A $100,000 marshmallow experiment: Withdrawal and spending responses to early retirement-savings access

Steven Hamilton
GWU

Geoffrey Liu
Harvard

Jorge Miranda-Pinto
IMF and UQ

Tristam Sainsbury
ANU

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Motivation

- Australia privatized social security in 1993 with mandatory 11% contributions into private retirement accounts and no withdrawal until retirement
- In 2020, the Australian government allowed the withdrawal of A$20k (50% of median annual wages) from these private retirement accounts
- This represented a large, unprecedented, unexpected, and one-off positive liquidity shock, holding lifetime income constant
- **In this paper**
  - We leverage high-frequency bank account and administrative data to study the withdrawal and spending responses to this shock
  - Use a quantitative heterogeneous agents model to rationalize the evidence

Preview of main results

1. Selection into the program (who withdrew, withdrew earlier, withdrew again)
   - *Those with modestly lower wages but radically worse financial health*
   - *Blue-collar occupations, lesser-educated, regional and remote*
   - More **permanent**, rather than idiosyncratic, **differences**
2. Effect of the program (what those who withdrew did with the money)
   - *Large and rapid spending impulse (MPX≈0.5, 90% in 4 wks, >70% non-durables)*
   - *Spending uniformly distributed and predicted by poor financial health, gambling*
3. Calibration exercise (compare results to leading consumption model predictions)
   - *Liquidity constraints (and impatience) explain withdrawal but not spending*
   - ***Present bias matches both** spending impulse and pre-withdrawal asset distribution*

Literature

- Empirical macro excess consumption sensitivity
  - Parker & Souleles, 2006 (tax credits); Hsieh, 2003 (Alaska Permanent Fund); Imbens et al., 2001 (lottery winnings)
- Liquidity constraints vs behavioral explanations
  - Kaplan & Violante, 2014 (liquidity constraints); Laibson, et al., 2021 (present bias)
- Consumption behavior with high-frequency data
  - Ganong & Noel, 2019 (UI exhaustion); Gerard & Naritomi, 2021 (severance pay)
- Retirement savings policy
  - Goda et al., 2022 (early withdrawal); Beshears, et al., 2020 (optimal liquidity)

Preliminaries

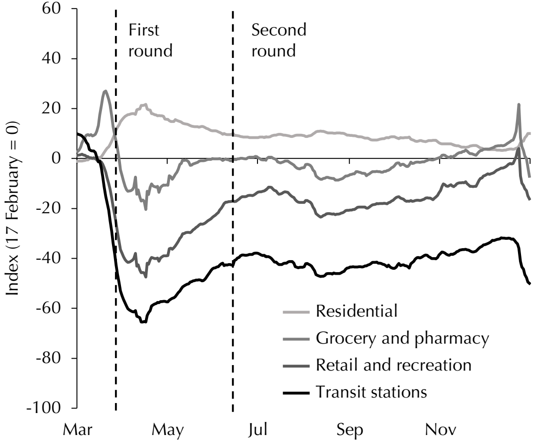
Australia's private pension system ('super')

- Australia has had a privatized social security system since 1993 ($\approx$200% of GDP)
- Mandatory 11% of all labor income taxed at 15% (with cash returns taxed at 15% and capital gains at 10% during accumulation, and no tax in retirement)
- Funds managed privately with median 30-year net nominal return of 8.3% p.a.
- Withdrawal is only allowed from age 65 if working (or 58 if retired, rising to 60)
- Median super balance of those aged 30 is $35k and of those aged 50 is $125k
- There is also a 'fall-back' public pension system

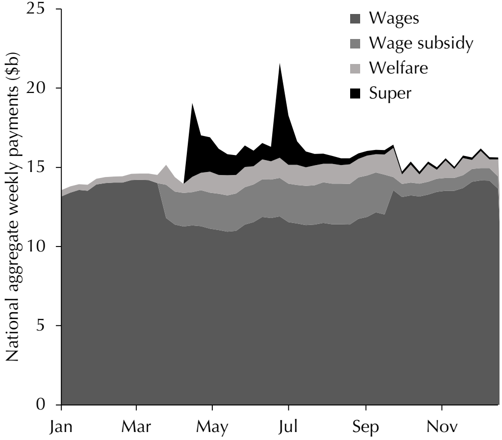
Early super withdrawal program

- On March 22, 2020, the government announced eligible people could withdraw \$10k by June 30 and another \$10k from July 1 – December 31
- First time early super withdrawal had ever been permitted
- Eligibility included: unemployed; government benefit receipt; having been made redundant or had working hours reduced by 20%; a sole trader whose business was suspended or has suffered a reduction in turnover of at least 20%
  - Not really enforced: $\approx$ 20% of withdrawers did not meet the eligibility criteria
- Website applications opened on April 20 with a 3-day processing time
- Withdrawals introduced alongside a raft of other fiscal supports

Pandemic timing in Australia



(a) Mobility indicators by establishment



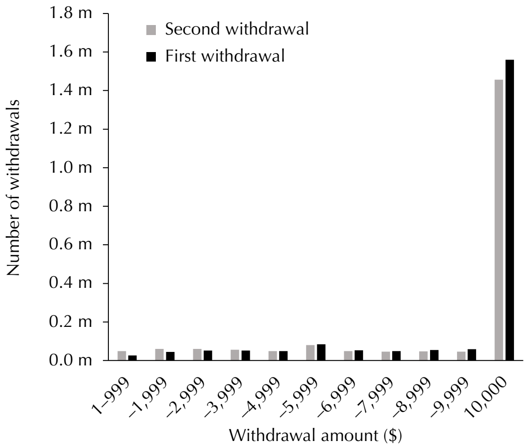
(b) Working-age payments by type

Empirical Evidence

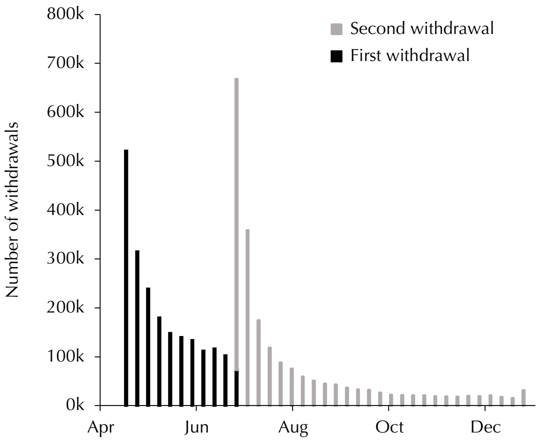
Data

- Administrative records of all super account holders (Australian Government)
  - Demographics (age, gender, number of children, location, occupation, etc.)
  - Three prior annual tax returns; weekly wages and welfare payments
  - Super balance, withdrawal dates, withdrawal amounts
- Detailed bank account transaction data (Illion)
  - Australia's largest independent credit bureau
  - 90-day snapshot of linked bank account and credit card transactions
  - Categorise weekly all payments and receipts (wages, rent, groceries, etc.)

