	CPS
	Separation Probability	p_u	0.011	CPS
	Stimulus Payment	T	0.6966	BANK
	Deterministic Income	$\{\Gamma_t\}_{t=0}^{T}$	●	First Stage
	Income Persistence	ρ	0.8962	First Stage
	Income Volatility	σ_ϵ	0.073	First Stage

Structural Estimation, Moments

Moments to Match
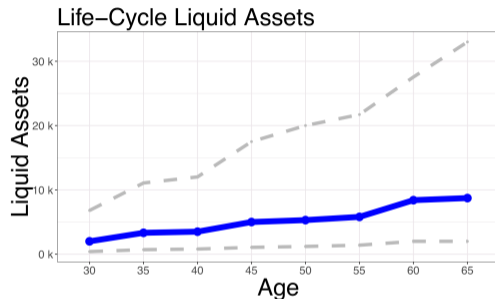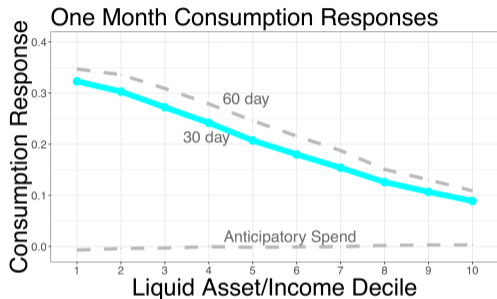
- **Standard Buffer-Stock** ($\{\beta, \gamma, \kappa\}$): match life-cycle asset accumulation.
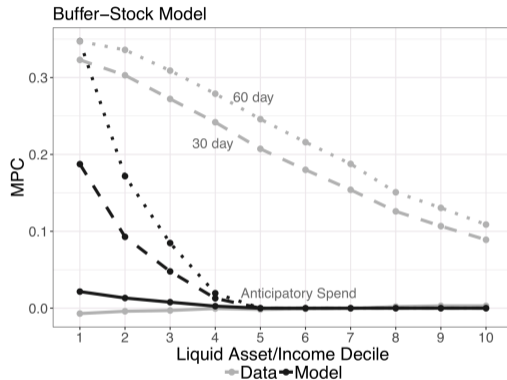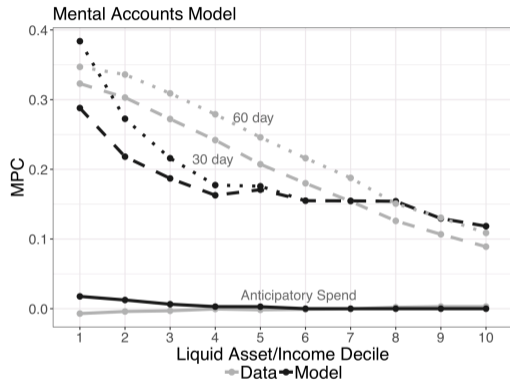- **Here** ($\{\beta, \gamma, \kappa, \psi\}$): jointly with cross-section of consumption responses.

Objective   Identification   Decomposition
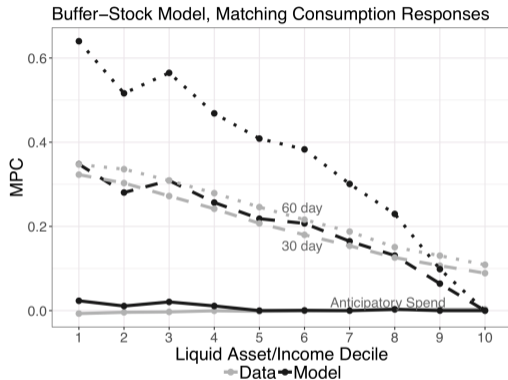
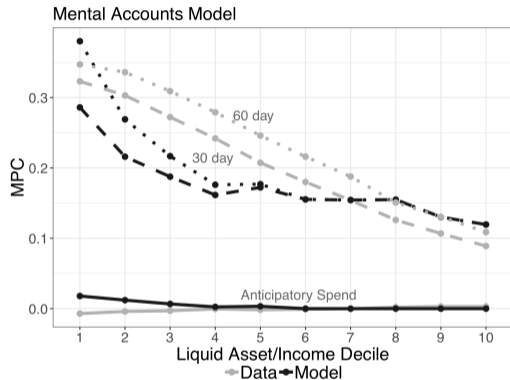# Estimation Results, Model Comparison

Estimation Results

Model	β (Annual)	γ	κ	ψ
Mental Accts.	0.9344	2.481	238.7	0.346
Buffer-Stock	0.8994	2.330	278.0	—

Full Results B-S Cons. Contours (M-A) Contours (B-S) Asset Dist. Vary

Estimation Results, Model Comparison

Estimation Results

Model	β (Annual)	γ	κ	ψ
Mental Accts.	0.9344	2.481	238.7	0.346
Buffer-Stock (Cons. Match)	0.748	1.043	287.8	—

Fiscal Stimulus

Fiscal Stimulus

Three Experiments

- ▶ Small open economy, monthly frequency

- ▶ Preference parameters from structural estimation

- ▶ Transfer payments to working age agents

Fiscal Stimulus
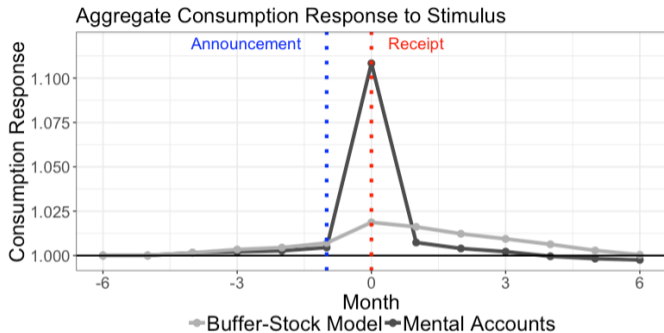## Three Experiments

- ▶ Small open economy, monthly frequency
- ▶ Preference parameters from structural estimation
- ▶ Transfer payments to working age agents

Experiment 1: Lump sum transfer to all households

- ▶ Announcement at time $t-1$.
- ▶ All households receive two weeks of income at time t ($T_t^i = 0.5 \ \forall i$)

Experiment 1: Lump Sum Stimulus

Aggregate Consumption Response to Stimulus

| Cumulative	Mental Accts.	Buffer-Stock
Announcement	0.009	0.014
Receipt	0.226	0.052
One Quarter	0.24	0.094

Three Experiments

Experiment 2: Redistributive taxation

- Announcement at time $t-1$.

