Marginal propensities to consume with behavioural agents

Andrej Mijakovic [1]

EEA, Barcelona

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[1]European University Institute

Motivation

- Marginal propensity to consume (MPC) used to
  - **Quantify consumption response** to fiscal & monetary policy (e.g. Kaplan-Violante-14, Kaplan-Moll-Violante-18)
  - **Discriminate between models** of consumption behaviour

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  - **Discriminate between models** of consumption behaviour
- **Disconnect** between data and theory
  1. MPCs are too high [Parker-et-al-2013, Fagereng-et-al-2021, Crawley-Kuchler-2023]
  2. Low MPC out of wealth and income news [Christelis-et-al-2021, Ganong-Noel-2019, McDowall-2019]
  3. Mixed evidence on MPC $\leftrightarrow$ liquidity constraints [Fuster-et-al-2021, Lewis-et-al-2019]
  4. **Sign asymmetry:** Larger consumption response to income losses than gains

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  4. **Sign asymmetry:** Larger consumption response to income losses than gains

$\Rightarrow$ Individual explanations exist, but **no unifying framework**

This paper

1. **Measure MPC asymmetries** using hypothetical survey questions
   → Find **MPC out of losses > MPC out of gains**, irrespective of liquid wealth

   [Bunn-et-al-2018, Christelis-et-al-2019, Fuster-et-al-2021]

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2. Develop consumption **model with mental accounting**
   - Funds are categorized into mental accounts (income or savings)
   - Consuming out of mental account for savings is costly

   → Higher MPC out of income losses than gains
   → Lower MPC out of income news and wealth
   → High MPC out of income gains for unconstrained households

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3. Conduct **redistributive fiscal experiment** in quantitative life-cycle model
   → Low (PE) aggregate consumption response with high MPC out of losses

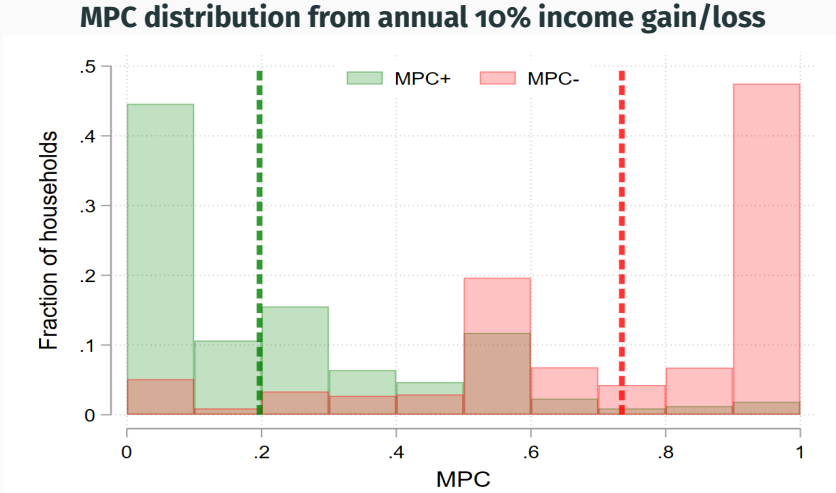
Literature

Empirical evidence

Measuring MPC asymmetries

- **Data**: FED Survey of Consumer Expectations (2015-2018) Summary statistics
- MPC measure:
  - *"Suppose next year you were to find your household with 10 percent more income than you currently expect. What would you do with the extra income?"*
  - Response options: **spending**, **saving** or **paying down debt** in % Response scheme
  - Same question for **losses** MPC-

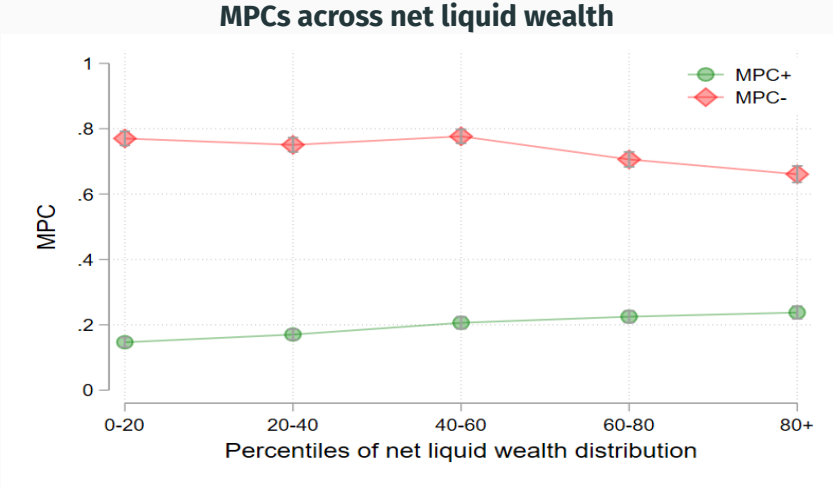
MPC DISTRIBUTION HIGHLY ASYMMETRIC



Note: MPCs from survey questions about hypothetical scenarios from NY FED Survey of Consumer Expectations.

Finer bins | Asymmetry

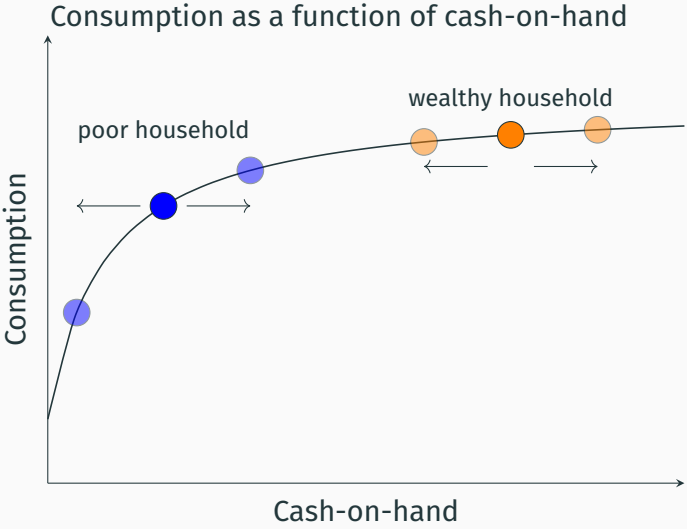
MPCs ASYMMETRIC IRRESPECTIVE OF LIQUID WEALTH



Note: Net liquid wealth defined as bank deposits + stocks + bonds - debt excl. mortgages

