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

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Bank of Canada Annual Economic Conference

Heterogeneous-agent behavioral household finance:

1. Modelled institutional factors
   - Stochastic income, stochastic interest rates, and stochastic lifecycle events
   - Assets: liquid wealth and illiquid housing
   - Liquidity constraints
   - Liabilities: credit card debt and fixed-rate mortgages
   - Refinancing opportunities
2. Naive present-biased preferences
   - Present Bias: one form of present-focused preferences
   - Naivete: unaware of future present bias

Preview of What We Find

1. Household consumption-savings behavior
   - Present bias fits range of empirical patterns from HF literature
     - High-cost credit card borrowing
     - Substantial illiquid wealth holding
     - Large MPCs for small and large wealth shocks
     - "Refinancing inertia" from procrastination

2. Fiscal Policy
   - Present bias amplifies potency
     - Present bias increases economy's average MPC

3. Monetary Policy
   - Present bias amplifies potency
     - Cash-out refis imitate liquidity-injection of fiscal policy
   - ... but also slows down the transmission speed
     - Households slow to refinance due to procrastination

4. Methods (not today's focus, see paper for details)
   - Present bias in continuous time

Related Literature

- Consumption-Saving Decisions and Behavioral Biases
  - Allcott et al. (2021), Han et al. (2019), Lian (2021), Malmendier and Shen (2019), Pagel (2017), Thaler (1990)

- Macro Stabilization Policy with Heterogeneous Agents
  - Auclert (2019), Auclert et al. (2018), Kaplan and Violante (2014), Kaplan et al. (2018), McKay, Nakamura, and Steinsson (2016)

- Refinancing Channel of Monetary Policy & Refinancing Inertia
  - Beraja et al. (2018), Berger et al. (2019), Bhutta and Keys (2016), Di Maggio et al. (2019), Eichenbaum et al. (2019), Greenspan and Kennedy (2008), Hurst and Stafford (2004), Wong (2019)
  - Andersen et al. (2019), Johnson et al. (2018), Keys et al. (2016)

- Continuous-Time Present Bias
  - Barro (1999), Cao and Werning (2016), Harris and Laibson (2013), Laibson and Maxted (2020), Maxted (2020)

Model

Model: Household Balance Sheets

- **Partial equilibrium** model of household consumption-savings behavior

- Stochastic income y_t, liquid wealth b_t, housing h, and mortgage m_t:

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

  - Liquidity constraint: $b_t \geq \underline{b}$
  - LTV constraint: $m_t \leq \theta h$

- Households can discretely adjust balance sheet by refinancing (details soon)

- Interest Rates
  - "Monetary Policy": movements in liquid rate r_t
  - FRMs: mortgage rate r_t^m fixed until refinance, then $r_t^m = r_t + \omega^m$

Model: Refinancing

- Refinancing = replace old mortgage with new mortgage
  - Requires fixed \$ cost κ^{refi} + small effort cost e_t
  - Choose new mortgage amount m':

$$m' \in [0, \theta h] \quad \text{and} \quad b' = b_t - \kappa^{refi} + [m' - m_t]$$

  - "Cash-Out Refi" when $m' > m_t$
  - Mortgage interest rate resets to $r_t^m = r_t + \omega^m$

- Why Refinance?
  1. Rate Refi Motive
     - If market rate r_t falls then refinancing lowers mortgage interest payments
  2. Cash-Out Refi Motive
     - Tap into housing wealth during low-income spells (consumption smoothing)
     - Replace expensive credit card debt with cheaper mortgage debt

- Refinancing motives not mutually exclusive
  - Rate cut will incentivize wave of cash-out refis

Model: Naive Present Bias

- Discrete-Time Setting
  - Present Bias: current self discounts all future selves by $\beta < 1$