- Balanced budget redistribution $(\sum_{q=1}^{5} \int_i T_t^{i,q} \cdot \Gamma_t^i di = 0$) across agents (i) and quintiles of liquid balances (q)

  - Lump sum transfer from fifth liquidity quintile to first of $2500.
  - Such that $T_t^{i,1} \approx 0.35 \ \forall i$ in quintile 1.

Experiment 2: Redistributive Taxation
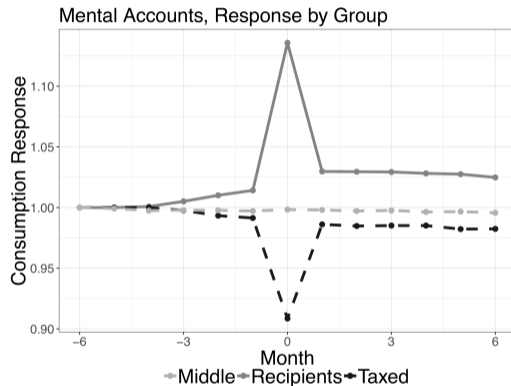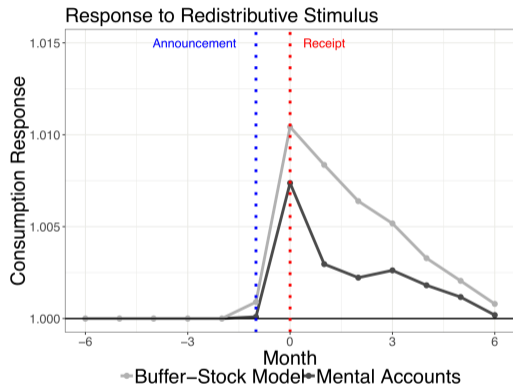
▶ Stimulus 53% less effective over 2 quarters under mental accounts

Fiscal Stimulus

Experiment 3: Targeted Stimulus Policies

Three distinct budget-equivalent policies:

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1. Un-targeted: $100 to all households
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2. Income-targeted: $500 to lowest 20% of income at announcement
   - ie. unemployment insurance, workers' compensation

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Experiment 3: Targeted Stimulus Policies

Three distinct budget-equivalent policies:

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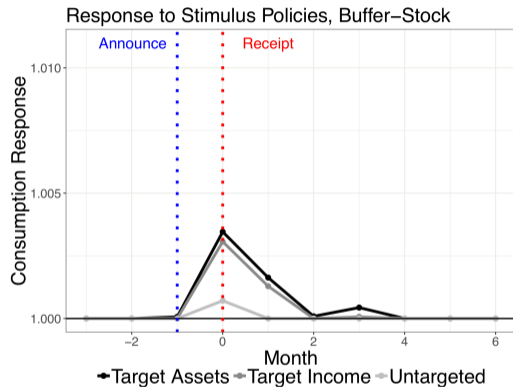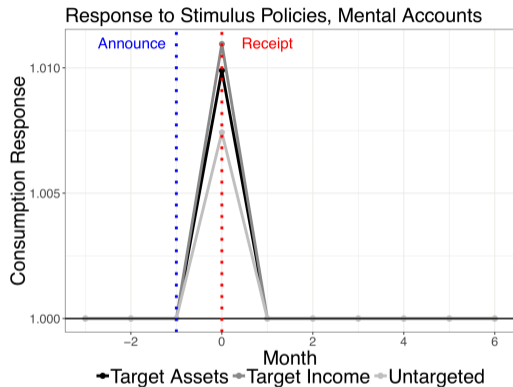   - ie. unemployment insurance, workers' compensation
3. Asset-targeted: $500 to lowest 20% of liquid assets
   - ie. means-tested programs, such as SNAP or TANF

Experiment 2: Redistributive Taxation

Response to Stimulus Policies, Mental Accounts

Response to Stimulus Policies, Buffer–Stock

- ▶ Buffer-stock: relative to un-targeted, income-target $+600\%$ & asset-target $+800\%$
- ▶ Mental Acct.: income-target $+47\%$ and asset-target $+33\%$

Conclusion

1. Document in micro-data:
   - Significant consumption responses amongst households with high levels of liquidity.
   - Responses that are highly front-loaded to receipt & decline moderately in levels of liquidity.

2. Propose departure from standard model in which households averse to dissaving.
   - Structural estimation of preference parameters.
   - Captures salient features of data.

3. Re-evaluate impact of stimulus policies.
   - Redistributive stimulus 53% less effective over 2 quarters under mental accounts

Overall Summary Statistics

Table: Summary Statistics

		Mean	25th	Median	75th
Demographics	Age	42.2	32	41	52
	Account Users	1.4	1	1	2
Income	Total Income	5935	2273	3923	6782
	Labor Income	4022	1835	2957	4754
Balances	Total Liquid	8673	473	1835	6442
	Checking	4955	341	1255	3691
	Savings	2302	0	0	263
	Revolving Credit	920	0	0	0

Expenditure Basket

Figure: Monthly Household Expenditures

External Benchmarking

Source	Annual Income			Checking			Liquid Balances		
	25th	Median	75th	25th	Median	75th	25th	Median	75th
SCF	29863	50569	85632	300	1700	5600	800	3800	16000
SCPC	-	-	-	200	1000	3500	-	-	-
BANK	31754	50568	82484	338	1251	3687	459	1796	6182

SCF Adjustment · External Benchmarking

SCF Post-Tax Adjustment

Table: Average Taxes by Bracket, 2016. Source: CBO

Bracket	Q1	Q2	Q3	Q4	Q5	99th
Bounds	<32.5	32.5-54.8	54.8-81.8	81.8-126.1	126.1-546.8	>546.8
Average Tax Rate	0.017	0.094	0.139	0.179	0.265	0.333