Withdrawal size and speed



(a) Number of withdrawals by amount



(b) Number of withdrawals by week

Withdrawal summary

- One quarter of all 34yos in Australia withdrew
- Half of all withdrawals in first 10 days; 5 in 6 withdrew max they could
- Withdrawal age concentrated among late 20s to early 40s
- Withdrawal strongly correlated with SES, education, occupation, financial health
- This is true in the 3 years before, 1 month before, and working life
- This selection effect is stronger the earlier they withdrew
- It's also stronger among those who withdrew a second time

▸ Age distribution/socio-econ/occupation/tax returns

Spending

Aggregate income and spending

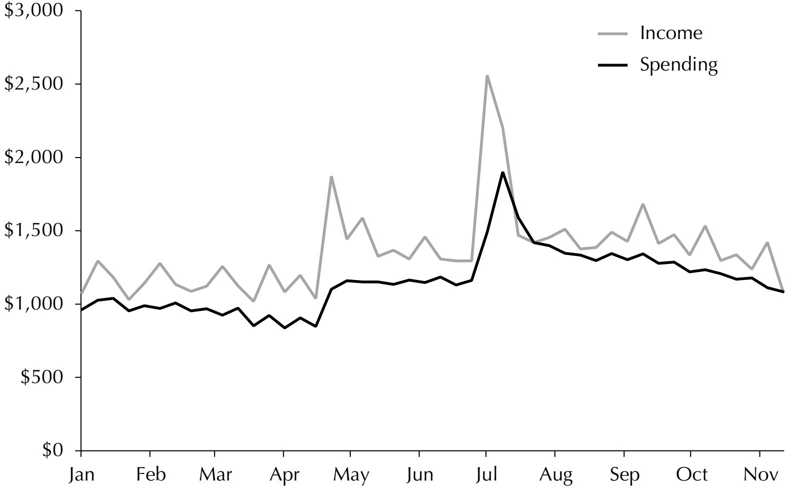


Figure: Average weekly income and spending

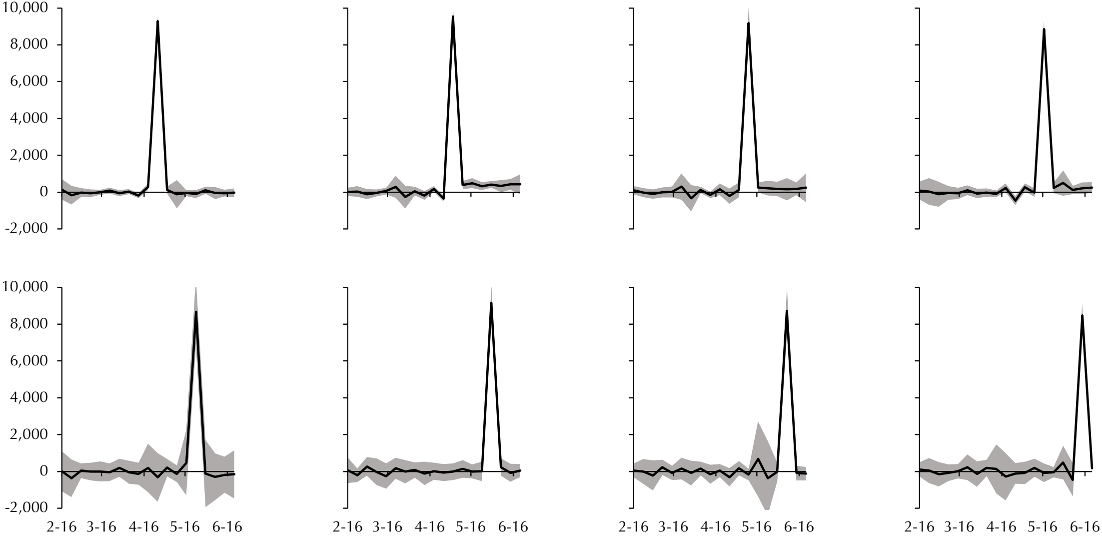
Identification strategy

Difference-in-differences with two-way fixed effects (event study)

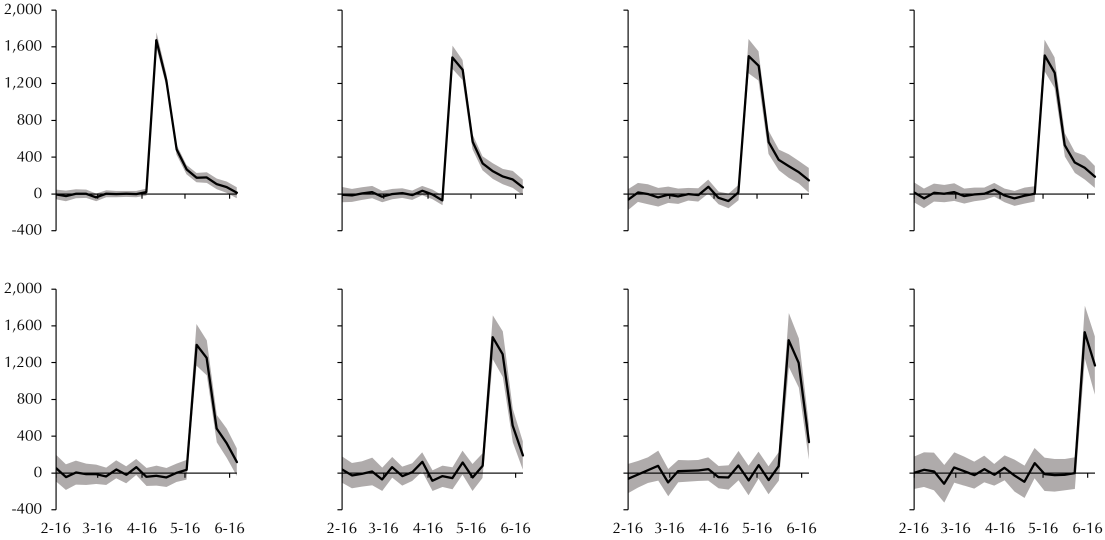
- Use modern methods (Callaway & Sant'Anna, 2021 / Sun & Abraham, 2021)
- Compare those who withdrew with those who didn't (or not-yet-withdrawers)
- Income and spending by week relative to pre-withdrawal week
- Estimate separately for each weekly withdrawal cohort and sample weight
- Estimating equation:

$$Z_{it} = \alpha_i + \lambda_t + \sum_{\ell \neq -1} \delta_{e\ell} \left(\mathbf{1}\left\{ E_i = e \right\} \cdot D_{it}^{\ell} \right) + \varepsilon_{it},$$

