Heterogeneity in what?
Cognitive skills, beliefs and the liquid wealth distribution

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Q: Can cognitive skill heterogeneity explain differences in households' savings behavior and their financial situations? If so, does it matter?

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  - accounts for the empirical findings
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- Develop HANK model with cognitive skill heterogeneity
  - accounts for the empirical findings
  - simultaneously matches empirical estimates of average MPCs and average wealth even when all wealth is liquid
  - optimal government debt level much lower than in standard models
  - increasing targeted transfers to low-income households less effective

Literature Review

- Cognitive skills, behavioral biases, subjective income risk, macroeconomic policies: D'Acunto, Hoang, Paloviita, and Weber (2019, 2020, 2022), Stango and Zinman (forthcoming), Balleer et al. (2022), Rozsypal and Schlafmann (forthcoming), Chapman et al. (forthcoming), Wang (2023), Caplin et al. (2023)

- HA(NK) models deviating from FIRE: Farhi and Werning (2019), Broer, Kohlhas, Mitman, and Schlafmann (2021), Auclert et al. (2020), Angeletos and Huo (2021), Kaplan and Violante (2022), Laibson et al. (2021), Pfäuti and Seyrich (2022), Sergeyev et al. (2022), Guerreiro (2023), Ilut and Valchev (2023)

⇒ **Contribution:**

- link cognitive skills to beliefs, savings behavior and financial situations
- HANK model w/ skill + belief heterogeneity and characterize its fiscal policy implications

Outline

1. **Empirics**
2. Model
3. Cognitive Skills, Overconfidence and MPCs
4. Implications for Fiscal Policy

Data: Cognitive Skills and Overconfidence

American life panel, two rounds on behavioral biases, preferences and cognitive skills (Stango/Zinman, REStud 2023):

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  - general or fluid intelligence
  - numeracy
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  - financial literacy

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- cognitive skills: measured by standard tests on
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  - financial literacy
- overconfidence:

$$\tilde{\mathbb{E}}_i[rank_i] - rank_i$$

  - highly correlated with other measures of overconfidence
  - behavioral bias that is most strongly correlated with cognitive skills (Stango/Zinman)

Data: Financial Situations and Savings Behavior

- financial-situation forecast errors:
  - expected future financial situation vs. actual future financial situation

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- financial-situation forecast errors:
  - expected future financial situation vs. actual future financial situation
- 8 measures of Hand-to-Mouth status:
  1. financial distress
  2. based on net worth
  3. difficulty to cover $2k unexpected expense
  4. say that they "wish they saved more"
  5. say that they "wish they saved a lot more"
  6. lives paycheck-to-paycheck
  7. lives paycheck-to-paycheck during Covid
  8. lacks precautionary savings

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4. Overconfident households are about 1.5 times as likely to be overly optimistic about their future financial situations ▸ Details
5. Overconfident households are more likely to be Hand-to-Mouth (HtM) ▸ Details
   - robust across HtM measures

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Model Overview

Households:

- incomplete markets, idiosyncratic risk, permanent heterogeneity in cognitive skills

Firms:

- representative firm, flexible prices, production: $Y_t = N_t$

Labor unions:

- sticky wages, all households work same number of hours

Government:

- fiscal policy: issues bonds B_t, raises taxes, transfers (later)
- monetary policy: controls real rate r_t

Households

Continuum of infinitely-lived households:

$$V_{g,t}\left(b_{t-1}, e_t\right) = \max_{c_t, b_t} \left\{ \frac{c_t^{1-\gamma}}{1-\gamma} - \frac{n_t^{1+\varphi}}{1+\varphi} + \beta \tilde{\mathbb{E}}_{g,t} \Big[V_{g,t+1}\left(b_t, e_{t+1}\right) \Big] \right\}$$

subject to

$$c_t + \frac{b_t}{1+r_t} = b_{t-1} + (1-\tau_t) w_t \bar{e}_g e_t n_t$$

$$b_t \geqslant -\underline{b},$$

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- permanent heterogeneity: hhs belong to different cognitive skill groups g:
  - average productivity: $\bar{e}_g$ ("lower income")
  - beliefs: $\tilde{\mathbb{E}}_{g,t}$ ("overconfidence")

Modelling "overconfident" beliefs

- Productivity states: $e_1 < e_2 < ... < e_J$
- Transition probabilities: $p_{ij} \equiv p(e_{t+1} = e_j | e_t = e_i)$

