Present Bias Amplifies the Household Balance-Sheet Channels of Macroeconomic Policy

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Slides at https://benjaminmoll.com/PBMP_slides/

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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 ⇒ household consumption and investment

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

Paper: speculative discussion through lens of HANK literature
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
  - Dividends/Profits
  - Capital Gains
- Fiscal Policy
- Labor Income
  - Level
  - Risk

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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:
  \[
  \dot{b}_t = y_t + r_t b_t + \omega^{cc} b_t^- - (r^m_t + \xi)m_t - c_t
  \]
  \[
  \dot{m}_t = -\xi m_t
  \]
  \[
  b_t \geq b, \quad m_t \geq 0, \quad m_t \leq \theta h
  \]
- Note shortcut: housing $h$ is fixed and cannot be adjusted
  \Rightarrow when taking to data, restrict to home-owners who do not move
- Liquid rate $r_t$ exogenous, follows finite-state process = mon. policy
- Mortgage interest rate $r^m_t$ fixed until refinance, then $r^m_t = r_t + \omega^m$
Why refinance?

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

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

- Can also prepay mortgage
  - Use large liquid wealth balances to pay off mortgage debt

- Model: mortgage adjustments are costly
  - refinancing: fixed cost $\kappa^{\text{refi}}$, effort cost $e_t \approx 0$
  - prepayment: fixed cost $\kappa^{\text{prepay}} \approx 0$, effort cost $e_t \approx 0$
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 $\beta < 1$

\[
\sum_{t=1}^{\infty} \delta^t u(c_t)
\]

- Naïveté: current self believes future selves time-consistent ($\beta = 1$)
  \[\Rightarrow\] 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 $\to 0$

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

- Details in Harris-Laibson (2013) and Laibson-Maxted (2020)
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 $e_t \approx 0$

• Application of result from theory literature (O’Donoghue-Rabin):
  naïfs procrastinate on immediate-cost delayed-benefit tasks

• Monetary cost not enough. Why? Effect on $u$-flow over next hrs of:
  ○ $10k$ payment $\Rightarrow$ small effect (via $c$)
  ○ 10 hours of pain $\Rightarrow$ large effect

Assumption: stochastic $e_t \in \{0, \varepsilon\}$ with $\varepsilon \downarrow 0$, flicks from $\varepsilon$ to 0 at rate $\phi$

• $\beta = 1$: small effort cost $\varepsilon$ does not affect refi decision

• $\beta < 1$: procrastinate whenever $e_t = \varepsilon$ (even though $\varepsilon \approx 0$)

Why $e_t \in \{0, \varepsilon\}$? W/o $e_t = 0$, never refinance! Future work: partial sophist’n
Model Summary

• Aim: analyze monetary and fiscal policy in heterogeneous-household model with present-biased preferences

• Household problem has 5 state variables:
  1. $b$: liquid wealth / credit card debt
  2. $y$: stochastic labor income
  3. $m$: mortgage (illiquid home equity)
  4. $r_m$: mortgage rate
  5. $r$: liquid rate

• Remainder of talk: show results for 3 cases
  1. Rational Benchmark: $\beta = 1$, Procrastination
  2. Intermediate Case: $\beta < 1$, Procrastination
  3. Behavioral Benchmark: $\beta < 1$, Procrastination
Effect of $\beta < 1$ on Policy Functions
Effect of present bias on policy functions

• Notation: household state variables = \( x = (b, m, y, r^m, r) \)

• Assumption: CRRA utility \( u'(c) = c^{-\gamma} \)

• Households make two decisions:
  1. consumption = continuous control
  2. mortgage refinancing and prepayment = impulse control

• Solve optimal control + option value problem
Effect of present bias on consumption

Continuous-time present bias ⇒ simple FOC for today vs future

\[
u'(c(x)) = \beta \frac{\partial v(x)}{\partial b}
\]

and naïveté ⇒ \( v(x) = \text{time-consistent value function (}\beta = 1\) 

Proposition

Consumption obeys Euler equation:

\[
E_t \frac{d u'(c(x_t))}{dt} \frac{d}{u'(c(x_t))} = \left[ \rho + \gamma \left(1 - \beta^{1/\gamma}\right) \frac{\partial c(x_t)}{\partial b} \right] - r_t(b_t)
\]

When unconstrained, households overconsume by \(\beta^{-1/\gamma} > 1\)

\[
c(x) = \beta^{-1/\gamma} \hat{c}(x) \quad \text{where} \quad \hat{c}(x) = \text{time-consistent policy fn (}\ast\)
\]

Observation: interaction of \(\beta < 1\) with liquidity constraint is critical. Otherwise (\ast) ⇒ \(\beta < 1\) and \(\beta = 1\) observationally equivalent
Effect of present bias on refinancing and prepayment

Proposition

Mortgage adjustment policy function independent of $\beta$, i.e. only depend on long-run discount rate $\rho$ (and other model parameters)

$\beta < 1$ affects refinancing decision only through procrastination
Calibration
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>
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</table>

<table>
<thead>
<tr>
<th>Calibration Targets</th>
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<tbody>
<tr>
<td>LTV</td>
<td>0.54</td>
<td>0.54</td>
<td>0.54</td>
<td>0.54</td>
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<tr>
<td>Avg. CC Debt</td>
<td>0.09</td>
<td>0.04</td>
<td>0.09</td>
<td>0.09</td>
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<tr>
<td>Share CC Debt &gt; 0</td>
<td>60%</td>
<td>27%</td>
<td>51%</td>
<td>46%</td>
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</table>
Other Parameters (Selected)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preferences</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \phi )  Procrastination Decay Rate</td>
<td>(-\log(0.5))</td>
<td>Andersen et al. (2020)</td>
</tr>
<tr>
<td><strong>Housing and Assets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( h )  House Value</td>
<td>2.9</td>
<td>2016 SCF</td>
</tr>
<tr>
<td>( \theta )  Max LTV</td>
<td>0.8</td>
<td>Greenwald (2018)</td>
</tr>
<tr>
<td>( b )  Credit Limit</td>
<td>(-\frac{1}{3})</td>
<td>2016 SCF</td>
</tr>
</tbody>
</table>
Results
Fiscal Policy: $1000 Helicopter Drop

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

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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 of Consumption Elasticity over Years]

- Exponential function
• 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

- Fiscal Policy: $\beta < 1$ amplifies potency

(b) Monetary policy

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

(a) -25% House Price Shock

(b) +25% House Price Shock

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

Final thought: het. agent macro as gateway to behavioral macro

- all about building things “from the ground up”
- for more see https://benjaminmoll.com/research_agenda_2020/
Thanks!
Fiscal Policy: Distributional Effects

• For $\beta < 1$, fiscal policy driven by low-$c$ households
  - Low-$c$ households are constrained, have high MPCs
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

Monetary transmission to individual consumption

- Direct effects (PE)
  - Intertemporal Substitution
  - Income Effects

- Indirect effects (GE)
  - Asset Prices/Returns
  - Fiscal Policy
  - Labor Income

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

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  - Level
  - Risk

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 $\Rightarrow$ 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 $\Rightarrow$ likely amplifies overall response