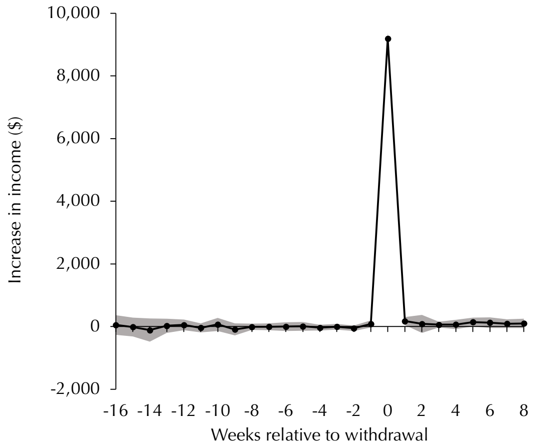
Event study (income)



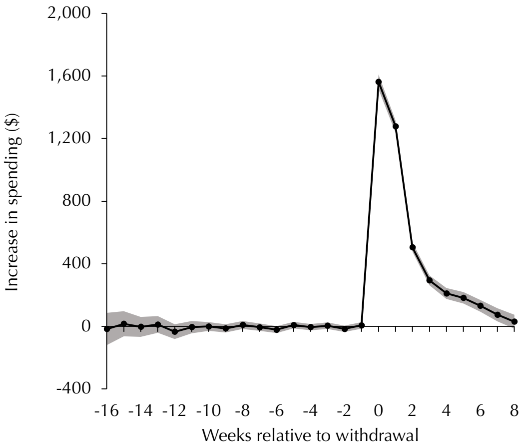
Event study (spending)



Event study



(a) Income

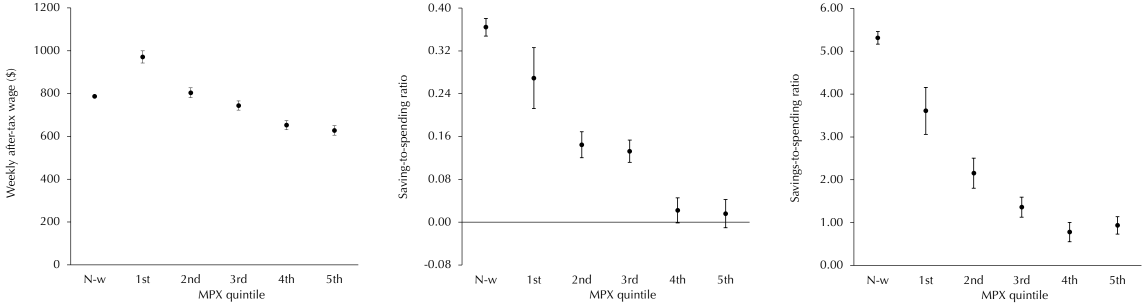


(b) Spending

MPX estimates

Outcome	First withdrawal	Second withdrawal
Income	9,343 (294)	10,314 (274)
Spending	4,033 (59)	4,982 (169)
MPX	0.43 (0.01)	0.48 (0.01)
N	337,223	410,761

Heterogeneity: pre-withdrawal predictors of spending



(a) Wages (b) Saving rate (c) Liquid assets

▸ More on liquidity and heterogeneity

Spending summary

- Withdrawers spent at least half of the withdrawals within 8 weeks
- 90% of the spending shock occurred in the first 3 weeks
- Spending response is roughly uniformly distributed with a long right tail
- Spending spread broadly across categories (31 out of 40 significant)
- ATM withdrawals and gambling the largest (larger than credit card repayments)
- Spending response decreases monotonically with pre-withdrawal liquidity
- Spending strongly predicted by pre-withdrawal financial health and gambling

A Theoretical Framework

Model

Adapted standard heterogeneous-agent model (Kaplan and Violante, 2014), featuring:

1. Idiosyncratic income risk
   - Households identical but subject to different stochastic income (z) paths
2. Two assets, with liquidity constraints
   - Liquid checking account (b) and perfectly illiquid pension savings (a)
   - Borrowing is constrained $b > \underline{b} = \phi w z$
3. Retirement
   - Exogenous retirement probability λ_R (Blanchard, 1985)
   - Pension has a self-funded component and a fixed income component
4. Accommodate present-biased households
   - Naïve hyperbolic discounting (Laibson, Maxted, and Moll, 2023)

Continuous time recursive formulation

The Hamilton-Jacobi-Bellman (HJB) equation for a household with exponential preferences:

$$\rho V(a,b,z) = \max_{c,d} u(c) + V_b(a,b,z)\dot{b} + V_a(a,b,z)\dot{a}$$
$$+ \sum_{z'} \lambda(z,z')\left(V(a,b,z') - V(a,b,z)\right) + \lambda_R \left(V^R(a,b) - V(a,b,z)\right),$$

subject to:

$$\dot{b} = (1-\xi)\,wz + \left(r^b + \phi \cdot \mathbf{1}\,(b<0)\right) b - d - \chi\,(d,a) - c$$
$$\dot{a} = r^a a + \xi wz + d$$
$$a \geq 0;\; b \geq \underline{b}$$
$$\chi\,(d,a) = -\chi_0 \cdot d^- + \frac{\chi_1}{2}\left(\frac{d^-}{a}\right)^2 a + \chi_2 \cdot d^+ \frac{\chi_3}{2}\left(\frac{d^+}{a}\right)^2 a,$$
$$V^R(a,b) = \frac{u\left(\bar{r}(a+b) + y_r\right)}{\rho}$$

Present-biased households

As in Laibson, Maxted, and Moll (2023), we accommodate naively present-biased households with the following instant gratification discount factor:

$$D(t) = \begin{cases} 1 & \text{if } t = 0 \\ \beta e^{-\rho t} & \text{if } t > 0 \end{cases}.$$

As shown by Laibson et al. (2023), the consumption policy rules for CRRA preferences are:

- for all $b > \underline{b}$, $\quad c(x) = \beta^{-\frac{1}{\gamma}} \hat{c}(x)$
- for $b = \underline{b}$, $\quad c(x) = \min\left\{\beta^{-\frac{1}{\gamma}} \hat{c}(x), (1-\xi)y + r\underline{b}\right\}$,

in which $\hat{c}(x)$ is the consumption policy function of the exponential household, which the naive household considers it will adopt in future.