Source	25th	Median	75th
SCF	30,379	58,733	104,302
SCF, Adjusted	29,863	50,569	85,632
BANK	31,754	50,568	82,484

Data, External Validation

Table: Expenditure Comparison, Monthly Averages, 2016

Source	Expenditure	Non-Durables	Durables	Services	Food Services	Groceries
CEX	4775.92	980.92	633.67	2386.83	337.42	303.17
BANK	5347.84	1059.18	168.40	1252.30	306.41	220.49

Table: Income Comparison, Monthly Averages, 2016

Source	Monthly Income	Federal Tax Refund	State/Local Tax Refund
CEX	5347.92	-	-
IRS	-	2860	1622
BANK	5949.35	2844.61	1218.37

Account Frequencies

Table: Number of Accounts, Frequencies, 2016

Source	Checking			Savings			
	1	2	3+	0	1	2	3+
SCPC	0.665	0.247	0.087	0.208	0.471	0.205	0.116
BANK	0.879	0.107	0.014	0.61	0.345	0.039	0.012

Overall Summary Statistics

Table: Summary Statistics, Tax Refund Recipients

	Mean	25th	Median	75th
Liquid Balances	7279	581	1828	5699
Income	5259	2425	3868	6245
Tax Refund	2072	360	1120	2993

Overall Summary Statistics

Table: Summary Statistics, Bonus Check Recipients

	Mean	25th	Median	75th
Liquid Balances	12690	2024	4930	13609
Income	8246	4207	6182	9396
Bonus Check	11445	3290	5733	10802
Tax Refund	2818	582	1170	3906

Refund Arrival Variation

Bonus Arrival Variation

Timing of Bonus Pay

Total Expenditure Response

Figure: Total Expenditure Response
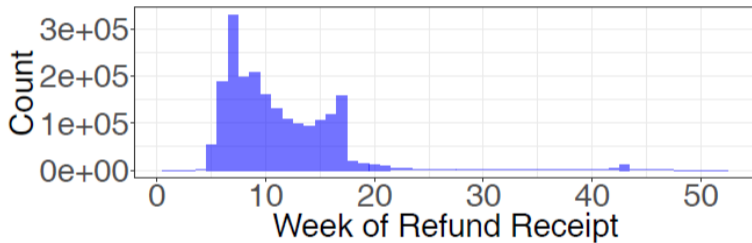
Non-Durable Measure Construction

Measure includes

1. **Non-durable goods**: groceries, entertainment, fuel, discount & drug stores, direct market catalogs
2. **Services**: utilities, telecommunications, insurance, health expenses, bills, food services, travel services, other personal and professional services.
3. **Imputation procedure**: assign cash, unclassified checks, payments to unobserved credit card accounts ▸ Imputation Procedure

Imputation Procedure

Denote total expenditure ($e^{i,q}$), observable non-durables ($e^i_{\mathcal{ND}}$), unclassified ($e^i_{\mathcal{C}}$).

- Mean observable expenditure on non-durables for households in population q,
  $\xi^q \equiv \frac{1}{N} \sum_{i=1}^{N} \frac{e^{i,q}_{\mathcal{ND}}}{e^{i,q} - e^{i,q}_{\mathcal{C}}}$,

- Imputed non-durable consumption responses for population q at lag j are then obtained via $\delta^{\mathcal{ND_I},q}_{t-l} = \delta^{\mathcal{ND},q}_j + \xi^q \cdot \delta^{\mathcal{C},q}_j$, where δ_j from regression

- ξ taken from the month prior to refund receipt

Procedure Assumes

1. Proportion of unclassified towards non-durables same as that of identifiable portion of total expenditure
   - SCPC (2018): 40% of cash and paper check transactions & 36% of payment card (credit, debit, pre-paid) transactions represented purchases of retail goods.

2. Excess response of these categories at income receipt scales proportionally
   - Shifts in the composition of expenditure around refund receipt are small ▸ Basket

Expenditure Basket

Expenditure Categories, Proportion of Total Expenditure by Time Period

Figure: Weekly Consumption Basket Around Tax Refund

‹ Balance Sheet Response   ‹ Non-Durable Response

Durable Consumption Responses, Tax Refunds

Durable Consumption

Non-Durable Response

Non-Durable Consumption Responses

Distributions by Decile

Total Liquid Balances by Liquid Balance/Income Deciles

Total Income by Liquid Balance/Income Deciles
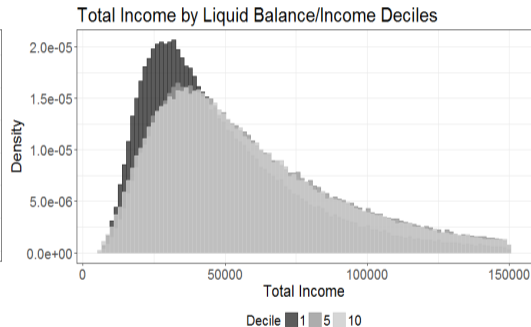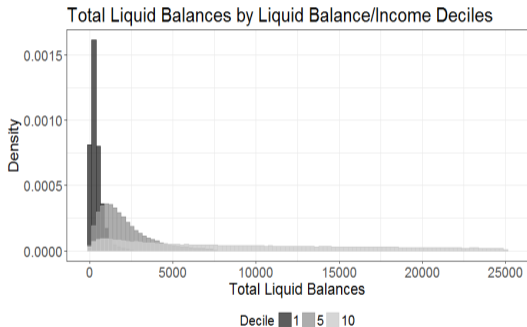
Non-Durable Consumption Responses

Baskets by Decile

Expenditure Categories, Proportion of Total Expenditure by Time Period, Lowest Liq./Income Quintile