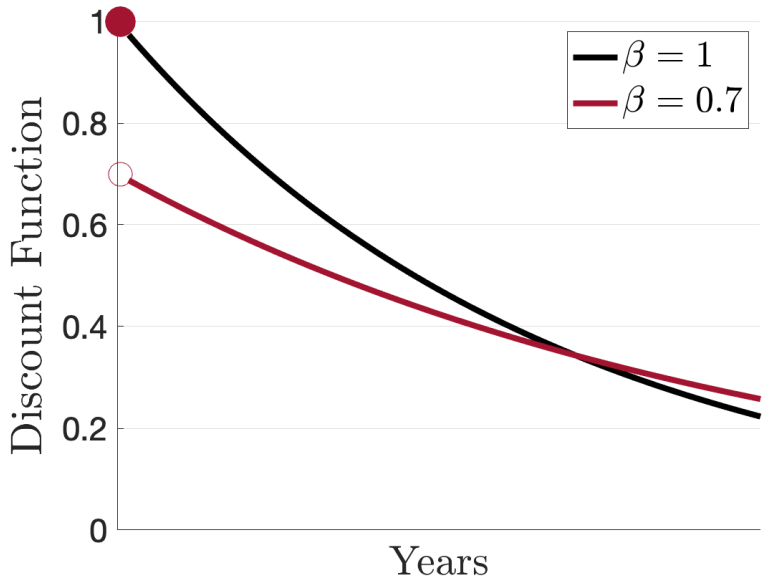
$$u(c_0) + \beta \sum_{s=1}^{\infty} \delta^s u(c_s)$$

  - Naivete: current self believes future selves time consistent ($\beta = 1$)

Model: Naive Present Bias

- Continuous-Time 'Instantaneous Gratification' (Harris & Laibson '13)
  - Present Bias: current self discounts all future selves by $\beta < 1$
  - **Take the period length** $\to 0$ (each self instantaneous)

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



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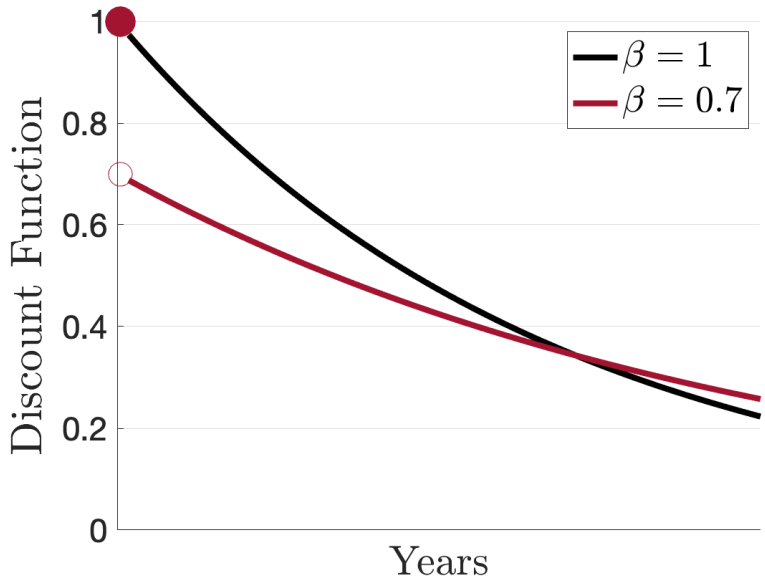


- Why continuous time? **Tractable** approx. of daily/weekly time-steps

  e.g., Augenblick (2018), Augenblick & Rabin (2018), McClure et al. (2007)

▸ Laibson & Maxted (2020)

Model: Refinancing Procrastination

- Empirical literature documenting households slow to refinance
  E.g., Keys et al. (2016), Andersen et al. (2019), Johnson et al. (2019)

- Naive $\beta < 1$ generates such refinancing procrastination
  - Key ingredient: small effort cost e_t
  - Naifs procrastinate on immediate cost, delayed benefit tasks (e.g., refi)
    E.g., O'Donoghue and Rabin (1999), DellaVigna and Malmendier (2006)

- Calvo-style procrastination with two-state effort cost $e_t \in \{\underline{\varepsilon}, \overline{\varepsilon}\}$
  - Assume $\beta\overline{\varepsilon} > \underline{\varepsilon} > 0$
  - Make both effort costs small (converge to zero)
  - Assume e_t sits at $\overline{\varepsilon}$, momentarily drops to $\underline{\varepsilon}$

- $\beta = 1$: small effort cost has no effect

- $\beta < 1$: small effort cost leads to procrastination
  - Never refi when $e_t = \overline{\varepsilon}$; only refi when $e_t = \underline{\varepsilon}$
  - Why? When $e_t = \overline{\varepsilon}$, self t will wait (one instant) to refi