Asymmetry | Other Wealth | Age/Housing/Income | Debtor/Creditor | Regressions | Validity | Comparison

MPC EVIDENCE THROUGH THE LENS OF A ONE-ASSET MODEL



Asymmetric MPCs difficult to rationalize

- Standard extensions:
  - Two-asset model
  - Consumption adjustment costs
  - Asymmetric portfolio adjustment costs
  - Discount-factor or return rate heterogeneity
- Behavioural extensions:
  - Present bias
  - Rational inattention
  - Temptation preferences
  - Reference-dependence and loss aversion

Theoretical framework

A BEHAVIOURAL CONSUMPTION MODEL

- Consumption model with **mental accounting**: [Shefrin-Thaler-1988, Thaler 1990]
  - Different mental accounts for income and savings
  - Breaks fungibility of money [Hastings-Shapiro-2013, 2018]
  - E.g. due to self-control problems or imperfect information [Thaler-Shefrin-1981, Lian-2021]

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- Implementation: [McDowall-2020]
  - Consuming out of savings account **costly**
  - **Savings rule** partitions mental accounts Data MPCs

Mental accounting preferences

- Modified utility function:

$$u^{MA}(c) = u(c) - \underbrace{\lambda d(a', a^{plan})}_{\text{MA penalty}}$$

- $\lambda \in [0, 1]$

- Consuming out of savings account costly:

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

Illustration

Two-period model

- Setup:

$$\max_{c_0, c_1} \quad log(c_0) - \lambda d(a_0, a_0^{plan}) + \beta log(c_1)$$
$$\text{s.t.} \quad c_0 + a_0 = y_0; \quad c_1 = Ra_0$$

- Savings rule: optimal savings with $\lambda = 0$

Two-period model

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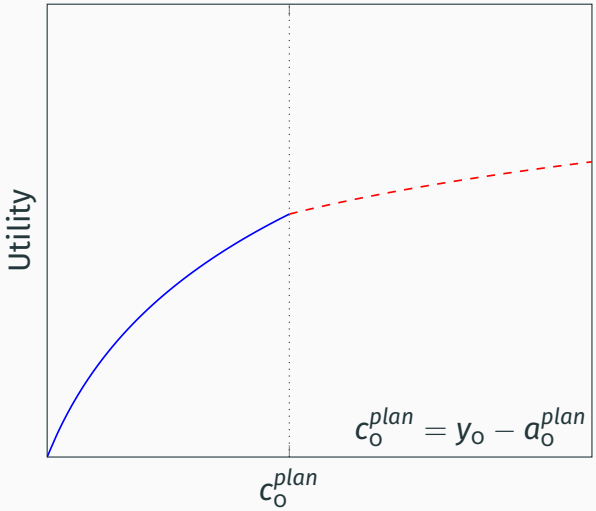
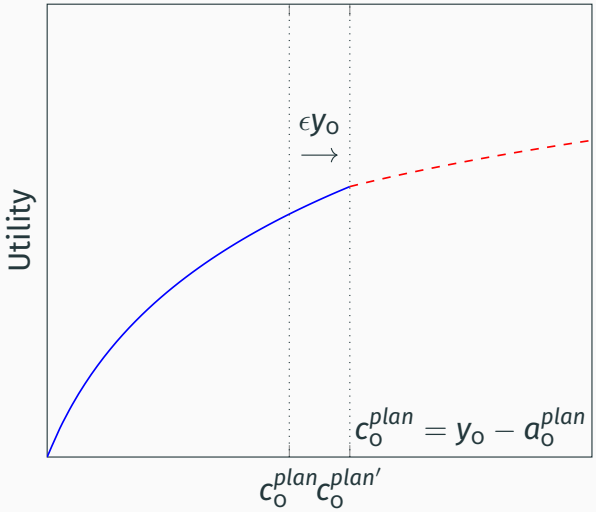
- Savings rule: optimal savings with $\lambda = 0$
- MPC:
  1. **Unanticipated** proportional income shock ϵ
  2. Shock **classified mentally as income** (rigid savings rule)

$$MPC = \frac{\Delta c_0}{\epsilon y_0} = \begin{cases} \frac{1}{1+\beta} & \text{if } \epsilon \geq 0 \\ \frac{1}{1+\beta} \underbrace{\left(\frac{1+\epsilon}{\epsilon} \frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon} \right)}_{\geq 1} & \text{if } \epsilon < 0 \end{cases}$$

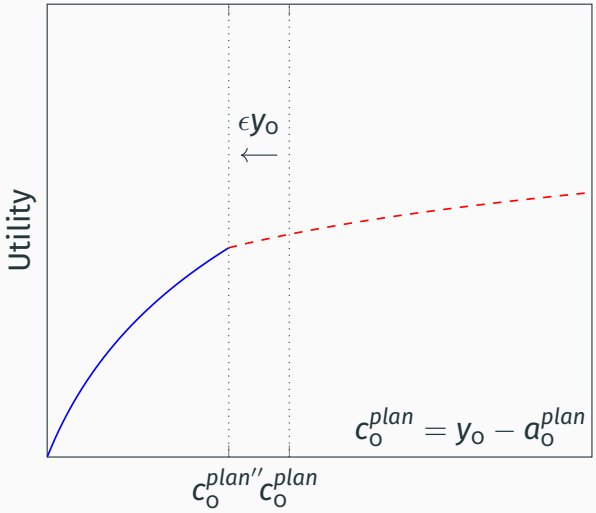
Mechanism



Mechanism - positive shock



Mechanism - negative shock



Quantitative model

Model overview

- **Life-cycle model** with idiosyncratic income risk + borrowing constraints
- **Mental accounting** preferences
- Savings rule depending on age, income and wealth
- Mental accounting motive allowed to vary with wealth [Stango-Zinman-2023]

Household problem

- Recursive problem:

$$V(j, z, e, a) = \max_{c} u(c) - \lambda(a) d(a', a^{plan}) + \beta \mathbb{E} V(j+1, z', e', a') \quad (1)$$

$$\text{s.t.} \quad c + a' = (1+r)a + exp(z+e) y_j, \quad a' \geq 0 \quad (2)$$

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- Savings rule:

$$a^{plan} = \tilde{a}^*(j,z,e=0,a) \quad (3)$$

$$\tilde{V}(j,z,e,a) = \max_{c} u(c) + \beta \mathbb{E} \tilde{V}(j+1, z', e', a') \quad \text{s.t.} \quad (2) \quad (4)$$