Withdrawal policy experiment

- **Setup:** In a stationary equilibrium, a temporary policy change is announced to households. Zero cost of withdrawing illiquid assets $(\chi_0 = \chi_1 = 0)$ up to the withdrawal limit $\overline{d} \geq -3w$.

- **Solution approach:** The household problem is solved backward from $t + \Delta$, using the continuation value $V_{t+\Delta}$ to solve the problem at each preceding time step.

- **MPC:** We obtain the household's illiquid withdrawal/deposit decision at the time of the shock time and calculate the marginal propensity to consume (MPC) as:

$$MPC = \frac{c(a^p, b^p, z) - c(a, b, z)}{|d^p|},$$

where d^p is the withdrawal amount at the implementation of the policy. The withdrawal amount d^p directly increases households' liquidity by $\dot{b} = b' - b$. Hence, $c(a^p, b^p, z) - c(a, b, z)$ describes the change in consumption after the portfolio reallocation.

Externally calibrated parameters

Parameter	Description	Value	Source / Target
Preferences			
γ	Risk aversion	2	Standard
λ_R	Retirement pbb	$1/(40 \times 12)$	Avg. time in the workforce of 40 years
Assets			
$\underline{b}$	Borrowing limit	$-2.6w$	HILDA (Lwin, 2020)
ϖ	Interest rate wedge	0.75%	Reserve Bank of Australia
r^b	Liquid asset return	0.17%	Kaplan et al. (2018)
r^a	Illiquid asset return	0.47%	Australian Super
ξ	Share of income automatically deposited	10.5%	Australian regulation
χ_0	Adj. cost linear component withdrawals	1.1	Arbitrarily large (policy)
χ_1	Adj. cost convex component withdrawals	12	Arbitrarily large (policy)
χ_2	Adj. cost linear component deposits	0.002	Arbitrarily small (policy)
χ_3	Adj. cost convex component deposits	0.01	Arbitrarily small (policy)
Income process			
z_1, z_2	Income states	0.94, 1.06	Guvenen et al. (2023)
λ_1, λ_2	Income jumps	0.887	Guvenen et al. (2023)

Internally calibrated parameters

We calibrate the population discount factor ρ, borrowing limit $\underline{b}$, the withdrawers discount factor ρ^w, and the present bias parameters of the withdrawers β_i, for each quantile i. We match the following moments:

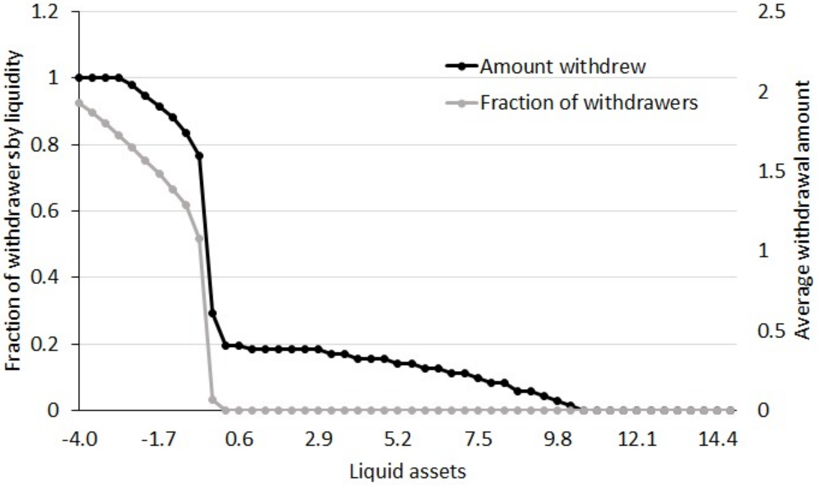
- the average net-liquid-assets-to-income ratio of the population
- the percentage of households that withdrew under the program
- and the average withdrawal amount
- the average liquidity for each of the liquidity quintiles of the withdrawers

▸ Calibration results

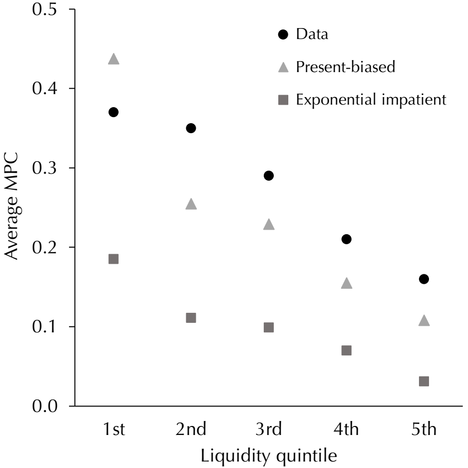
Withdrawers' MPC

Impatience vs present-bias

Liquidity and withdrawal decision

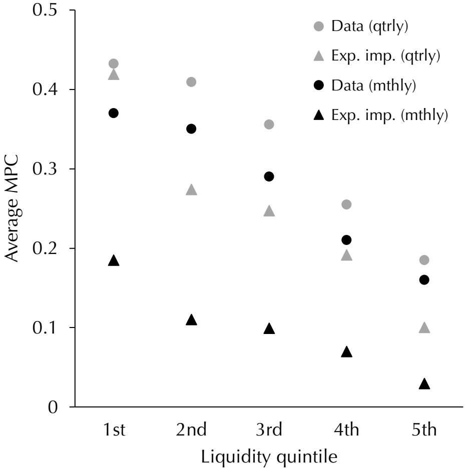


MPC heterogeneity from both models



Impatience, with an annual subjective discount factor $\in$[0.39-0.85], fails to match spending patterns.
Present-bias, with β within the range in the literature ($\in$[0.48-0.72]), is able to match the data

Role of high-frequency data



If we ignored the high-frequency evidence and calibrate the model to quarterly data, we would conclude that impatience alone—annual subjective discount factor $\in$[0.54,0.85]—can explain the evidence