Model: Summary

- Household problem has six state variables:
  1. b: liquid wealth, which when negative represents credit card debt
  2. y: stochastic labor income
  3. m: mortgage, which pins down illiquid home equity $h - m$
  4. r^m: household's mortgage rate
  5. r: market interest rate (e.g., 10-yr Treasuries)
  6. e: effort cost to refinance

- Households make two decisions:
  1. Consumption (chosen continuously)
  2. Mortgage refis, cash-outs, and pay-downs (stopping problems)

- Study Three Cases:
  1. **Rational Benchmark:** $\beta = 1$, No Procrastination
  2. Intermediate Case: $\beta < 1$, No Procrastination
  3. **Present-Bias Benchmark:** $\beta < 1$, Procrastination

Model Calibration

Externally Calibrated Parameters (Selected)

- Average income normalized to 1

	Description	Value
Preferences		
ϕ	Procrastination Decay Rate	$-\log(0.5)$
Housing and Assets		
h	House Value	3.1
θ	Max LTV	0.8
$\underline{b}$	Credit Limit	$-\frac{1}{3}$
Interest Rates		
ω^m	Mortgage Wedge	1.7%
ω^{cc}	Credit Card Wedge	10.3%

▸ Full Calibration

Internally Calibrated Parameters: Discount Rates

- Calibrate discount function to match empirical wealth moments
- Using 2016 SCF wave for homeowners:
  - Calibrate ρ to match average LTV ratio of 0.54
  - Calibrate β to match average credit card debt to income ratio of 0.09

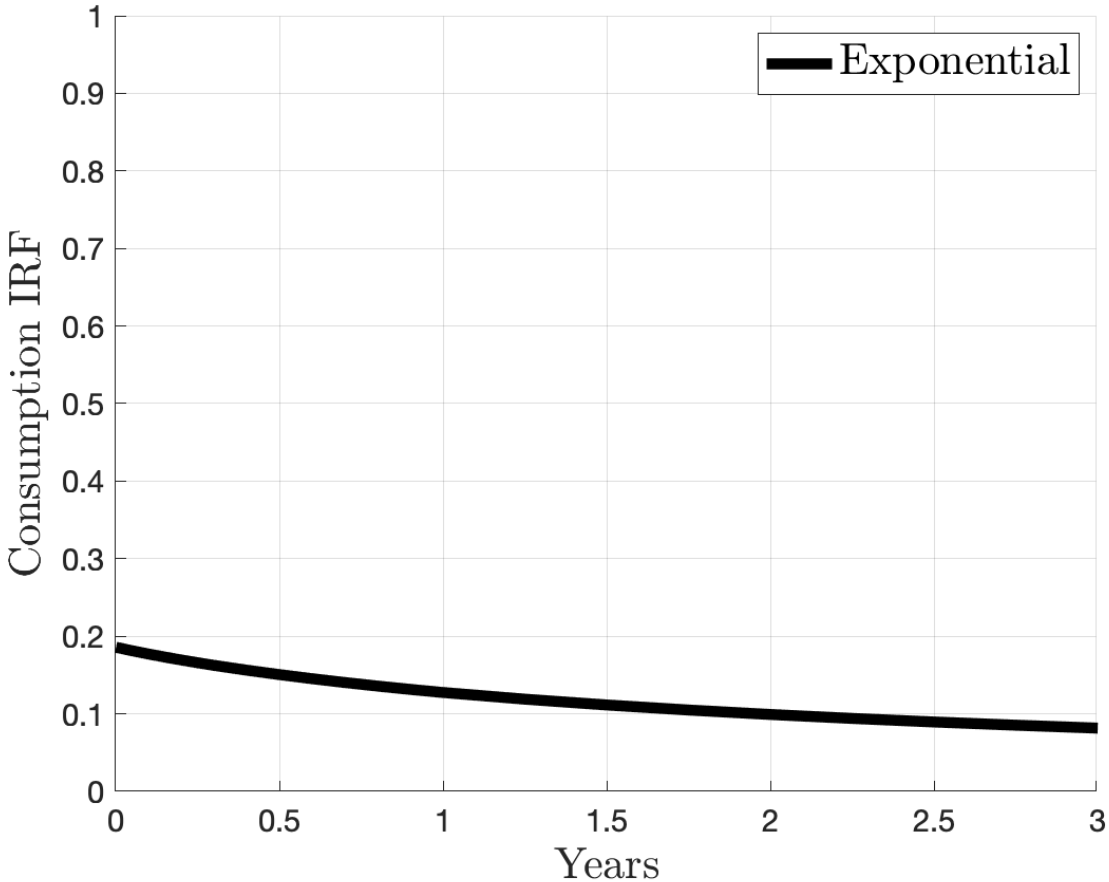
	Data	**Exponential Benchmark**	Intermediate Case	**Present-Bias Benchmark**
Discount Function				
β	-	1	0.70	0.83
ρ	-	1.47%	0.64%	0.97%
Calibration Targets				
LTV	0.54	**0.54**	**0.54**	**0.54**
Avg. C.C. Debt	0.09	0.03	**0.09**	**0.09**