Expenditure Categories, Proportion of Total Expenditure by Time Period, Highest Liq./Income Quintile
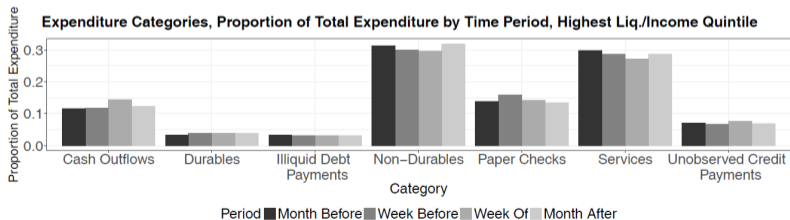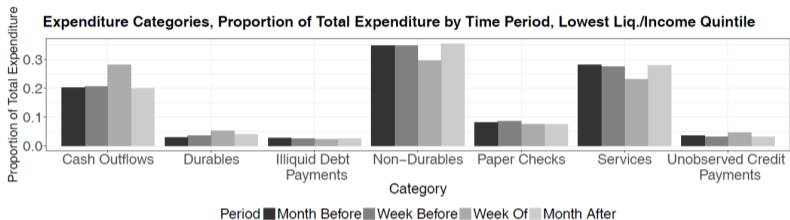
Non-Durable Consumption Responses, Bonuses

Cross–Sectional MPCs out of Bonuses, Non–Durables

Liquid Assets / Income Deciles

— 1 Month — 2 Months — 3 Months — Anticipatory Spend
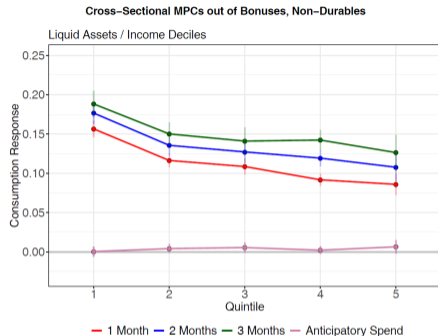
Quintile	1	2	3	4	5
$\frac{Liquid\ Assets}{Total\ Income}$, Lower Bound	0	0.29	0.55	1	2.35
Total Income	7023	7738	8260	8765	8734
Bonus	6770	8542	10584	12953	15952

Total Expenditure Responses
Cross-Section

Marginal Propensities to Spend out of Tax Refund

Liquid Assets / Income Deciles

Legend: 1 Month, 2 Months, 3 Months, Anticipatory Spend

Axis labels: Estimate (y-axis), Decile (x-axis)

↦ Non-Durable Responses

Non-Durable Expenditures, Pre-Imputation

Cross-Section

Cross-Sectional MPCs, Non-Durables (Expanded Measure)

Liquid Assets / Income Deciles

— 1 Month — 2 Months — 3 Months — Anticipatory Spend

▸▸ Imputation Procedure   ▸▸ Non-Durable Responses

Non-Durable Consumption Responses

Dynamics

Non–Durable Consumption, Liquid Balance/Income Quintiles (Expanded Measure)

Quintile 1 | Quintile 2 | Quintile 3 | Quintile 4 | Quintile 5
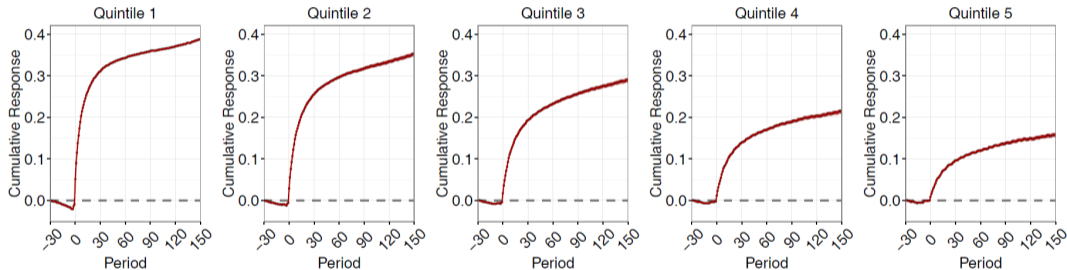
⇥ Imputation Procedure   ⇥ Non-Durable Responses

Robustness
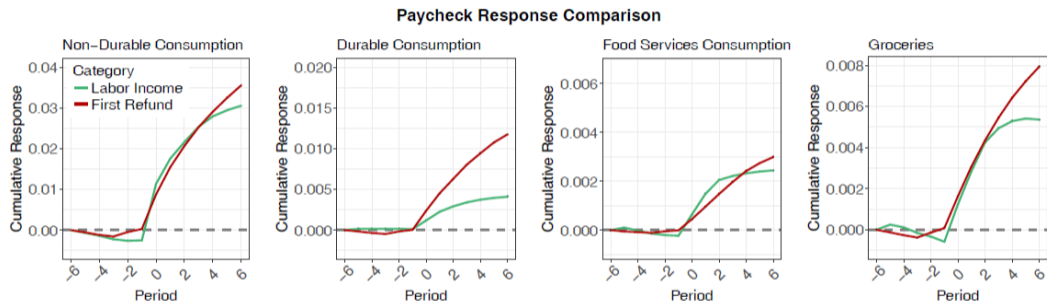
Figure: Consumption Responses Around Regular Paychecks