Modelling "overconfident" beliefs

- Productivity states: $e_1 < e_2 < ... < e_J$
- Transition probabilities: $p_{ij} \equiv p(e_{t+1} = e_j | e_t = e_i)$
- Perceived transition probabilities $\tilde{p}_{ij}$:

$$\tilde{p}_{ij} \equiv \begin{cases} \alpha_g p_{ij}, & \text{if } i < j \\ \frac{1}{\alpha_g} p_{ij}, & \text{if } i > j \\ 1 - \sum_{j \neq i} \tilde{p}_{ij}, & \text{if } i = j. \end{cases}$$

- $\alpha_g \geqslant 1$ captures belief accuracy:
  - $\alpha_g > 1$: overconfidence $\Rightarrow$ overestimate probability of reaching good states
  - $\alpha_g = 1$: rational

Calibration

Calibrating permanent heterogeneity:

- two groups: 38% low-skilled and overconfident, 62% high-skilled and rational
- overconfident HHs 1.5 times as likely to overestimate future earnings $\Rightarrow \alpha_{OC} = 1.9$

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Parameter	Description	Value
R	Steady State Real Rate (annualized)	2%
γ	Risk aversion	2
φ	Inverse of Frisch elasticity	2
$\underline{b}$	Borrowing constraint	0
$\frac{\bar{B}}{4\bar{Y}}$	Average wealth to average income	4.0
Idiosyncratic risk		
ρ_e	Persistence of idiosyncratic risk	0.966
σ_e^2	Variance of idiosyncratic risk	0.016

Outline

1. Empirics
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3. **Cognitive Skills, Overconfidence and MPCs**
4. Implications for Fiscal Policy

Our model increases HtM shares and MPCs

	Standard HANK (1)
HtM Share	0.02
Avg. MPC	0.03
HtM rational HHs	0.02
HtM HHs OC LS	-

- Standard HANK model implies much too low MPC

Cognitive skill heterogeneity increases HtM shares and MPCs

	Standard HANK (1)	Baseline (2)
HtM Share	0.02	0.25
Avg. MPC	0.03	0.18
HtM rational HHs	0.03	0.01
HtM OC LS HHs	-	0.63

- Model with cognitive skill heterogeneity matches average MPC
- and predicts OC LS households more likely to be HtM

▸ Disentangling avg. prod. and overconfidence

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Optimal government debt level

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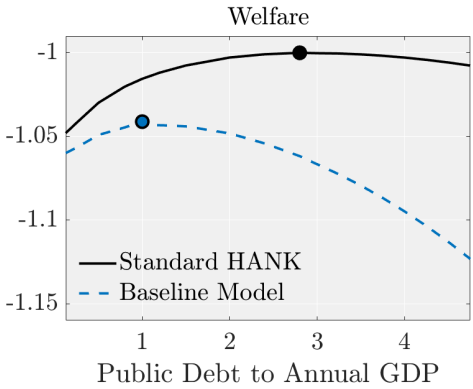
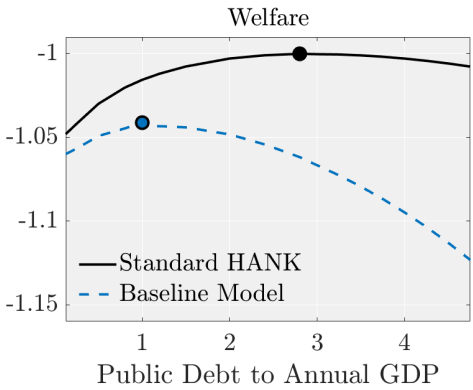


Optimal government debt level

- Higher debt: more insurance but higher distortionary taxes
- Utilitarian social welfare function: average expected discounted lifetime utility
- robust to extension with capital as illiquid asset (20% vs. 45% in rational model)



Targeted transfers

- now, consider a different policy: targeted transfers to below-median income HHs
- re-calibrate wealth in standard HANK to have the same average MPC
  - Details
  - Stationary equilibrium

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Q: what happens if we temporarily increase these transfers?