▸ SCF Details ▸ with Share C.C. > 0 ▸ Steady State Moments

Results

Fiscal Policy: $1000 Helicopter Drop

- Consumption IRF at time $t = \frac{\text{Change in avg. consumption at } t}{\$1000}$



▸ IRF Details ▸ MPC Table ▸ MPC & MPX Table

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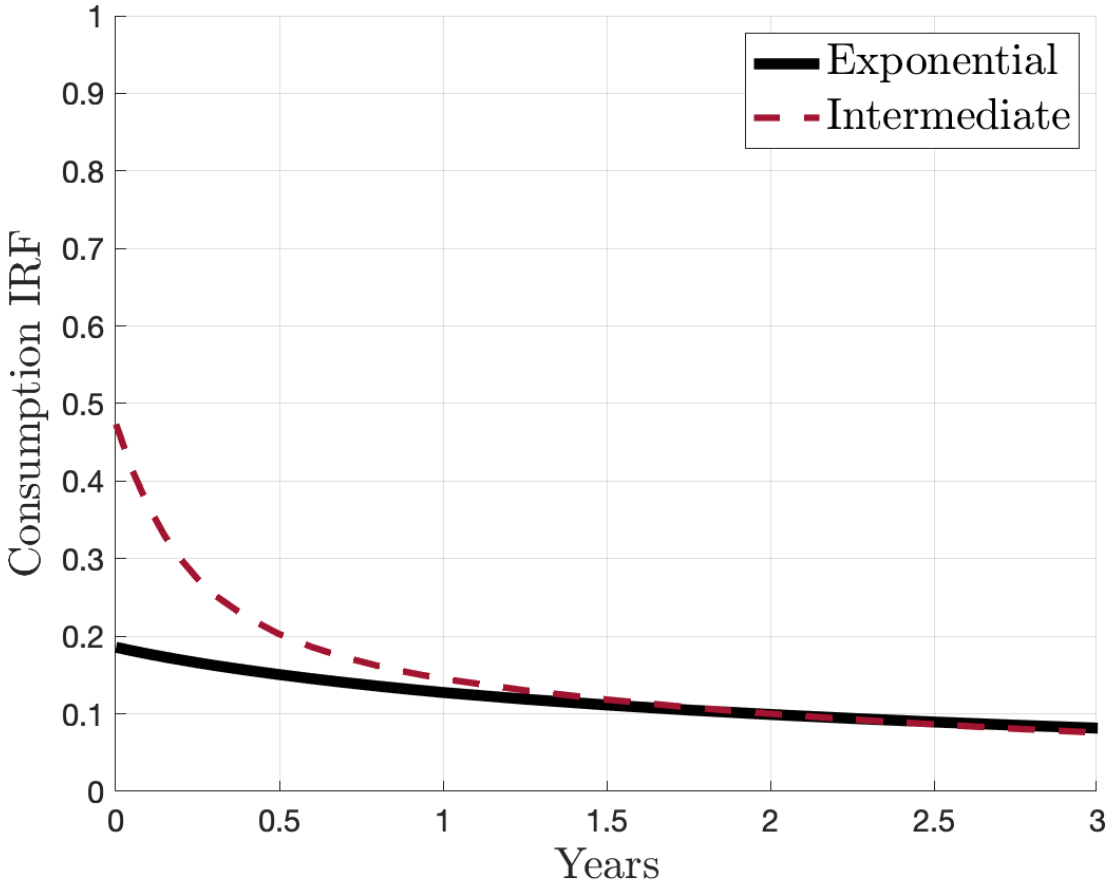