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- Mental accounting:

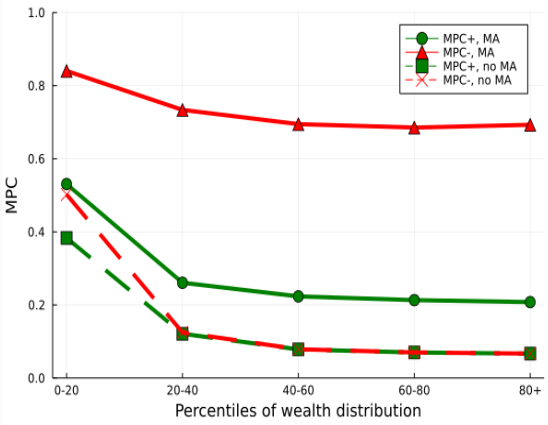
$$\lambda(a) = \lambda_0 exp(a\lambda_1) \quad (5)$$

Calibration

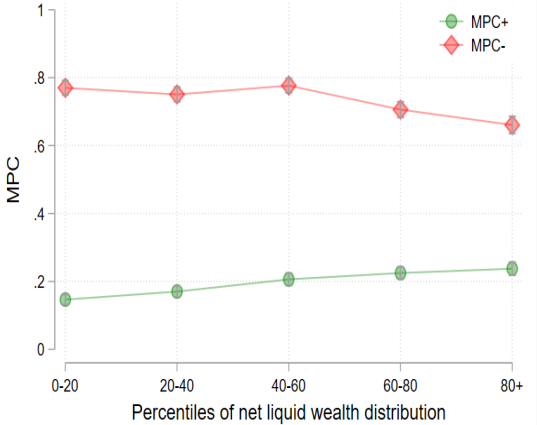
Parameter	Description	Value	Source/Target
External			
γ	Risk aversion	2	Standard
J	Length of life-cycle	60	Standard
JR	Length of working-life	40	Standard
$\bar{y}$	Life-cycle income profile	Cubic polynomial	PSID
ω	Replacement rate	0.6	Standard
r	Interest rate	0.02	Standard
ρ_z	Persistence of z_t	0.953	PSID (KV22)
σ_z^2	Variance of z_t	0.0422	PSID (KV22)
σ_e^2	Variance of e_t	0.0494	PSID (KV22)
$\underline{a}$	Borrowing limit	0	Standard
Internal			
β	Discount factor	0.93	Avg. net wealth-to-income
λ_0	Mental accounting - level	0.70	Avg. MPC^-
λ_1	Mental accounting - decay	-0.0195	Top-bottom ratio of households with savings plan

Moments Lambda

Model vs Data MPCs



(a) Model



(b) Data

Income | Constant λ

Other results

- MPC distribution MPC distribution
- Lower MPCs out of wealth MPC wealth
- Lower MPCs out of income news MPC news
- Size-dependence MPC size
- Consumption-savings dynamics Wealth/consumption LC-profiles

Fiscal experiment

Fiscal experiment

- Policy experiment:
  1. **Targeted transfers** to bottom half of income distribution of $500
  2. Financed by **one-off tax** on top 25%

% change in aggregate consumption after policy

	Without MA	With MA
Income tax	0.25	-0.01
Wealth tax	0.24	0.57

Conclusion

- Disconnect between MPCs measured in data and predicted by models
- Mental accounting model provides unified framework to rationalize asymmetry and other MPC puzzles
- Implications for fiscal policy:
  - Certain types of redistributive policies potentially less stimulative
  - Fiscal contractions more powerful than expansions? [Barnichon-et-al-2021]

Response scheme for MPC question

- Qualitative:
  1. Save or invest all of it
  2. Spend or donate all of it
  3. Use all of it to pay down debts
  4. Spend some and save some
  5. Spend some and use part of it to pay down debts
  6. Save some and use part of it to pay down debts
  7. Spend some, save some and use some to pay down debts

- Quantitative (if previously 4-7):
  1. Save or invest: %
  2. Spend or donate: %
  3. Pay down debts: %

Go back

Measuring MPCs

$\underline{MPC^{+}}$: *"Suppose next year you were to find your household with 10 percent more income than you currently expect. What would you do with the extra income?"*

$\underline{MPC^{-}}$: *"Now imagine that next year you were to find yourself with 10 percent less household income. What would you do?"*

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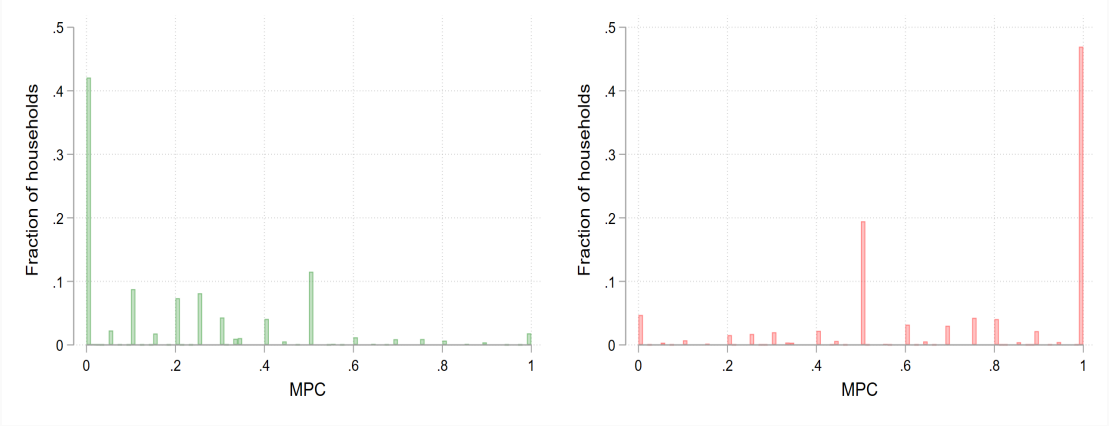
MPC DISTRIBUTION HIGHLY ASYMMETRIC

