Heterogeneous-Agent Macro as a Gateway to Behavioral Macro

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Slides at https://benjaminmoll.com/CEMLA_behavioral_macro/
Present Bias Amplifies the Household Balance-Sheet Channels of Macroeconomic Policy

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CEMLA
HA Macro as a Gateway to Behavioral Macro

Philosophy of heterogeneous-agent macro:

• build things from ground up, take individual behavior seriously
• flesh out implications for macro policy, fluctuations

Enormously successful research program...

Household finance & behavioral econ literatures:

• Empirical findings that are hard to rationalize w optimizing behavior
  1. pension saving
  2. credit card borrowing
  3. mortgage refinancing
  4. ...
• Propose alternative models that do rationalize empirical findings

Logical question: Does incorporating such behavior into our (HA) macro models change our thinking about macro policy, fluctuations?
Mortgage refinancing: large delays, sums left on table

Andersen et al (AER 2020) on refinancing of Danish fixed-rate mortgages

(a) Interest savings left on table

(b) Refinancing delays

Note: Prediction of \((S, s)\) model = refinance whenever incentive > 0 where incentive \(\approx\) potential savings = \(r_{old} - r_{new} - \) fixed cost (ADL threshold)

- Also: inconsistencies that violate optimal inaction, instead Calvo

Questions:

1. Where does this inertia come from?
2. Does incorporating it change our thinking about macro policy?
A Bottom-Up Approach to Behavioral Macro

Behavioral macro is well-established field, many important contributions

Most theoretical work uses RA rather than HA models

- RA models hard to connect to micro data
- often top-down approach: pick behavioral biases to fit macro data
- sometimes feels a bit reverse-engineered

Usefulness of heterogeneous-agent modeling? Bottom-up approach

- starting point: empirical findings about individual behavior
- easier to link HA models to huge body of micro work in household finance, behavioral econ, psychology,...

This talk: (baby) attempt at doing this = paper with Laibson and Maxted

A number of other recent HA macro papers move in same direction
Auclert-Rognlie-Straub, Boutros, Maxted, Laibson-Maxted-Moll, Lian, Kueng, ...
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CEMLA
Question

Idea with long tradition (Strotz 1956, ...)

- dynamically inconsistent preferences alter dynamic choices
- particular form with strong empirical support: present bias
  (e.g. Ashraf-Karlan-Yin, Augenblick-Niederle-Sprenger, Laibson-Maxted-Repetto-Tobacman, ...)

Monetary and fiscal policy $\Rightarrow$ household consumption and saving

- = leading examples of dynamic choices affected by present bias

To what extent does present bias alter impact of these policy tools?

(To be clear: present bias $= \beta - \delta$ preferences $=$ quasi-hyperbolic discounting)
What We Do

Starting point: “positive household finance”

- households face complex financial planning problem, behavior is influenced by psychological factors
- want our model to capture relevant complexities

Develop partial-equilibrium heterogeneous-household model with

1. rich household balance sheets (“Aiyagari w mortgages & housing”)
   (e.g. Guerrieri-Lorenzoni-Prato, Wong, Eichenbaum-Rebelo-Wong, Kaplan-Mitman-Violante,...)
   - assets: liquid wealth and illiquid housing
   - liabilities: credit card debt and fixed-rate mortgages
   - liquidity constraints

2. present biased preferences
   - naïve present bias with procrastination

Goal: understand how interaction of (1)+(2) affects policy transmission
Our Scope: Monetary Policy Transmission

Monetary transmission to individual consumption

Direct effects (PE)
- Intertemporal Substitution
- Income Effects
  - Standard Income
  - Effects through Interest Rates
  - Valuation Effects from Inflation (Fisher Effects)
  - Income Effects through Mortgage Rates

Indirect effects (GE)
- Asset Prices/Returns
- Fiscal Policy
- Labor Income
  - Capital Gains
  - Dividends/Profits

Important: today ≠ GE analysis, want to first understand PE

Paper: speculative discussion through lens of HANK literature
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Paper: speculative discussion through lens of HANK literature
What We Find

1. Fiscal policy
   • present bias amplifies potency
   • generically increases economy’s average MPC

2. Monetary policy
   • present bias amplifies potency...
   • ... but at same time slows down transmission speed

Both effects of present bias move model toward data

3. Methods (not today’s focus)
   • continuous-time present bias, option value problem via HJBQVI
What We Find

1. Fiscal policy
   - present bias amplifies potency
   - generically increases economy’s average MPC

2. Monetary policy
   - present bias amplifies potency...
     - cash-out refis = liquidity injections to high-MPC households
   - ... but at same time slows down transmission speed
     - refinancing inertia due to procrastination