- Present bias amplifies the potency of fiscal policy

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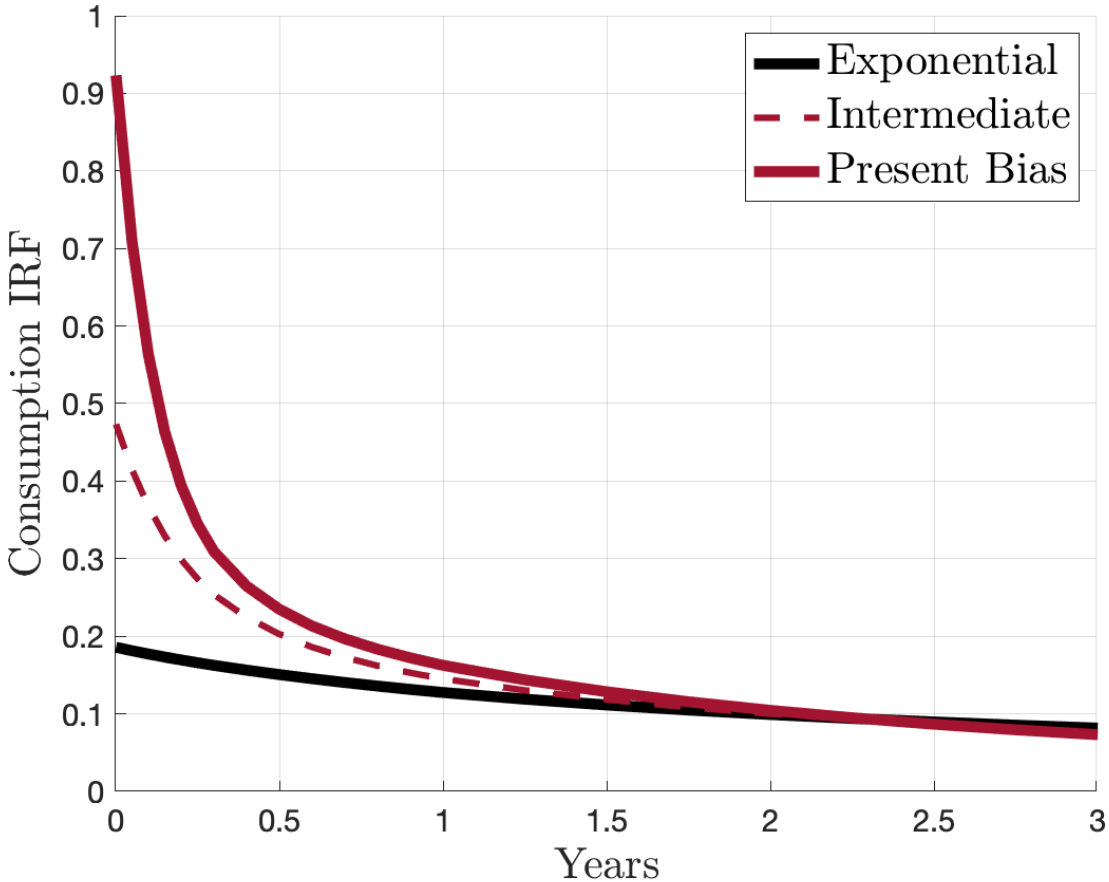