MPC distribution from 10% annual income gain



(a) Gains

(b) Losses

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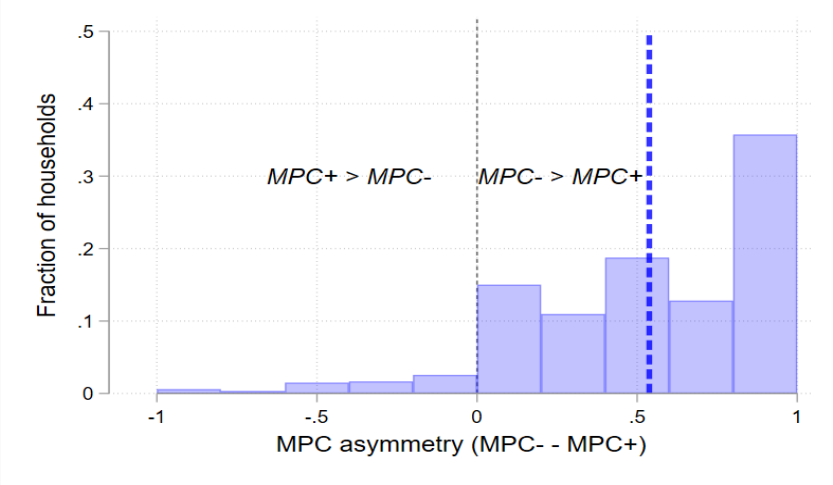
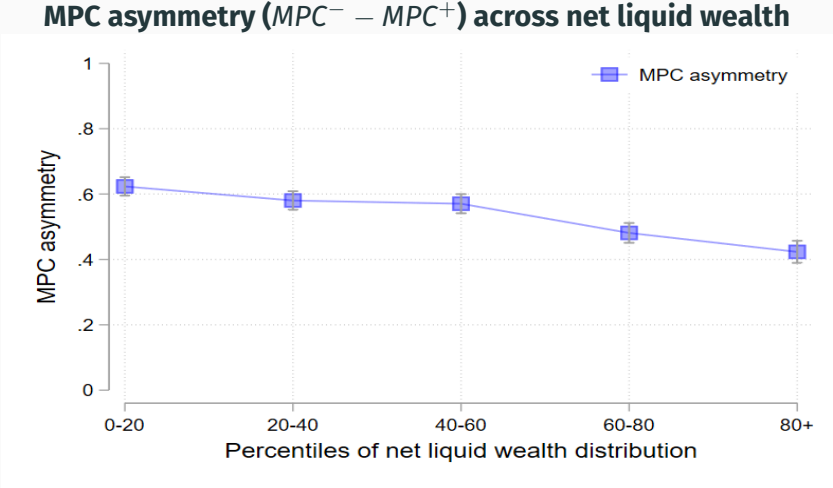
MPC ASYMMETRY DISTRIBUTION



Go back

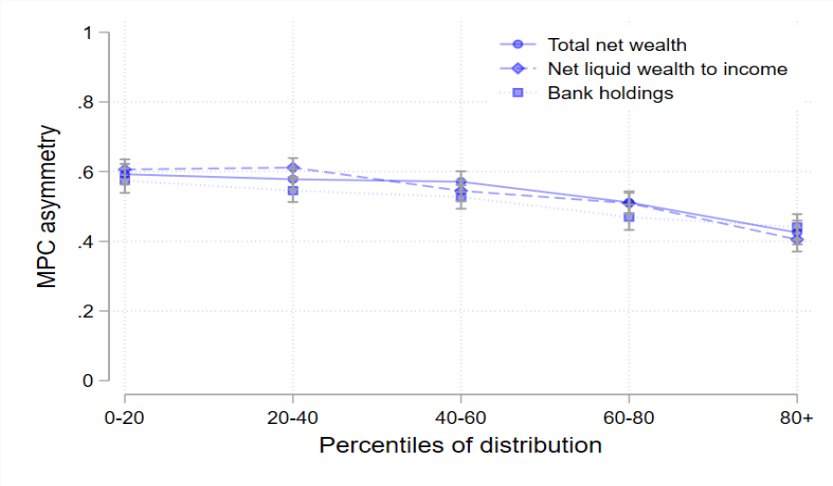
MPCs ASYMMETRIC IRRESPECTIVE OF LIQUID WEALTH



Note: Net liquid wealth defined as bank deposits + stocks + bonds - debt excl. mortgages

Go back

MPC ASYMMETRIES ACROSS WEALTH DISTRIBUTION



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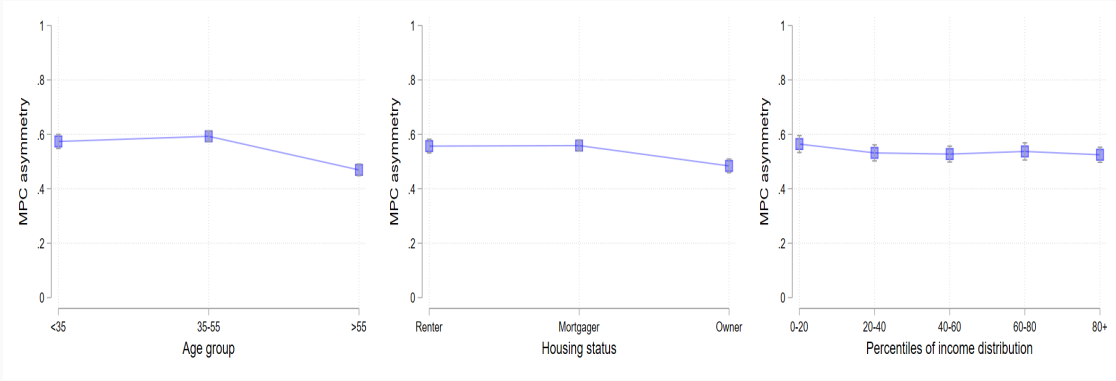
MPC ASYMMETRY ACROSS OTHER DIMENSIONS