Both effects of present bias move model toward data

3. Methods (not today’s focus)
   - continuous-time present bias, option value problem via HJBQVI
Model
Plan for model exposition

1. Household balance sheets: “Aiyagari with mortgages & housing”
2. Time preferences: naïve present bias
3. Refinancing procrastination
Household Balance Sheets

- Continuum of households
- Stochastic income $y_t$, liquid wealth $b_t$, housing $h$, mortgage $m_t$
- Can refinance mortgage at cost (both $ and effort – details later)

When not refinancing:

$$\dot{b}_t = y_t + r_t b_t + \omega^{cc} b_t^- - (r_t^m + \xi) m_t - c_t$$

$$\dot{m}_t = -\xi m_t$$

- credit card limit: $b_t \geq b$
- LTV constraint: $m_t \leq \theta h$

- Note shortcut: housing $h$ is fixed and cannot be adjusted
  \(\Rightarrow\) when taking to data, restrict to home-owners who do not move

- “Monetary policy”: exogenous process for liquid rate $r_t$
- Mortgage interest rate $r_t^m$ fixed until refinance, then $r_t^m = r_t + \omega^m$
Why refinance?

1. Rate refinancing motive
   - Lower mortgage interest payments if market rate falls

2. Cash-out refinancing motive
   - Access home equity during low-income spells (c smoothing)
   - Replace expensive credit card debt w cheaper mortgage debt

- Model: refinancing is costly
  - fixed cost $\kappa^{\text{refi}}$, effort cost $\bar{\epsilon} \approx 0$
Time preferences: naïve present bias

Key behavioral element: present bias = $\beta - \delta$ discounting

Additional assumption: households are naïve about their present bias
Time preferences: naïve present bias

Key behavioral element: present bias $= \beta - \delta$ discounting

Additional assumption: households are naïve about their present bias

Discrete-time warmup:

- Current self discounts all future selves by $\beta < 1$

$$u(c_0) + \beta \sum_{t=1}^{\infty} \delta^t u(c_t)$$

- Naïveté: current self believes future selves time-consistent ($\beta = 1$) ⇒ no game between current and future selves
Time preferences: naïve present bias

Key behavioral element: present bias = $\beta - \delta$ discounting

Additional assumption: households are naïve about their present bias

**Continuous time:**

- Current self discounts all future selves by $\beta < 1$
- Take period length $\rightarrow 0$

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

Why continuous time? Tractable approx. of daily/weekly time-steps

(Laibson-Maxted, Augenblick, Augenblick-Rabin, McClure et al.)
Refinancing Procrastination

Large empirical literature: households slow to refinance – think Calvo (e.g. Andersen-Campbell-Nielsen-Ramadorai, Keys-Pope-Pope,...)

Naïve $\beta < 1$ naturally generates such refinancing procrastination

- Key ingredient: effort cost $\bar{\varepsilon} \approx 0$
- Application of result from theory literature (O’Donoghue-Rabin): naïfs procrastinate on immediate-cost delayed-benefit tasks

- Take $\bar{\varepsilon} \to 0$: no effect when $\beta = 1$ but procrastination when $\beta < 1$
- Monetary cost not enough. See discussion in paper.

How get Calvo? Stochastic $\varepsilon_t \in \{\varepsilon, \bar{\varepsilon}\}$, flicks from $\bar{\varepsilon}$ to $\varepsilon$ at rate $\phi$

- $\varepsilon < \beta \bar{\varepsilon} \Rightarrow$ procrastinate whenever $\varepsilon_t = \bar{\varepsilon}$, refi whenever $\varepsilon_t = \varepsilon$
- True even though we take limit as $\varepsilon, \bar{\varepsilon} \to 0$
Effect of $\beta < 1$ on Policy Functions

Skip today
Calibration and Results
Calibration and results

Always show results for 3 cases

1. **Rational Benchmark:** $\beta = 1$, Procrastination

2. **Intermediate Case:** $\beta < 1$, Procrastination

3. **Behavioral Benchmark:** $\beta < 1$, Procrastination
Discount Function

- Calibrate discount function to match empirical wealth moments
- 2016 SCF wave of home owners who don’t move:
  - Average LTV = 0.54
  - Average credit card debt to income ratio = 0.09