Conclusion

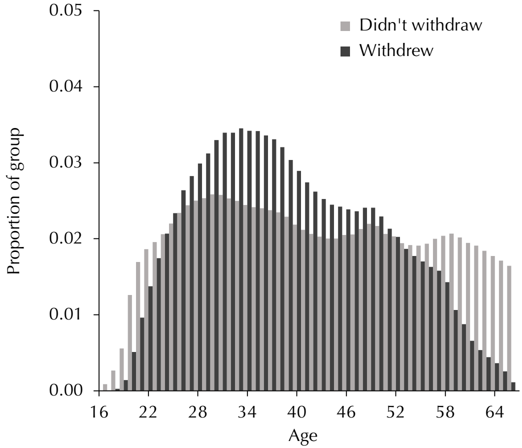
- Poor financial health, education, occupation, all predict withdrawal
- Observe large and rapid spending immediately after withdrawal
- Low liquidity and gambling strongly predict spending out of withdrawals
- Spending is too large and fast for liquidity constraints and impatience alone
- Present bias reconciles this spending and the pre-withdrawal asset distribution
    - Consistent with Ganong & Noel (2019) and Gerard & Naritomi (2021)
- Broadly, this selection advises against liquidity / early withdrawal availability

Appendix

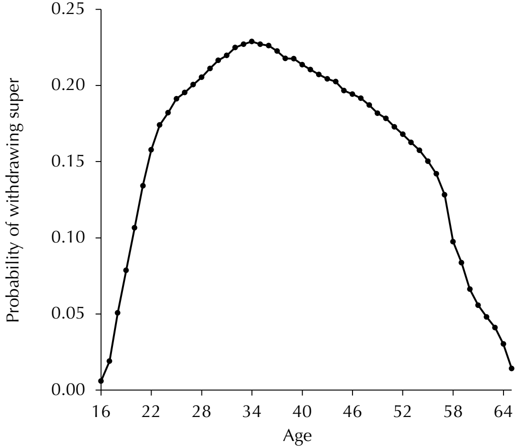
Policy implications

- Long-running debate about liquidity of retirement savings (e.g., Rubio proposal)
- Better outcomes for time-consistent vs worse outcomes for time-inconsistent
- We find extreme selection into withdrawal by likely present-biased types
- Those who withdraw are precisely those the withdrawal limits are intended for
- The flip-side is this selection mechanism targets the high-MPC consumers
- But then they bear the entirety of the burden of the effectiveness of stimulus
- The financing of standard stimulus spreads the fiscal burden across others

Age



(a) Age histogram by withdrawal status



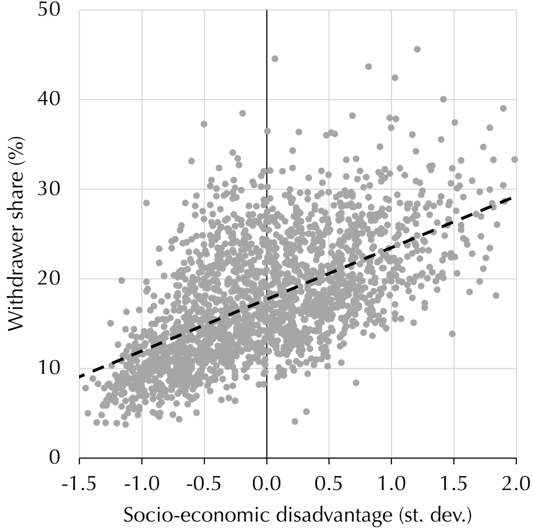
(b) Probability of withdrawal by age

▸ Back

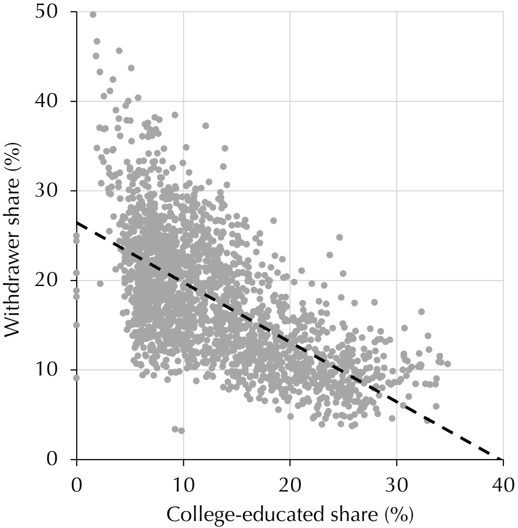
Occupation

Occupation	Withdrew (%)
Machinery operators and drivers	32.3
Laborers	30.5
Technicians and trades workers	24.4
Community and personal service workers	22.7
Sales workers	20.0
Managers	16.8
Clerical and administrative workers	15.4
Professionals	9.4

Socio-economic characteristics by location



(a) Socio-economic status v withdrawal by suburb



(b) College-educated share v withdrawal by suburb

Comparing withdrawers' and non-withdrawers' tax returns

	Non-withdrawer	Withdrawer (difference)			
Controls	None	None	Wages	Plus age	Plus all
Annual wage income	47,340	-4,050			
	(15)	(35)			
Super balance	121,398	-61,237	-48,383	-35,882	-34,520
	(66)	(157)	(143)	(133)	(134)
Interest income	420	-314	-306	-258	-261
	(1)	(2)	(2)	(2)	(2)
Rental income	958	-369	-296	-240	-229
	(1)	(3)	(3)	(3)	(3)
Dividends	1,106	-857	-809	-657	-669
	(4)	(10)	(9)	(9)	(9)
Voluntary Super	2,467	-2,199	-2,159	-1,692	-1,637
	(4)	(11)	(11)	(11)	(11)
N = 15,249,488					

▸ Back

Comparing withdrawers' and non-withdrawers' demographics

	Non-withdrawer	Withdrawer (difference)			
Controls	None	None	Wages	Plus age	Plus all
Age	41.09	-2.68	-2.09		
	(0.00)	(0.01)	(0.01)		
Female	0.49	-0.05	-0.08	-0.07	
	(0.00)	(0.00)	(0.00)	(0.00)	
Had spouse	0.57	-0.12	-0.09	-0.06	
	(0.00)	(0.00)	(0.00)	(0.00)	
Had dependents	0.38	0.08	0.09	0.10	
	(0.00)	(0.00)	(0.00)	(0.00)	
N = 15,249,488					