(a) Age (b) Housing status (c) Income

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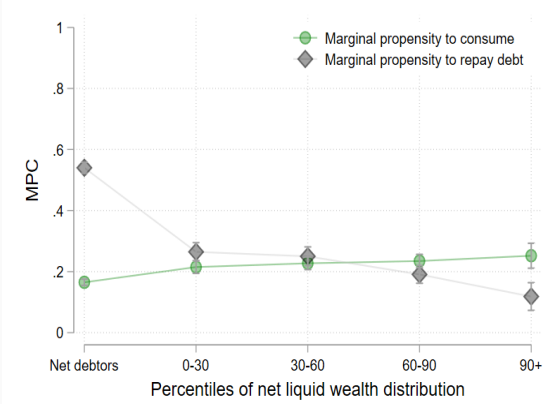
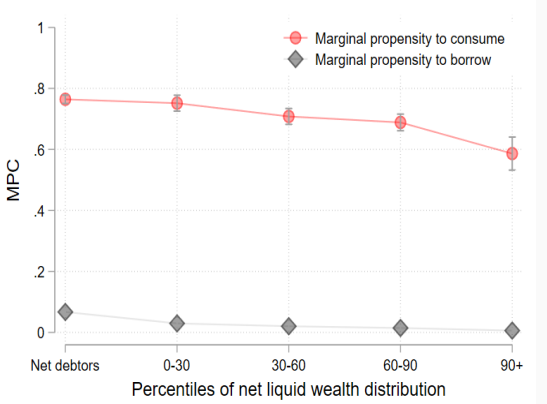
MPCs by debtor/creditor status



(a) MPC^{+}



(b) MPC^{-}

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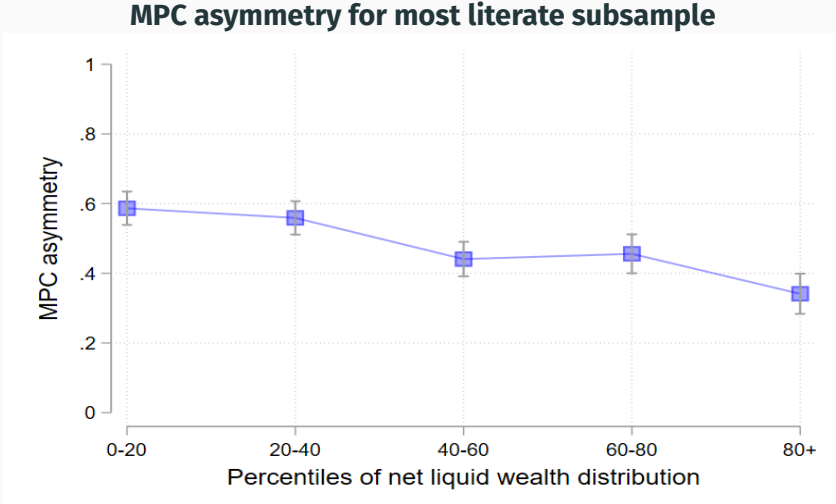
Robustness: Financial literacy of respondents



Note: Financial literacy is measured through seven questions testing quantitative skills. Most literate subsample only includes respondents that got all questions right (1/3 of sample).

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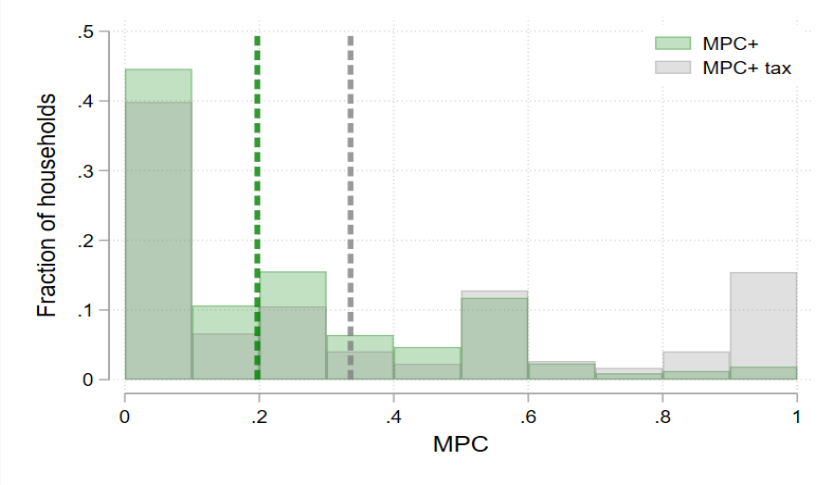
Robustness: MPCs out of tax refunds



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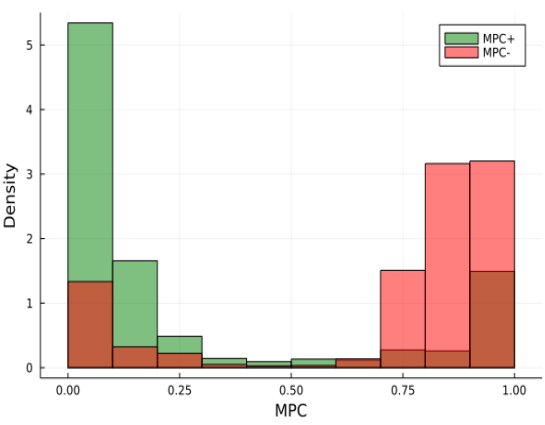
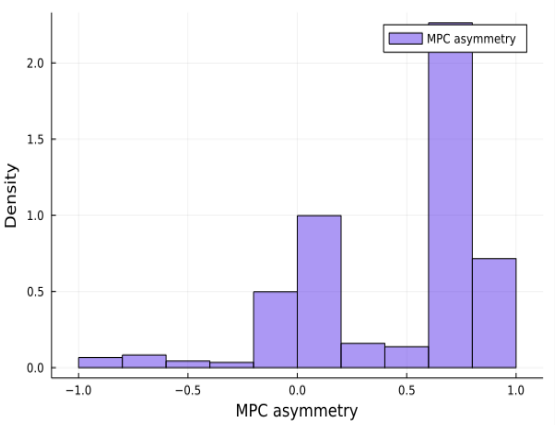
Model MPC distribution