▸ Robustness

Robustness

Bonus Checks
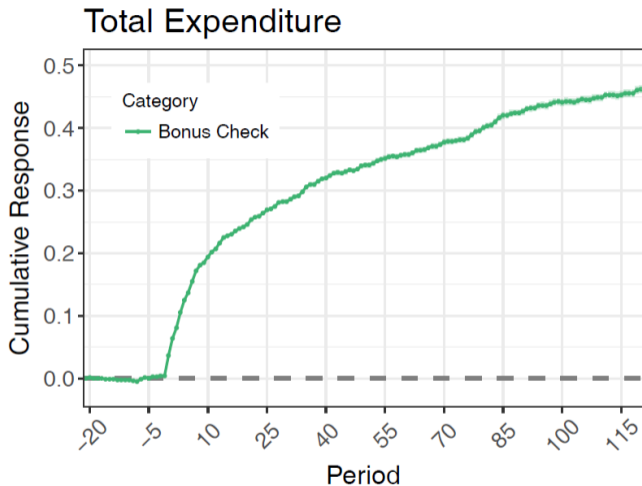
Total Expenditure

Figure: Total Expenditure Response to Bonus Checks

Robustness

Magnitude

Non–Hand–to–Mouth, Total Expenditure, Refund Size/Income Quantiles
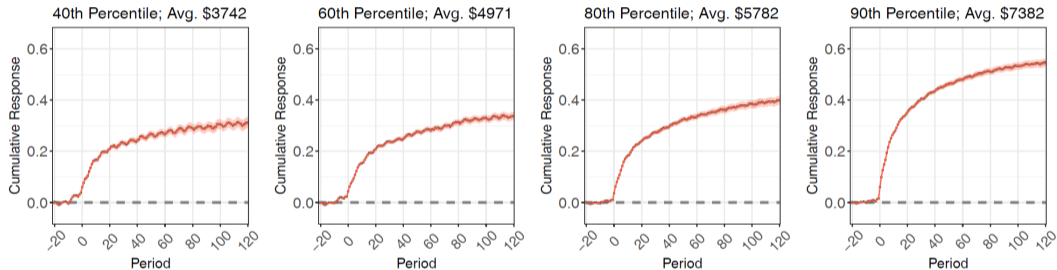
Figure: Expenditure Responses of the Non-Hand-to-Mouth Across Refund Size Relative to Income

▸ Robustness

Robustness

Categories

Food Services Consumption

Grocery Consumption

Robustness

Categories

Retail & Entertainment Consumption
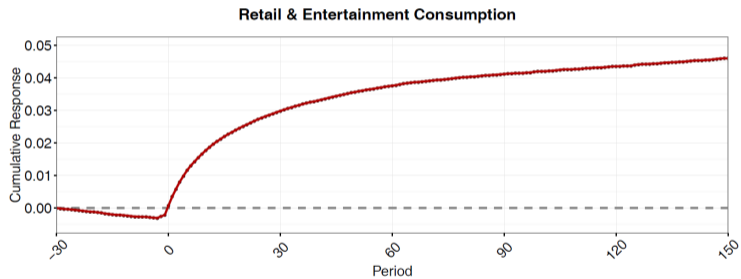
Robustness

Two Refunds
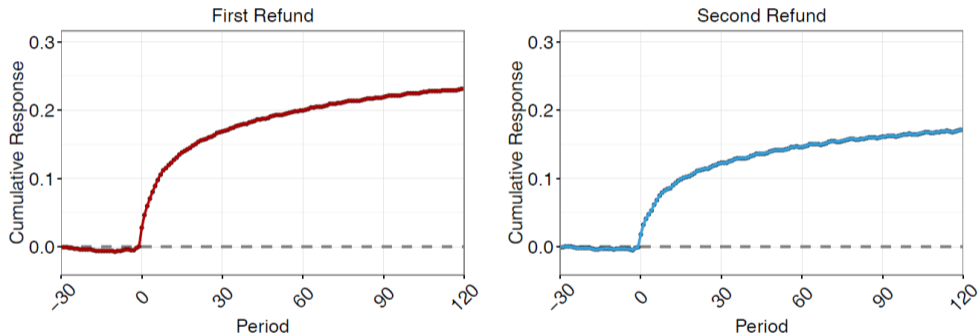
Figure: Tax Refund Responses, Multiple Refunds

⊳⊳ High Liquidity   ⊳⊳ Robustness

Robustness

Tax Filing
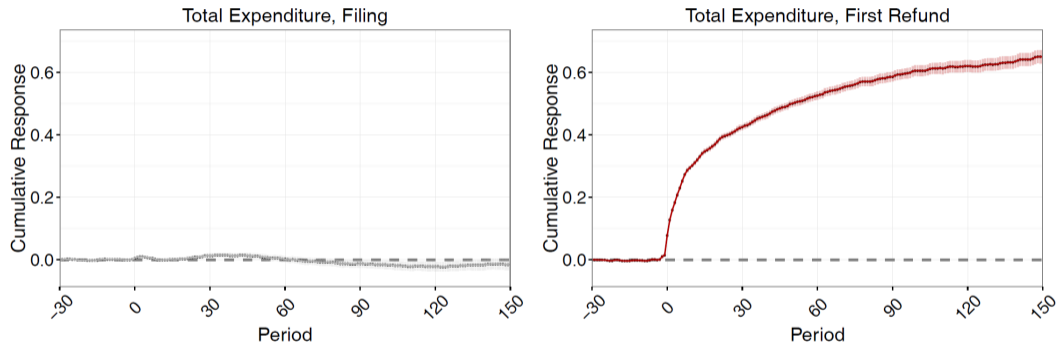
Figure: Expenditure Response at Tax Filing

‣ High Liquidity   ‣ Robustness

Robustness

Response at Receipt and Filing, Total Expenditure, Liquid Balance/Income Quintile 5
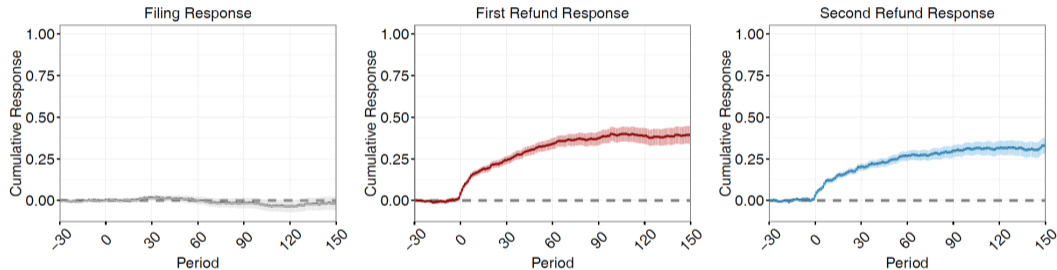
Figure: Expenditure Response, Multiple Refunds and Filing, Highest $\frac{Liquid\ Asset}{Income}$ Quintile

⊷ Robustness

Robustness

Cross-Sections

Marginal Propensities to Spend out of Tax Refund

Legend: 1 Month, 1 Quarter, 2 Quarters, Month Before

▸ Summary   ▸ Variance Decomposition   ▸▸ Robustness

Robustness

Table: MPC Correlates, Averages within deciles

Decile	1	2	3	4	5	6	7	8	9	10
Age	25	29	33	37	41	45	49	53	57	62
Income	2534	2675	3026	3450	3949	4543	5307	6356	8020	13725
Liquid Assets	133	378	635	968	1434	2134	3261	5264	9579	33176
Income C.V.	0.08	0.15	0.19	0.22	0.25	0.31	0.39	0.50	0.70	1.25
Daily Logins	0.07	0.23	0.42	0.60	0.77	0.95	1.17	1.45	1.90	3.35