<table>
<thead>
<tr>
<th>Discount Function</th>
<th>Data</th>
<th>Exponential Benchmark</th>
<th>Intermediate Case</th>
<th>Present-Bias Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>-</td>
<td>1</td>
<td>0.7</td>
<td>0.83</td>
</tr>
<tr>
<td>$\rho$</td>
<td>-</td>
<td>1.65%</td>
<td>0.66%</td>
<td>1.08%</td>
</tr>
</tbody>
</table>

| Calibration Targets | | | | |
|---------------------| | | | |
| LTV                 | 0.54 | 0.54 | 0.54 | 0.54 |
| Avg. CC Debt        | 0.09 | 0.04 | 0.09 | 0.09 |
| Share CC Debt > 0   | 60%  | 27%  | 51%  | 46%  |
Fiscal Policy: $1000 Helicopter Drop

- Present bias $\beta < 1$ robustly amplifies potency of fiscal policy
Fiscal Policy: $1000 Helicopter Drop

• Present bias $\beta < 1$ robustly amplifies potency of fiscal policy
Fiscal Policy: $1000 Helicopter Drop

- Present bias $\beta < 1$ robustly amplifies potency of fiscal policy
Present bias amplifies potency of fiscal policy: intuition

- $\beta < 1$ creates large MPCs + large mass of households at $b$
Monetary Policy: 1% Interest-Rate Cut

Present bias $\beta < 1$ amplifies potency of monetary policy ... but slows transmission speed

- refi procrastination $\Rightarrow$ “dry powder” ignited more slowly

![Graph showing consumption elasticity over years](image)

- Exponential
Monetary Policy: 1% Interest-Rate Cut

- Present bias $\beta < 1$ amplifies potency of monetary policy ...
  - cash-out refis imitate liquidity-injection of fiscal policy
Monetary Policy: 1% Interest-Rate Cut

- Present bias $\beta < 1$ amplifies potency of monetary policy ...
- ... but slows transmission speed
  - refi procrastination $\Rightarrow$ “dry powder” ignited more slowly
Summary: Effect of $\beta < 1$ on Magnitude and Timing

- Fiscal and Monetary Policy scaled to impact of $\beta = 1$ case

(a) Fiscal policy

(b) Monetary policy

- Fiscal Policy: $\beta < 1$ amplifies potency
- Monetary Policy: $\beta < 1$ amplifies potency but slows transmission
Monetary policy and house price shocks

Our main result – that present bias amplifies consumption response to monetary policy – still holds in both cases.
Conclusion

**Present bias amplifies household balance-sheet channels of macroeconomic policy**

1. Fiscal policy
   - present bias amplifies potency
   - generically increases economy’s average MPC

2. Monetary policy
   - present bias amplifies potency but...
   - ... at same time slows down speed of monetary transmission

**Heterogeneous-agent macro as a gateway to behavioral macro**

- bottom-up rather than top-down
- for more see https://benjaminmoll.com/research_agenda_2020/
- virtual seminar series https://micro-macro-household-finance.co.uk/
Thanks!
• For $\beta < 1$, fiscal policy driven by low-$c$ households
  ○ Low-$c$ households are constrained, have high MPCs
Monetary Policy: Distributional Effects

- For $\beta < 1$, low-consumption households left out of MP on impact
  - Low-\(c\) households constrained, procrastinate refinancing

- $\beta$ critical for the distributional effects of stabilization policy
  - $\beta = 1$: monetary policy promotes \(c\) of low-\(c\) households
  - $\beta < 1$: fiscal policy promotes \(c\) of low-\(c\) households
Discussion: General Equilibrium
So far: partial equilibrium analysis

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  - Capital Gains
  - Level
  - Risk

Valuation Effects from Inflation (Fisher Effects)

Raises question: how would present bias affect transmission of monetary and fiscal policy in full GE analysis?
GE effects through lens of HANK literature

Monetary transmission to individual consumption

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Next: brief speculative discussion of this question
GE effects through lens of HANK literature

Fiscal policy:

- primary GE effect through labor income
- size depends primarily on MPCs
- present bias amplifies MPCs ⇒ likely amplifies overall response

Monetary policy:

- as for fiscal policy, GE effects through labor income
- additional GE effects through stock prices / returns, house prices also move but at much lower frequencies
- size depends on MPCs out of labor income and stock capital gains
- present bias amplifies MPCs ⇒ likely amplifies overall response