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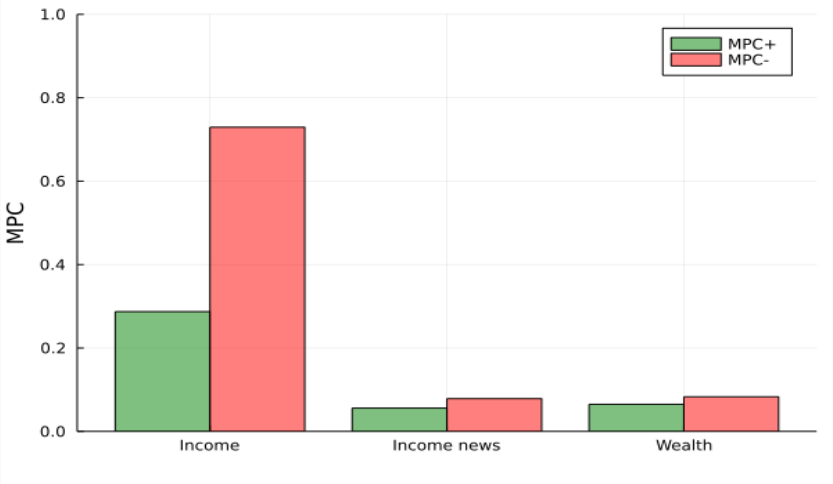
Model MPCs out of wealth and income news



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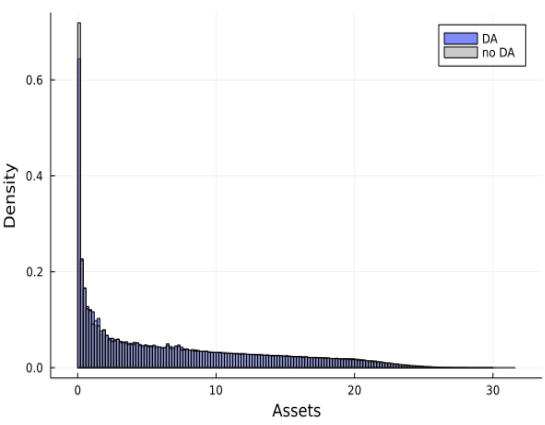
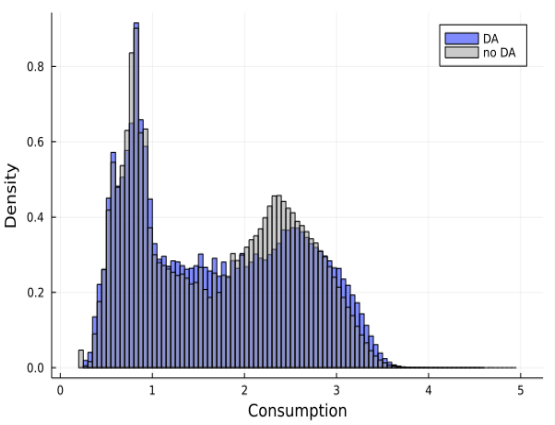
Wealth and consumption distribution



(a) Wealth



(b) Consumption

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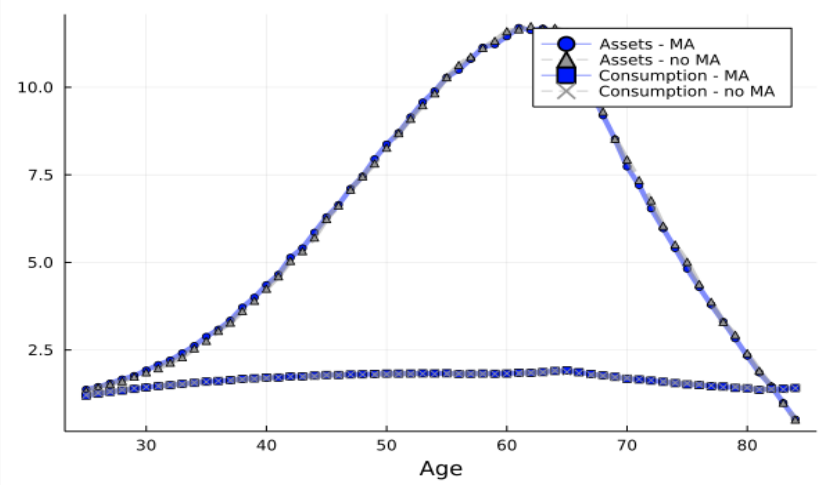
Life-cycle profile of consumption and savings



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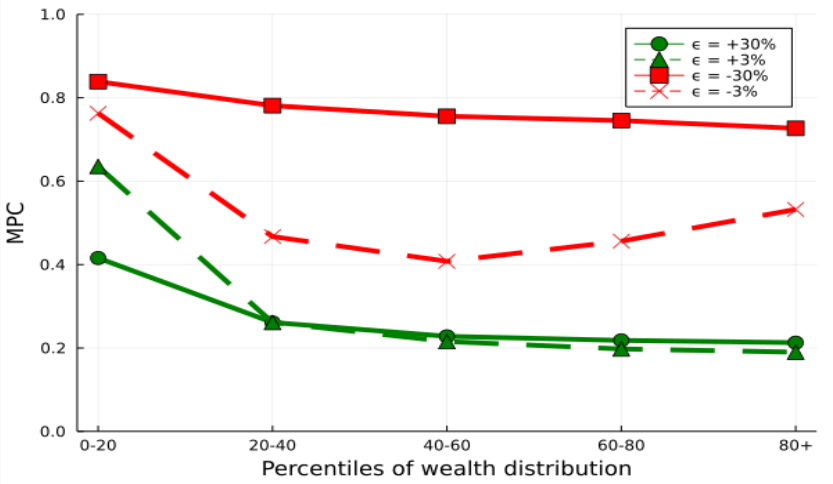
Model MPCs by shock size



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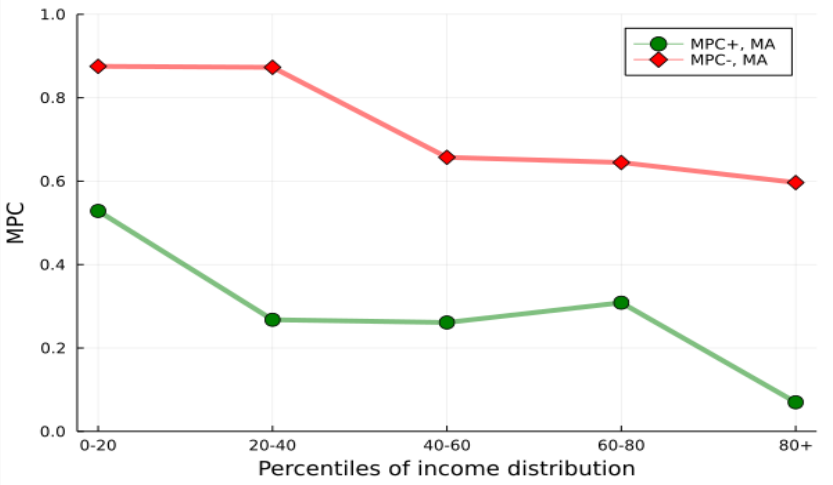
Model MPCs by income