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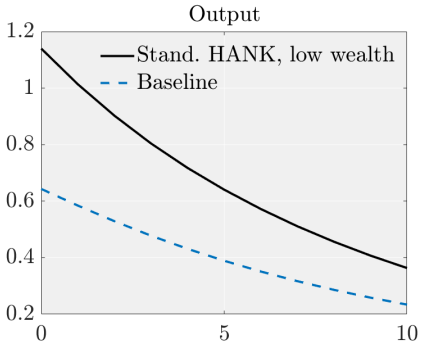

Two channels:

1. average MPC of transfer recipients smaller in our baseline model (consistent with data) ▸ Data
2. temporary relaxation of income risk also weaker in our baseline model

Extension: Two-asset model with overconfidence

- Two-asset models require (implausible?) high return gap to match average MPC (Kaplan & Violante 2022)

Extension: Two-asset model with overconfidence

- Two-asset models require (implausible?) high return gap to match average MPC (Kaplan & Violante 2022)
- our model matches average MPC with much smaller return gap

	baseline two-asset	rational two-asset	two-asset recalib.
HtM	0.318	0.12	0.24
Avg. MPC	0.186	0.077	0.166
return gap	2.2%	4.0%	8.2%

Conclusion

In this paper, we...

... provide new evidence on cognitive skills and financial situations

... introduce cognitive skill heterogeneity in a HANK model

- model matches average MPC even when all wealth is liquid

... find that the underlying reason why households do not hold liquidity matters

- lower optimal government debt level
- targeted transfers are less stimulating

Appendix

Cognitive Skills and Overconfidence

back

	1 = oc both rounds		oc percentile rank	
	Unweighted	Weighted	Unweighted	Weighted
	(1)	(2)	(3)	(4)
Population share	0.340	0.377		
s.e.	0.017	0.035		
N	817	817		
Cognitive skill measures				
Summary: 1st principal component	-0.546	-0.542	-0.818	-0.830
s.e.	0.030	0.045	0.032	0.049
N	733	733	733	733
Component: Fluid intelligence	-0.718	-0.734	-1.049	-1.065
s.e.	0.026	0.047	0.026	0.055
N	817	817	817	817
Component: Numeracy	-0.362	-0.453	-0.573	-0.656
s.e.	0.040	0.068	0.046	0.077
N	798	798	798	798
Component: Financial literacy	-0.321	-0.242	-0.467	-0.362
s.e.	0.038	0.087	0.041	0.087
N	813	813	813	813
Component: Executive function	-0.316	-0.407	-0.444	-0.600
s.e.	0.045	0.072	0.052	0.090
N	749	749	749	749

Overconfidence and Financial Situation Forecast Errors

$\frac{\text{(Optimist share} \mid \text{overconfident)}}{\text{(Optimist share} \mid \text{not oc)}}$	Optimism measure	
	$1 = \text{(Consec. Opt. FEs)}$	$1 = \text{(Prop. Opt. FEs} \geq 0.5)$
Unweighted	1.51	1.77
Weighted	1.17	1.63

▸ back

Overconfidence and HtM Status I

back

	1=O/c both rounds		O/c pctile rank		Row variable, unw.	Row variable, w.
	Unweighted	Weighted	Unweighted	Weighted	Pop. share	Pop. share
	(1)	(2)	(3)	(4)	(5)	(6)
1=(Severe financial distress)	0.176	0.273	0.194	0.180	0.277	0.305
s.e.	0.059	0.119	0.039	0.078	0.016	0.035
N	813	813	813	813		
1=(Low net worth)	0.250	0.198	0.226	0.086	0.397	0.468
s.e.	0.057	0.097	0.041	0.073	0.018	0.032
N	760	760	760	760		
1=(Wishes saved more)	-0.003	0.080	0.025	-0.041	0.611	0.615
s.e.	0.058	0.111	0.041	0.075	0.017	0.033
N	813	813	813	813		
1=(Wishes saved a lot more)	0.172	0.359	0.131	0.183	0.156	0.156
s.e.	0.066	0.127	0.041	0.084	0.013	0.035
N	813	813	813	813		