▶ Cross-Sections   ▶▶ Robustness

Robustness
Cross-Sections, Variance Decomposition

	MPC Total Expenditure		MPC Non-Durables	
	Proportion of Variation	Correlation	Proportion of Variation	Correlation
Age	0.0053	+	0.0168	+
Liquid Balance	0.5841	−	0.5006	−
Liquid Balance, Deviation	0.0008	+	0.0013	+
Credit Card Balance	0.0317	−	0.0007	+
Credit Card Bal., Deviation	0.0036	−	0.0012	−
Total Income	0.1667	−	0.1333	−
Total Income, Deviation	0.0571	−	0.0515	−
Account Logins	0.0538	+	0.1399	+
Account Logins, Deviation	0.0480	+	0.038	+
Home Owner	0.0487	−	0.1147	−

Robustness

MPCs obtained non-parametrically

$$MPC_{i,t} = \frac{\Delta c_{i,t}}{\Delta y_{i,t}} = \frac{c_{i,t} - c_{i,t-1}}{Refund_{i,t}}$$

Regression

$$\begin{aligned}
MPC_{it} = {} & \alpha + \gamma_1 age_{i,t} + \gamma_{2a}\widetilde{liq\_bal}_{i,t} + \gamma_{2b}\overline{liq\_bal}_{i,t} + \gamma_{3a}\widetilde{credit\_bal}_{i,t} + \gamma_{3b}\overline{credit\_bal}_{i,t} \\
& + \gamma_{4a}\widetilde{income}_{i,t} + \gamma_{4b}\overline{income}_{i,t} + \gamma_{5a}\widetilde{logins}_{i,t} + \gamma_{5b}\overline{logins}_{i,t} \\
& + \gamma_6 \mathbb{I}_{home,i} + \epsilon_{i,t}
\end{aligned}$$

Use the method of Lindeman, Merenda, and Gold (1980) which derives the variance decomposition from sequential sums of squares averaged over all permutations of the RHS variables. ▸ Cross-Sections   Variance Decomposition   ▸▸ Robustness

Robustness

Income Groups

Robustness
Self-Selection

- Exploit panel dimension, within household variation in liquidity across years
- Construct monthly non-durable MPCs non-parametrically, ie. $\frac{\Delta e_{i,t}^{\mathcal{ND}}}{Refund_{i,t}}$.
- Decile households by $\frac{Liquid\ Assets}{Income}$ as in event study

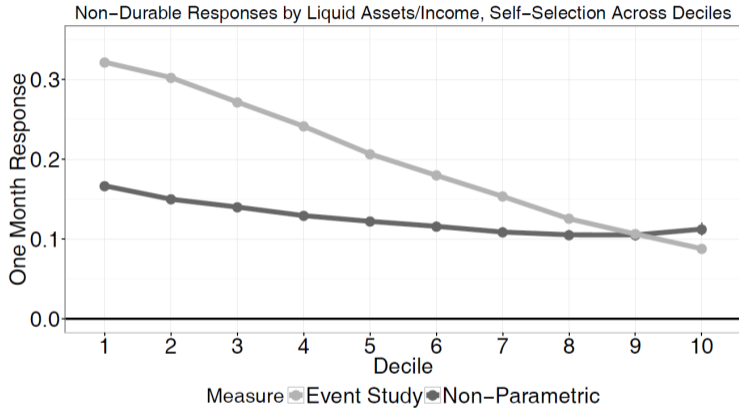$$\frac{\Delta e_{i,t}^{\mathcal{ND}}}{Refund_{i,t}} = \alpha_i + \gamma_t + \sum_{q=2}^{10} \beta_q \frac{Liquid\ Assets}{Income}^q_{i,t} + \epsilon_{i,t}$$

- Coefficients of interest: $\{\beta_q\}_{q=2}^{10}$

Robustness

Self-Selection

Non−Durable Responses by Liquid Assets/Income, Self−Selection Across Deciles

Robustness

Table: Summary Statistics by Income Level

		Median			Mean
	$\frac{Income}{LiquidBalance}$	Income	Liquid Balances	Expenditure	Tax Refund
Low Income	Low	2608	499	2374	1694
($< 40k$)	Middle	2769	1564	2603	1673
	High	2827	5059	2769	1634
Middle Income	Low	5650	1546	5238	2344
($40k - 120k$)	Middle	5897	4763	5649	2388
	High	5738	13823	5646	2417
High Income	Low	13567	5854	12492	3540
($> 120k$)	Middle	13894	14601	13010	3887
	High	13801	35539	13141	4326

Estimation Objective

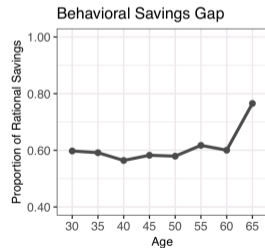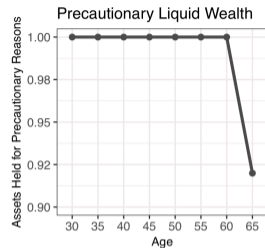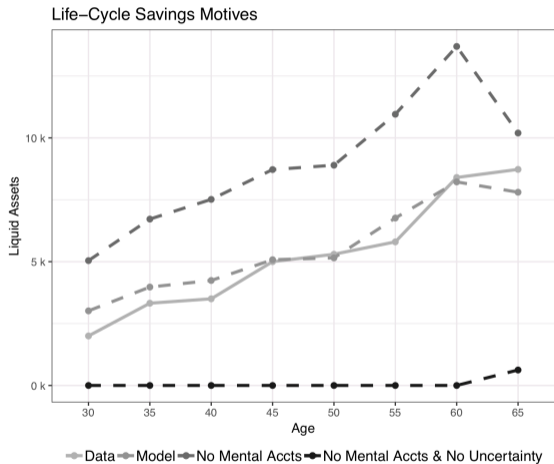**Moments to Match**