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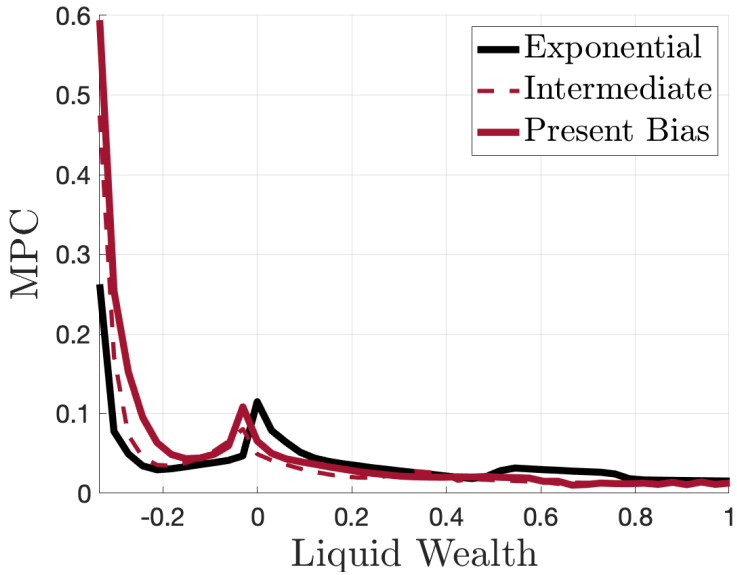
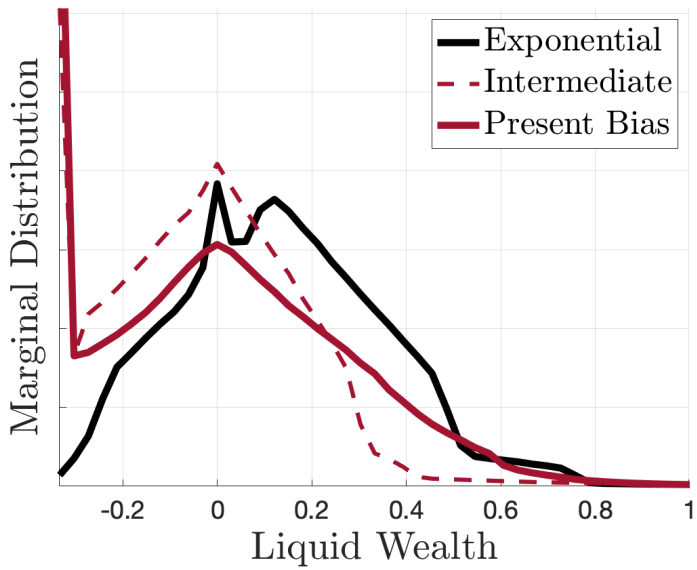
Fiscal Policy: Intuition