Overconfidence and HtM Status II

back

	1=O/c both rounds		O/c pctile rank		Row variable, unw.	Row variable, w.
	Unweighted	Weighted	Unweighted	Weighted	Pop. share	Pop. share
	(1)	(2)	(3)	(4)	(5)	(6)
1=(paycheck-to-paycheck c. 2012)	0.151	0.023	0.154	0.155	0.588	0.561
s.e.	0.099	0.181	0.074	0.099	0.031	0.056
N	255	255	255	255		
paycheck-to-paycheck, COVID era	0.224	0.220	0.301	0.290	0.404	0.440
s.e.	0.053	0.085	0.049	0.077	0.018	0.028
N	516	516	516	516		
1=(Lacks prec. savings in 2012 & 2018)	0.112	0.104	0.181	0.205	0.634	0.691
s.e.	0.101	0.133	0.071	0.086	0.030	0.037
N	262	262	262	262		
Difficult covering $\$2k$ emergency expense	0.230	0.314	0.222	0.281	0.513	0.543
s.e.	0.065	0.078	0.050	0.058	0.021	0.026
N	485	485	485	485		

Overconfidence (not avg productivity) increases HtM shares and MPCs

	Baseline (1)	Standard HANK (2)	HANK w\skills (3)	HANK w\OC (4)
HtM Share	0.2461	0.0228	0.0227	0.2489
Avg. MPC	0.178	0.031	0.031	0.1833
HtM rational HHs	0.0121	0.0228	0.0227	0.0108
HtM OverConfident HHs	-	-	-	0.6374
HtM rat. HHs Low-Skilled	-	-	0.0226	-
HtM OC HHs LS	0.6278	-	-	-

Our baseline model further produces:

- median wealth of 1.67 (vs. 1.5 in data), no "missing middle" problem ▸ Wealth Distribution
- top 10% wealth share of 40%

▸ back

Wealth Distribution

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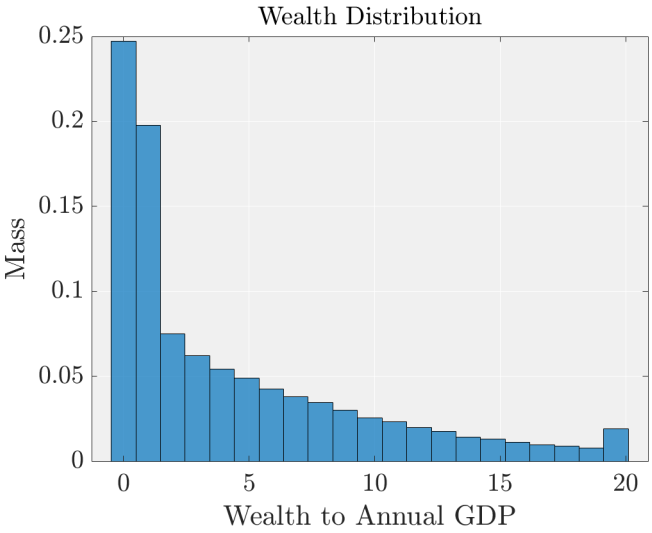


Targeted Transfers

$$tr_{it} = \max\{0, \epsilon_t^{TT} a_1 \bar{y} - a_2 w_t n_{i,t} e_{i,t}\},$$

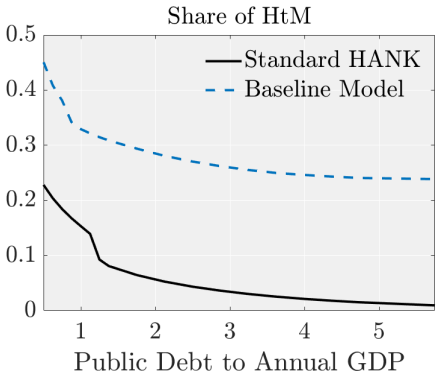
$\bar{y}$: median income in stationary equilibrium

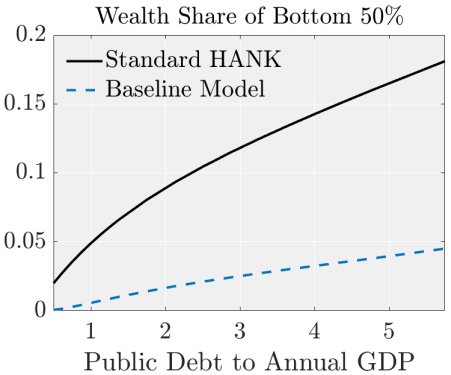
No transfers to households whose labor income $w_t n_{i,t} e_{i,t} \geqslant \epsilon_t^{TT} \frac{a_1}{a_2} \bar{y}$

Calibration: $a_1 = 0.5$ and $a_2 = 0.8$

Aggregate shock: $\epsilon_t^{TT} > 1$ ▸ back

Poor households remain poor





$\Rightarrow$ liquidity mainly goes to rational households, but all pay higher taxes

$\Rightarrow$ optimal debt level substantially lower than in rational model! ▸ back

Stationary Equilibrium Effects of Targeted Transfers

- Targeted transfers to below-median income HHs

  $\Rightarrow$ reduces precautionary savings motive...