One Month Consumption Responses — Life–Cycle Liquid Assets
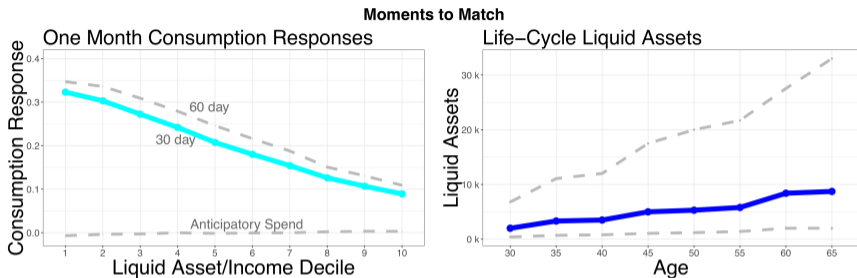
- Match assets by age group ($\{d_a^{liq}\}_{a=1}^8$) jointly with cross-section of consumption responses ($\{d_j^{mpc}\}_{j=1}^{10}$).

$$\min_{\beta,\gamma,\psi,\kappa} \Theta \sum_i^N \omega_i^a \mid d_{i,a}^{liq} - m_a^{liq}(\beta,\gamma,\psi,\kappa) \mid + (1-\Theta) \sum_j^{10} \mid d_j^{mpc} - m_j^{mpc}(\beta,\gamma,\psi,\kappa) \mid$$

Structural Estimation

Life-Cycle Decomposition

Life–Cycle Savings Motives

Precautionary Liquid Wealth

Behavioral Savings Gap

Data — Model — No Mental Accts — No Mental Accts & No Uncertainty

Moments

Identification

- Perfect Foresight. Agent lives $T = 660$ months, $a_0 = 0$, income only in the initial period ($y_0 > 0$, $y_t = 0 \ \forall \ t > 0$).
- Monthly return on savings $(1 + r)$, faces no credit constraints. Solves

$$\max \sum_{t=0}^{T} \beta^t \nu(c_t)$$
$$c_t + a_{t+1} \leq y_t + a_t(1 + r)$$
$$a_{T+1} \geq 0$$

- Given γ, restrictions imposed by $\frac{\partial c_0}{\partial y_0}$ and $\frac{\partial c_{t+1}}{\partial y_0} / \frac{\partial c_t}{\partial y_0} \ \forall t > 0$ identify β and ψ.

Identification
Cont.

Period 0 response

$$\frac{\partial c_0}{\partial y_0} = \left(1 + \left(1 - \psi\right)^{\frac{1}{\gamma}} \cdot \left[\frac{\beta^{\frac{1}{\gamma}}(1 + r)^{\frac{1-\gamma}{\gamma}} - (1 + r)^{-T}(\beta(1 + r))^{\frac{T}{\gamma}}}{1 - \beta^{\frac{1}{\gamma}}(1 + r)^{\frac{1-\gamma}{\gamma}}}\right]\right)^{-1}$$

And

$$\frac{\partial c_{t+1}}{\partial y_0} = \frac{\partial c_t}{\partial y_0}[\beta(1 + r)]^{\frac{1}{\gamma}} \text{ for all } t > 0.$$
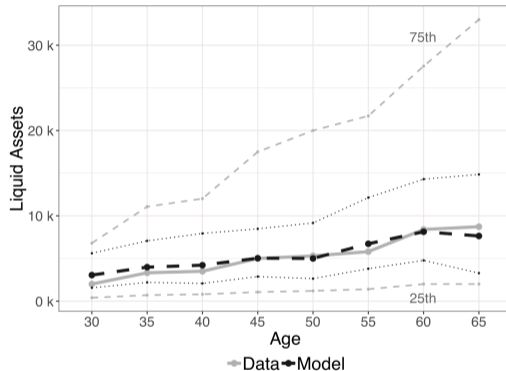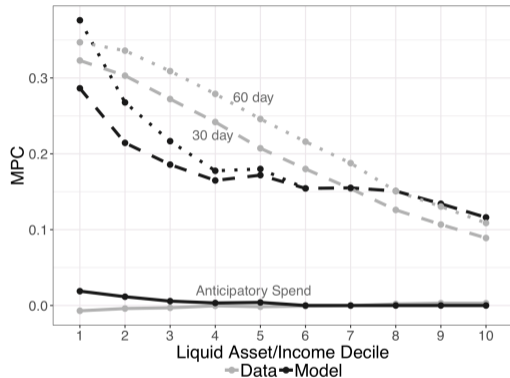
Identification

Cont.

Amongst fifth liquidity quintile $\frac{\partial c_0}{\partial y_0} \approx 0.095$, $\frac{\partial c_4}{\partial y_0} / \frac{\partial c_3}{\partial y_0} \approx 0.986$. Choosing $(1+r) \approx 1$, $\gamma = 1$ (log utility), it follows $\beta = 0.986$ and $\psi = 0.867$.

Figure: Mental Accounts Consumption Response

Parameters

Figure: Deterministic Profiles

Parameters

Life–Cycle Income Profile, Liquid Assets

Figure: Deterministic Component of Income, Monthly Frequency

Estimation Results

Estimation Results

β (Annual)	γ	κ	ψ
0.9344	2.481	238.7	0.2089

Estimation Results, Buffer-Stock Model

Estimation Results
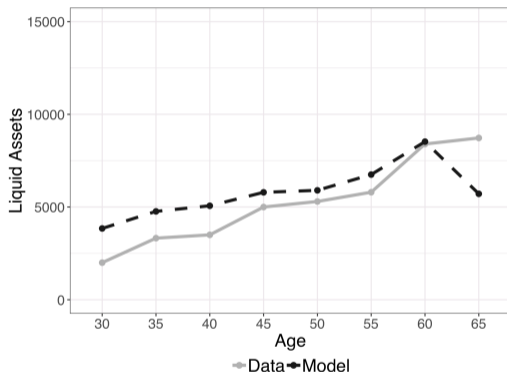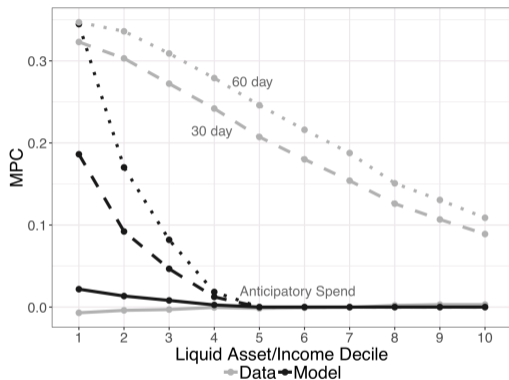
β (Annual)	γ	κ	ψ
0.8994	2.330	278.0	—