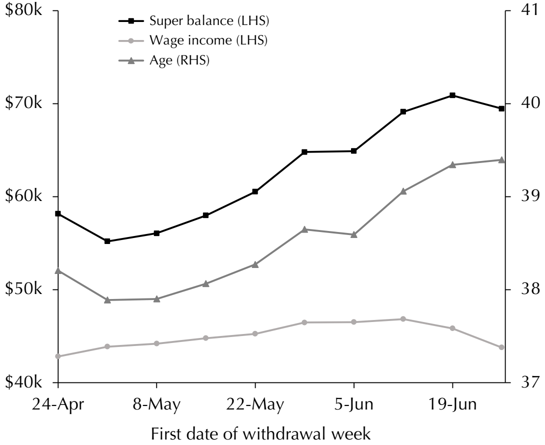
Comparing withdrawers' and non-withdrawers' bank accounts

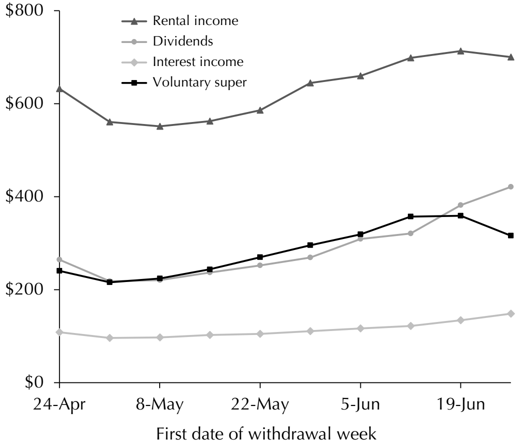
	Non-withdrawer	Withdrawer (difference)			
Controls	None	None	Wages	Plus age	Plus all
Weekly wage income	786	-21			
	(2)	(7)			
Saving / spending	0.37	-0.20	-0.22		
	(0.01)	(0.03)	(0.03)		
Savings / spending	5.38	-3.31	-3.34		
	(0.07)	(0.25)	(0.25)		
Debt payment / spending	0.14	0.01	0.01		
	(0.00)	(0.00)	(0.00)		
Had negative balance	0.09	0.02	0.02		
	(0.00)	(0.00)	(0.00)		
N = 336,809					

Comparing those who did and did not withdraw a second time

	Withdrew first only	Withdrew first and second (difference)			
Controls	None	None	Wages	Plus age	Plus all
Wages	43,173	4,897			
	(54)	(64)			
Age	37.88	1.82	1.67		
	(0.01)	(0.02)	(0.02)		
Super balance	55,652	16,226	11,774	6,024	6,024
	(128)	(150)	(139)	(128)	(128)
Interest income	137	-30	-32	-40	-38
	(1)	(2)	(2)	(2)	(2)
Rental income	707	-43	-122	-160	-130
	(5)	(6)	(6)	(6)	(6)
Dividends	317	-43	-52	-87	-80
	(7)	(9)	(9)	(9)	(9)
Voluntary Super	394	-142	-161	-194	-190
	(4)	(5)	(5)	(5)	(5)
N = 1,862,516					

Withdrawal timing

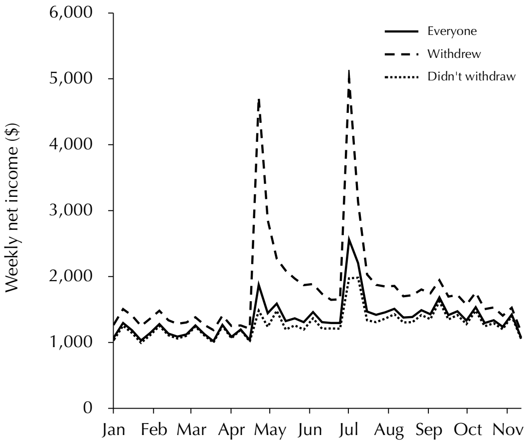




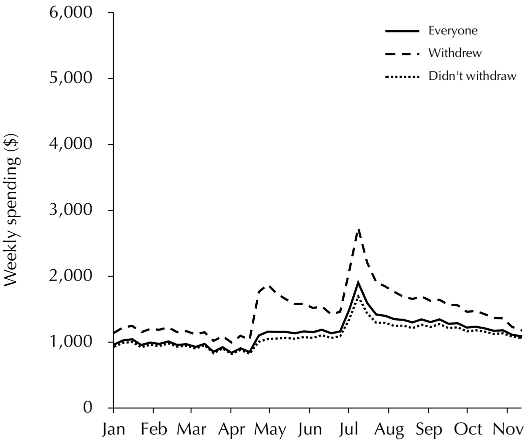
Identification assumption

- Withdrawal is non-random so we rely on a standard parallel trends assumption
- TWFE address time-varying but common confounders and time-invariant but idiosyncratic confounders
  - Pre-trends are parallel for each cohort in previous plots
  - So selection has to happen in event time: no evidence of it in wages ▸ Wages and timing
- Remaining concern is those withdrawing who would have spent anyway
  - This should generate a noticeable drop in spending among comparison group
- Remaining possibility is retiming (durables) but this is unlikely given mostly non-durables

Aggregate income and spending by week

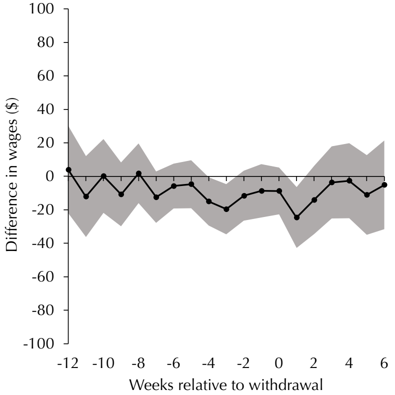


(a) Income



(b) Spending

Relationship between wages and withdrawal timing



Data: Australian Taxation Office
Notes: Results are averages of cohort ATTs, weighted by cohort size, estimated via the R package, 'did', which implements Callaway and Sant'Anna (2021). Comparison group is the never-treated. Estimation is 'doubly-robust', with standard errors computed using the bootstrap procedure of Callaway and Sant'Anna (2021). Confidence intervals are at the 95% level.