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- Targeted transfers to below-median income HHs
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  - $\Rightarrow$ rational model: average MPC increases from 0.18 to 0.23 and HtM share from 0.23 to 0.3

Stationary Equilibrium Effects of Targeted Transfers

- Targeted transfers to below-median income HHs
  - $\Rightarrow$ reduces precautionary savings motive... especially for rational households
  - $\Rightarrow$ rational model: average MPC increases from 0.18 to 0.23 and HtM share from 0.23 to 0.3
  - $\Rightarrow$ baseline model: average MPC from 0.18 down to 0.17 and HtM share barely changed

$\Rightarrow$ crowding-out effects of income insurance are dampened back

Two-Asset Model: Details

back

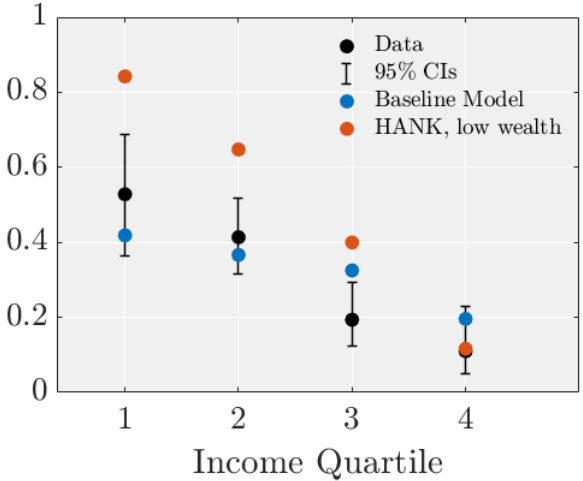
$$c_t + \frac{b_t}{1+r_t} + k_t = b_{t-1} + (1 + r_t^k)k_{t-1} + (1-\tau_t)w_t \bar{e}_g e_t n_t$$

- k illiquid: only fraction λ participate in capital markets in a given period

$$Y_t = K_{t-1}^{\alpha} N_t^{1-\alpha}$$

	baseline two-asset	rational two-asset	two-asset recalib.
HtM	0.27	0.06	0.23
Avg. MPC	0.16	0.058	0.16
return gap	1.6%	1.5%	4.8%
HtM rat. HHs	0.0658	0.06	0.23
Avg. MPC rat. HHs	0.060	0.058	0.16
HtM OC HHs ls	0.600	-	-
Avg. MPC OC HHs ls	0.323	-	-

HtM along the income distribution



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Optimal Debt Level with Discount Factor Heterogeneity

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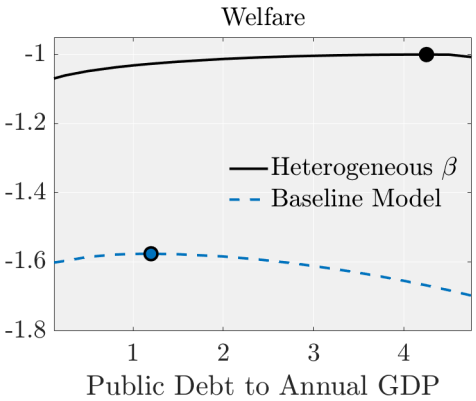

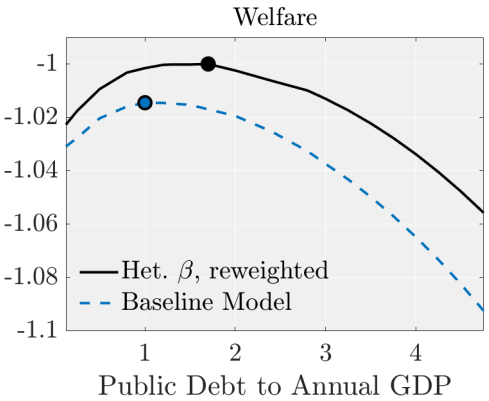

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