Estimation Contours

Figure: Parameter Identification Contours

Estimation Results, Buffer-Stock Model

Estimated to match consumption responses

Estimation Results

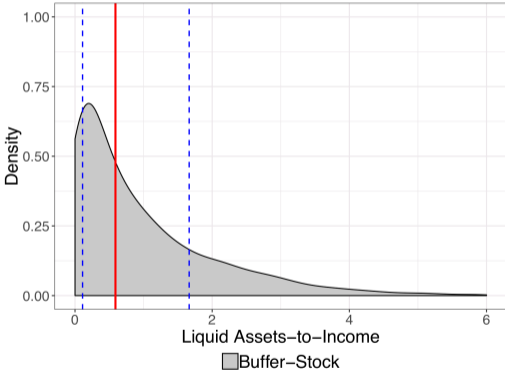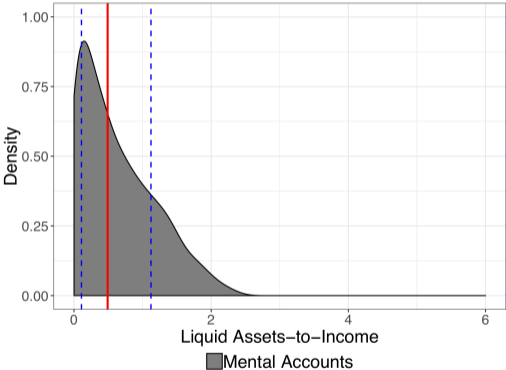# Estimation Contours, Baseline Model

Figure: Parameter Identification Contours
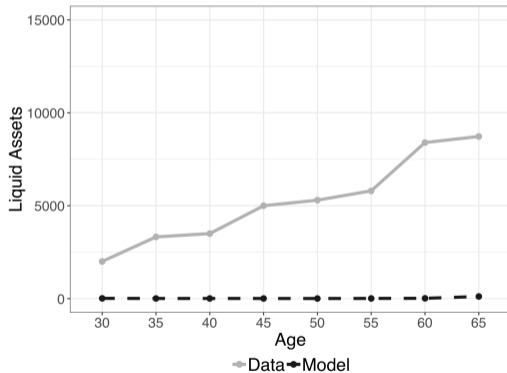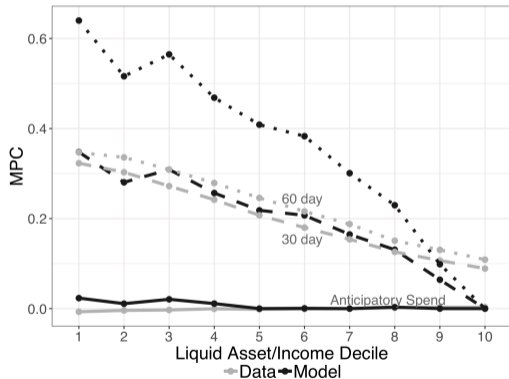
Asset Distributions

Liquid Asset Distributions

Consumption Responses
Other Models

- **Buffer-stock**, **Two assets**[1]: consumption responses display moderate decline in levels of liquidity, significant amongst those with high liquidity, front-loaded to receipt.

- **Rational inattention**[2]: consumption responses in data immediate and short-lived, no systematic innovation at the date of filing.

- **Temptation**[3], **Reference**-dependence[4]: consumption responses delayed until receipt, even for households with substantial liquid wealth, access to credit cards.

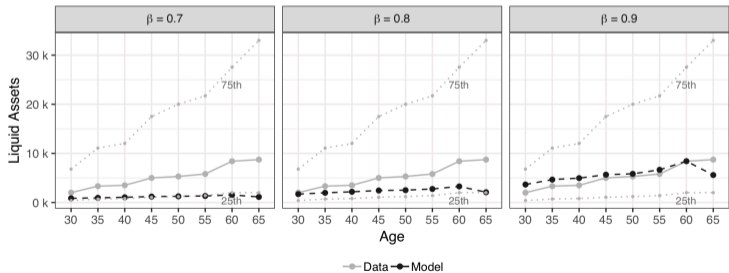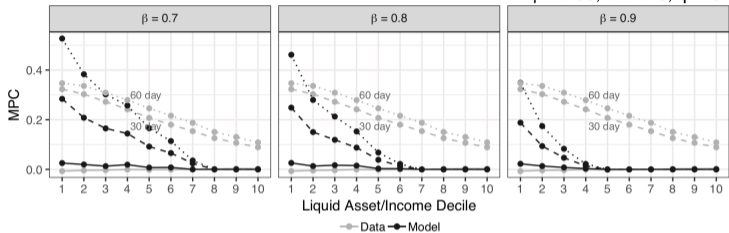[1] Parker and Gourchinas (1999), Kaplan & Violante (2011)
[2] Reis (2006), Gabaix (2011)
[3] Laibson (1997), Gul & Pesendorfer (2001)
[4] Köszegi & Rabin (2006)

▸▸ Robustness

Vary β

Varying Time Preference

$\gamma = 2.33, \kappa = 278, \psi = 0.0$

Vary ψ

Varying Dissaving Aversion

$\beta = 0.9348$, $\kappa = 238.7$, $\gamma = 2.481$

Vary γ

Cross–Sectional MPCs, Buffer–Stock Model

$\beta = 0.8994, \kappa = 278, \psi = 0.0$