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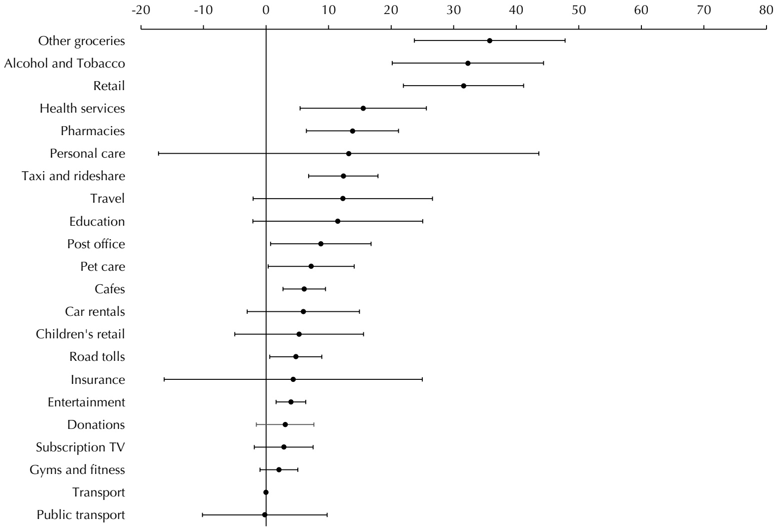
Categories II



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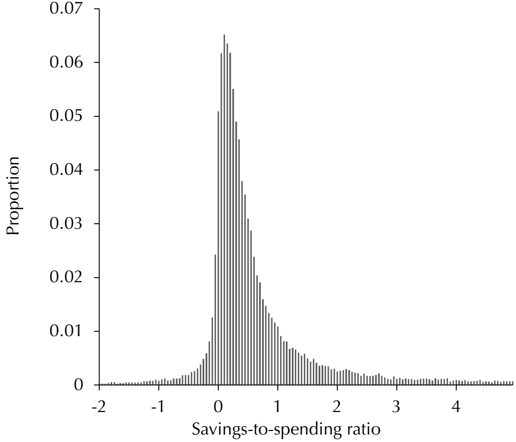
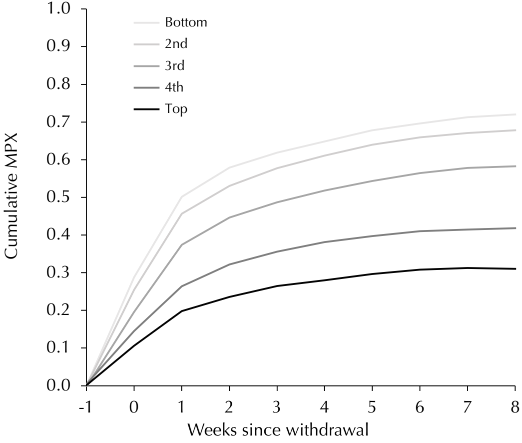
Heterogeneity in MPX by liquidity quintile



(a) Liquidity histogram



(b) Cumulative MPX by liquidity quintile

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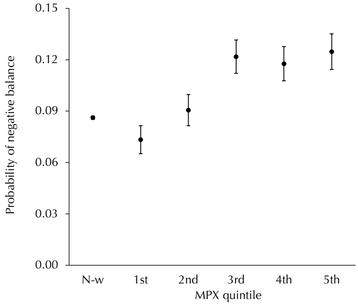
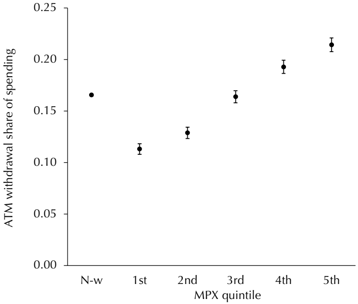
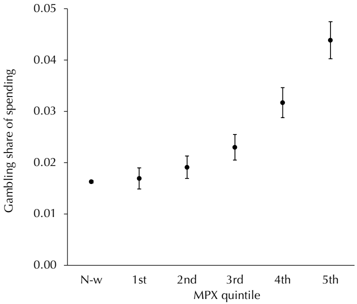
Heterogeneity: pre-withdrawal predictors of spending