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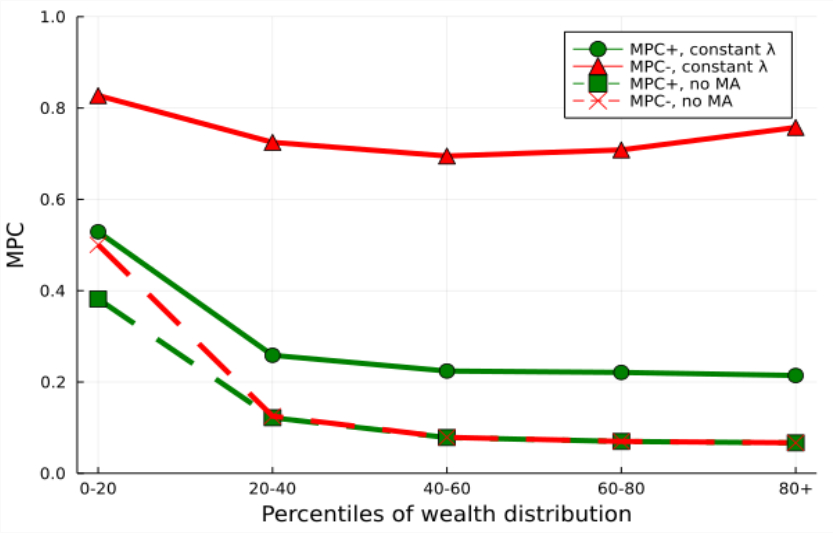
Model MPCs with constant λ



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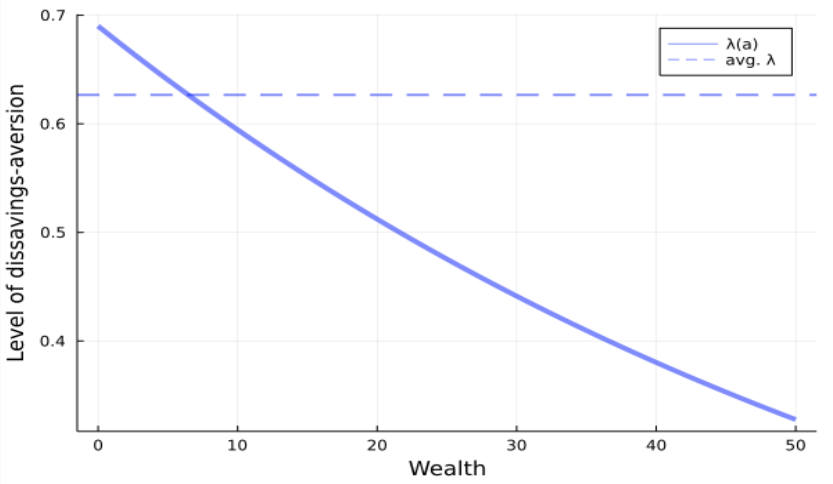
Calibrated level of mental accounting



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Summary statistics

	Mean	Median	Std. dev.	Min	Max	N
Demographics						
Age	50.72	51.00	15.24	18	96	4,009
Female	0.48	0.00	0.50	0	1	4,009
College degree	0.56	1.00	0.50	0	1	4,009
Homeowner	0.74	1.00	0.44	0	1	3,684
Financial variables						
Income	82,137	65,000	69,549	0	400,000	3,630
Bank holdings	21,735	3,000	61,906	0	1,600,000	3,421
Liquid assets	90,409	10,000	234445	0	1,600,000	3,450
Liqid debt	27,695	10,000	48,463	0	300,000	3,660
Total assets	450,130	239,000	602,383	0	4,585,000	3,284
Total debt	96,766	36,500	133,111	0	880,000	3,642
Spending responses						
MPC+	0.20	0.10	0.24	0	1	4,009
MPC-	0.73	0.85	0.31	0	1	4,009

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Regression results

	MPC asymmetry	MPC asymmetry	MPC+	MPC+	MPC-	MPC-
Net liq. assets=2	-0.042	-0.039	0.023	0.011	-0.019	-0.027
	(0.024)	(0.025)	(0.014)	(0.014)	(0.019)	(0.020)
Net liq. assets=3	-0.045	-0.046	0.054***	0.035*	0.010	-0.011
	(0.026)	(0.027)	(0.016)	(0.017)	(0.020)	(0.020)
Net liq. assets=4	-0.161***	-0.147***	0.079***	0.075***	-0.082***	-0.072***
	(0.026)	(0.027)	(0.015)	(0.015)	(0.020)	(0.021)
Net liq. assets=5	-0.194***	-0.165***	0.081***	0.070***	-0.114***	-0.095***
	(0.027)	(0.029)	(0.015)	(0.016)	(0.022)	(0.023)
35-55		0.030		0.005		0.035
		(0.023)		(0.014)		(0.018)
>55		-0.042		0.047**		0.005
		(0.025)		(0.015)		(0.020)
Income		-0.015		-0.010		-0.025**
		(0.011)		(0.006)		(0.008)
Mortgager		0.054*		-0.053***		0.000
		(0.023)		(0.013)		(0.018)
Owner		0.002		-0.013		-0.011
		(0.024)		(0.015)		(0.019)
Income expectations		0.013		0.008		0.021
		(0.017)		(0.010)		(0.014)
Constant	0.636***	0.769***	0.145***	0.260***	0.782***	1.029***
	(0.017)	(0.117)	(0.009)	(0.070)	(0.014)	(0.089)
R-squared	0.03	0.04	0.02	0.04	0.02	0.03
Observations	3444	3341	3444	3341	3444	3341

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Robustness: Planned vs actual expenditure

- How well do households predict their expenses?
- Compare predicted with realized expenditure

	(1) Appliances	(2) Electronics	(3) Furniture	(4) Home repairs	(5) Car	(6) Trips
LPM	0.0030***	0.0037***	0.0039***	0.0048***	0.0041***	0.0056***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Logit	0.0020***	0.0031***	0.0023***	0.0037***	0.0025***	0.0044***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R-squared LPM	0.04	0.05	0.08	0.13	0.07	0.21
R-squared Logit	0.04	0.04	0.09	0.11	0.07	0.17
Observations	5704	5693	5683	5691	5673	5690