(a) Overdrawn

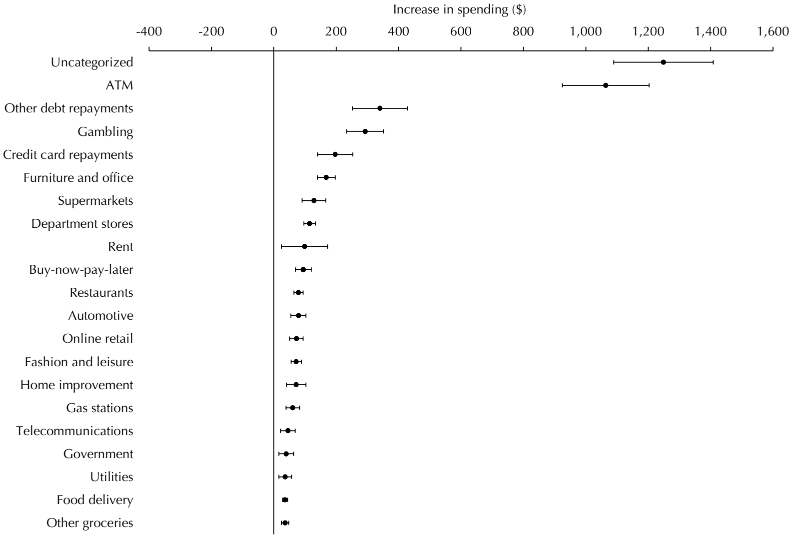


(b) Cash withdrawals



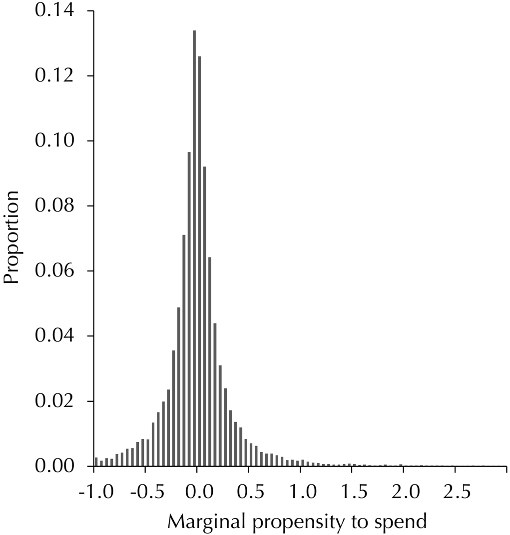
(c) Gambling

Categories

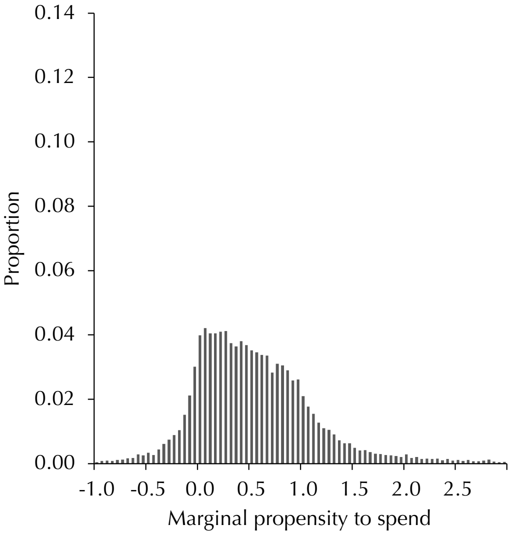


Categories II

Heterogeneity



(a) Pre-treatment

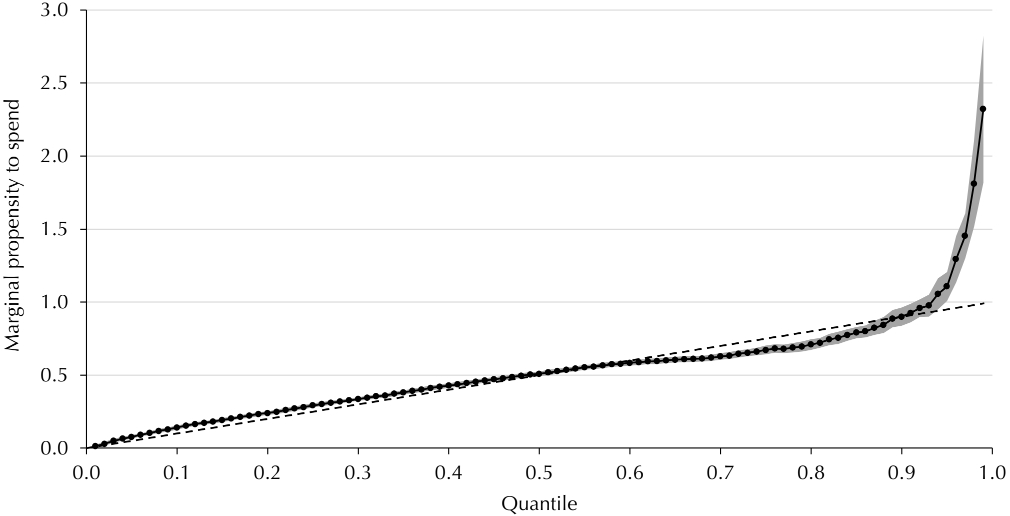


(b) Post-treatment

Quantile difference-in-differences (of spending changes)

- Exploit panel to calculate individual-level change in spending 3 weeks pre vs post
- Do the same for three weeks before withdrawal and 3 weeks before that
- When done for those who withdrew and didn't withdraw, get 2 x 2 quantiles
- Perform difference in differences on each centile of the spending changes
- Bootstrap standard errors
- Relies on rank preservation assumption but for spending changes not levels

Quantile difference-in-differences of the MPX



▸ Back

Internally calibrated parameters (average)

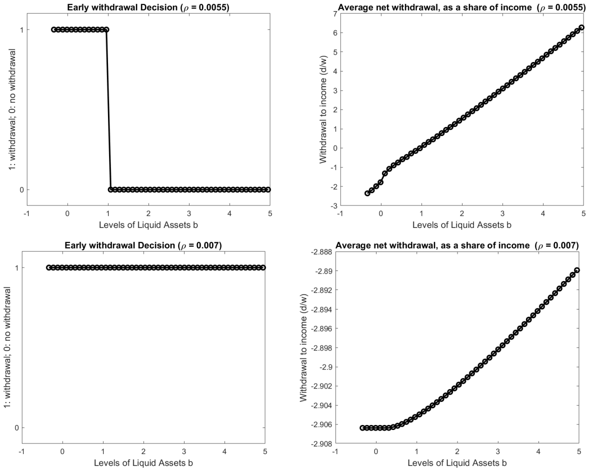
Parameter/Moment	(1) Data	(2) Exponential impatient	(3) Present-biased
Preferences			
ρ (population)	-	0.5%	0.5%
ρ (withdrawers)	-	3%	0.8%
β (withdrawers)	-	1	0.63
Liquidity			
b/w (population)	156%	155%	155%
b/w (withdrawers)	-286%	-286%	-286%
Withdrawal			
Withdrawer percentage ($\mathbf{1}_{d<0}$)	17%	18%	18%
Withdrawal amount ($\mathbf{1}_{d<0}$)	$-3 \cdot w$	$-3 \cdot w$	$-3 \cdot w$
Spending			
Average MPC	28%	10%	24%

Internally calibrated parameters (across quintiles)

Liquidity quintile	(1) 1st	(2) 2nd	(3) 3rd	(4) 4th	(5) 5th
Calibration target					
Liquid assets to income	-355%	-325%	-317%	-285%	-152%
Exponential impatient					
ρ	8.2%	4.1%	3.6%	2.5%	1.4%
β	1	1	1	1	1
Liquid assets to income	-355%	-325%	-317%	-285%	-152%
Present-biased					
ρ	0.8%	0.8%	0.8%	0.8%	0.8%
β	0.48	0.59	0.62	0.68	0.72
Liquid assets to income	-355%	-325%	-317%	-285%	-152%

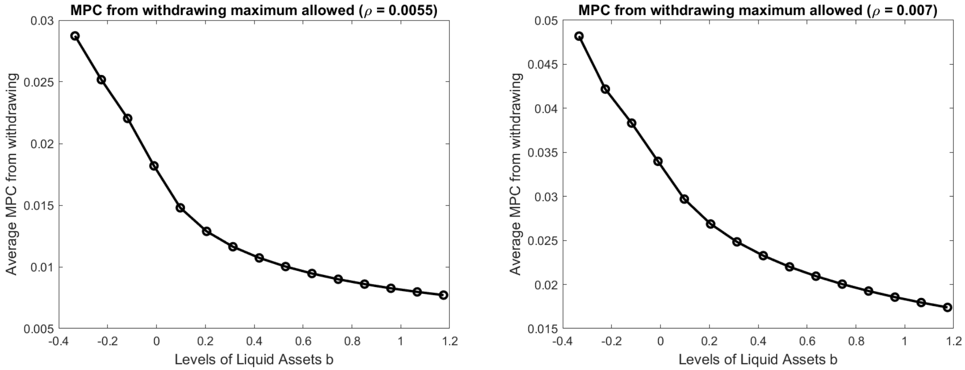
Back

Withdrawal decision (different discount factor)



Reasonable discount factor delivers withdrawal pattern (more liquidity constrained HHs withdraw).
Overall impatience leads all households to withdraw (counterfactual)

Consumption decision (different discount factor)



Standard discount factor delivers withdrawal pattern but extremely low MPC, even for borrowing constrained households