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Households with savings plan have more asymmetric MPCs

	MPC Asymmetry	MPC+	MPC-
Keeps budget	0.092***	-0.043***	0.049***
	(0.019)	(0.011)	(0.014)
Has savings/debt repayment plan only	0.047*	-0.042***	0.005
	(0.020)	(0.012)	(0.017)
R-squared	0.06	0.05	0.04
Observations	3341	3341	3341

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Savings plans

Share of households with savings or debt repayment plan in SCE

Percentile of net liquid wealth distribution	0-20	20-40	40-60	60-80	80+
Keeps budget (in %)	68.5	66.3	70.8	65.8	59.8
Has savings/debt repayment plan (in %)	68.9	66.5	59.5	64.5	53.5

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Data versus model moments

	Data	Model
Average wealth-to-income ratio	4.28	4.28
Average MPC out of losses	0.73	0.73
Ratio of households with savings plan/dissaving-aversion ratio between bottom and top quintile of wealth distribution	1.29	1.29

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Low MPC out of wealth and income news

- **MPC out of wealth:** Details

$$MPC^{wealth} = \frac{\Delta c_0}{\epsilon^{w_0} w_0} \leq MPC^{income} \quad \text{if} \quad \frac{\partial a_0^{plan}}{\partial \epsilon^{w_0}} = \epsilon^{w_0} w_0$$

- **MPC out of income news:** Details

$$MPC^{news} = \frac{\Delta c_0}{\epsilon^{y_1} y_1} \leq MPC^{income} \quad \text{if} \quad \frac{\partial a_0^{plan}}{\partial \epsilon^{y_1}} = 0$$

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MPCs OUT OF WEALTH

- The MPC out of a wealth shock is smaller than the MPC out of an income shock if the savings rule moves one-to-one with wealth.

$$MPC^{+,wealth} = \max\left\{\frac{1}{1+\beta}\left(\frac{1+\epsilon}{\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon}\right), 0\right\} \leq \frac{1}{1+\beta} = MPC^{+}$$

$$MPC^{-,wealth} = \frac{1}{1+\beta} \leq \min\left\{\frac{1}{1+\beta}\left(\frac{1+\epsilon}{\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon}\right), 1\right\} = MPC^{-}$$

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MPCs OUT OF FUTURE INCOME

- The MPC out of income news is smaller than the MPC out of current income changes if the savings rule does not respond to news.

$$MPC^{+,news} = \max\left\{\frac{1}{1+\beta}\left(\frac{1+\epsilon}{R\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{R\epsilon}\right), 0\right\} \leq \frac{1}{1+\beta} = MPC^{+}$$

$$MPC^{-,news} = \frac{1}{R(1+\beta)} \leq \min\left\{\frac{1}{1+\beta}\left(\frac{1+\epsilon}{\epsilon}\frac{1+\beta}{1+\frac{\beta}{1-\lambda}} - \frac{1}{\epsilon}\right), 1\right\} = MPC^{-}$$

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Validity

How reliable are MPCs from hypothetical survey questions?

1. Results hold for most financially literate households Financial literacy
2. MPC distribution similar to distribution of MPCs out of tax refunds MPC^{tax}
3. Stated spending plans predict realized spending Prediction
4. Literature: Different methods produce comparable estimates for *same* household
   - Hypothetical vs reported MPCs [Bunn et al-2018]
   - Reported vs estimated MPCs [Parker Souleles-2019; Parker et al-2020]

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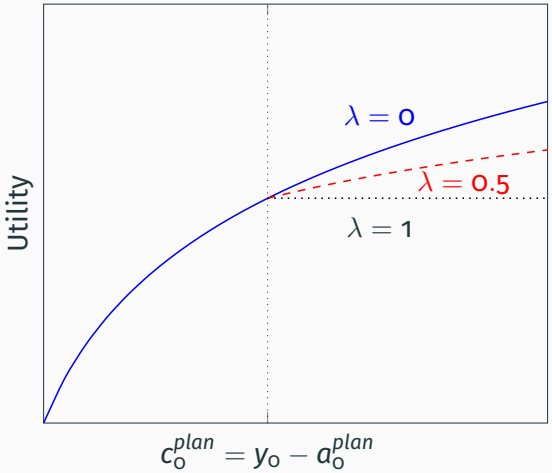
Mental accounting utility function



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MPC ASYMMETRIES IN THE LITERATURE

	Avg. MPC^{+}	Avg. MPC^{-}	$Bot.MPC^{+}$	$Bot.MPC^{-}$	$TopMPC^{+}$	$TopMPC^{-}$
Bunn-et-al-2018	0.14	0.64	0.15	0.72	0.14	0.65
Christelis-et-al-2019	0.14	0.24	0.16	0.27	0.15	0.22
Fuster-et-al-2021	0.07	0.32	0.05	0.38	0.12	0.17
Bracha-Cooper-2014*	0.60	0.90	-	-	-	-
Sahm-et-al-2015*	0.14	0.55	-	-	-	-

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Contribution

1. **Asymmetries in MPCs** [Bracha-Cooper-2014, Bunn-et-al-2018, Christelis-et-al-2019, Fuster-et-al-2021, Sahm-et-al-2015]
   $\Rightarrow$ Asymmetries are large and broad-based

2. **Broader empirical literature on MPCs** [Fagereng-et-al-2012, Lewis-et-al-2019; Chodorow-Reich-et-al-2021, Christelis-et-al-2021, DiMaggio-et-al-2020; Ganong-Noel-2019, Kueng-2018, Olafsson-Pagel-2018, McDowall-2019, Fuster-et-al-2021]
   $\Rightarrow$ Provide unified theoretical framework

3. **Behavioral models of consumption** [Attanasio-et-al-2021, Boutros-2022, Ganong-Noel-2019, Ilut-Valchev-2020, Kueng-2018, Laibson-et-al-2021, Lian-2020, Mcdowall-2020]
   $\Rightarrow$ Mental accounting also explains MPC asymmetry

4. **Asymmetric responses to policy at macro-level** [Angrist-et-al-2018, Barnichon-et-al-2021, Grigoli-Sandri-2022, Tenreyro-Thwaites-2016]
   $\Rightarrow$ Micro-level mechanism explaining aggregate asymmetries

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