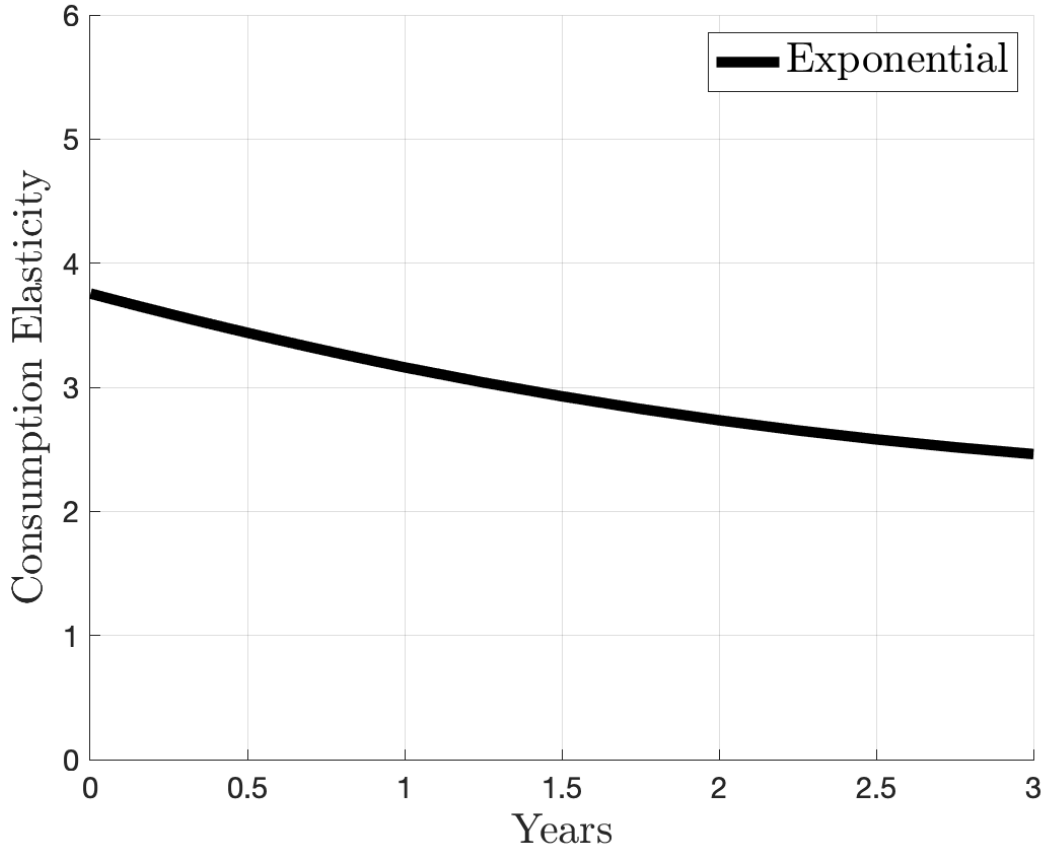




- $\beta < 1$ **creates large MPCs + large mass of households near** $\underline{b}$
  - Intuition: $\beta < 1$ households don't smooth consumption near b

▸ $c(x)$ for Exp. ▸ $c(x)$ for Inter. ▸ $c(x)$ for P.B. ▸ $g(x)$ for Exp. ▸ $g(x)$ for Inter. ▸ $g(x)$ for P.B.

Monetary Policy: 1% Interest-Rate Cut



▸ Refi Regions ($\beta = 1$)

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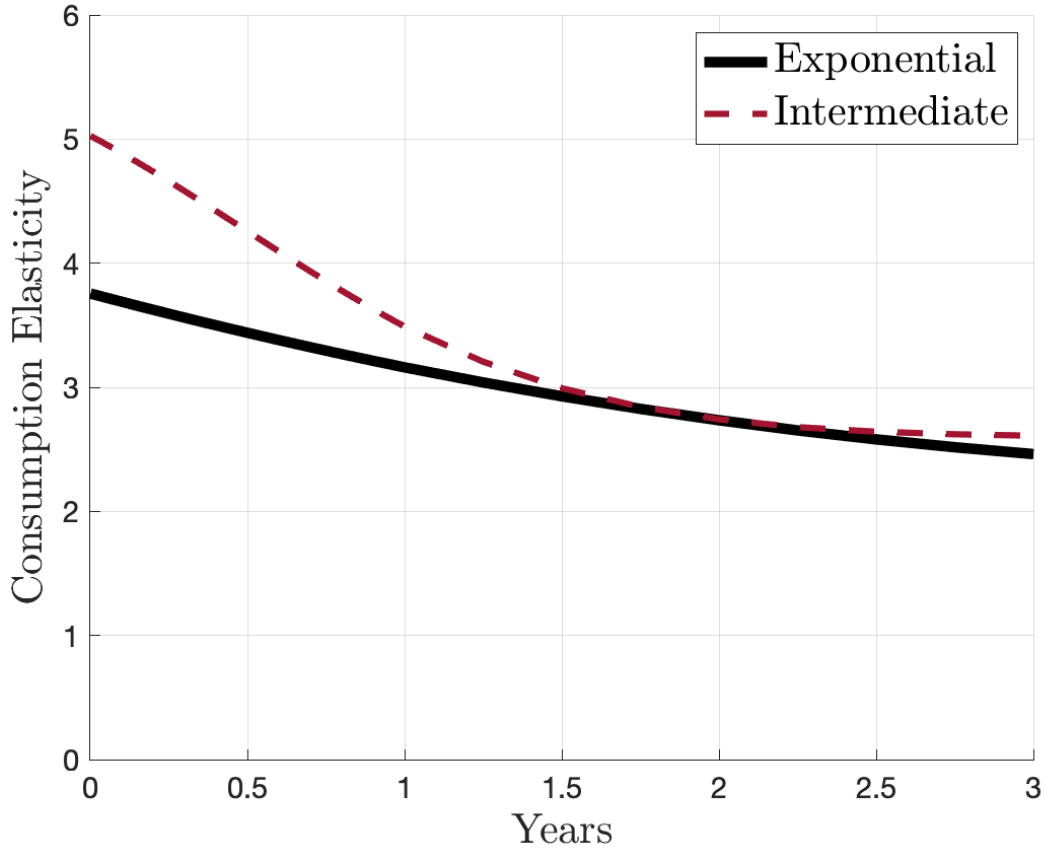

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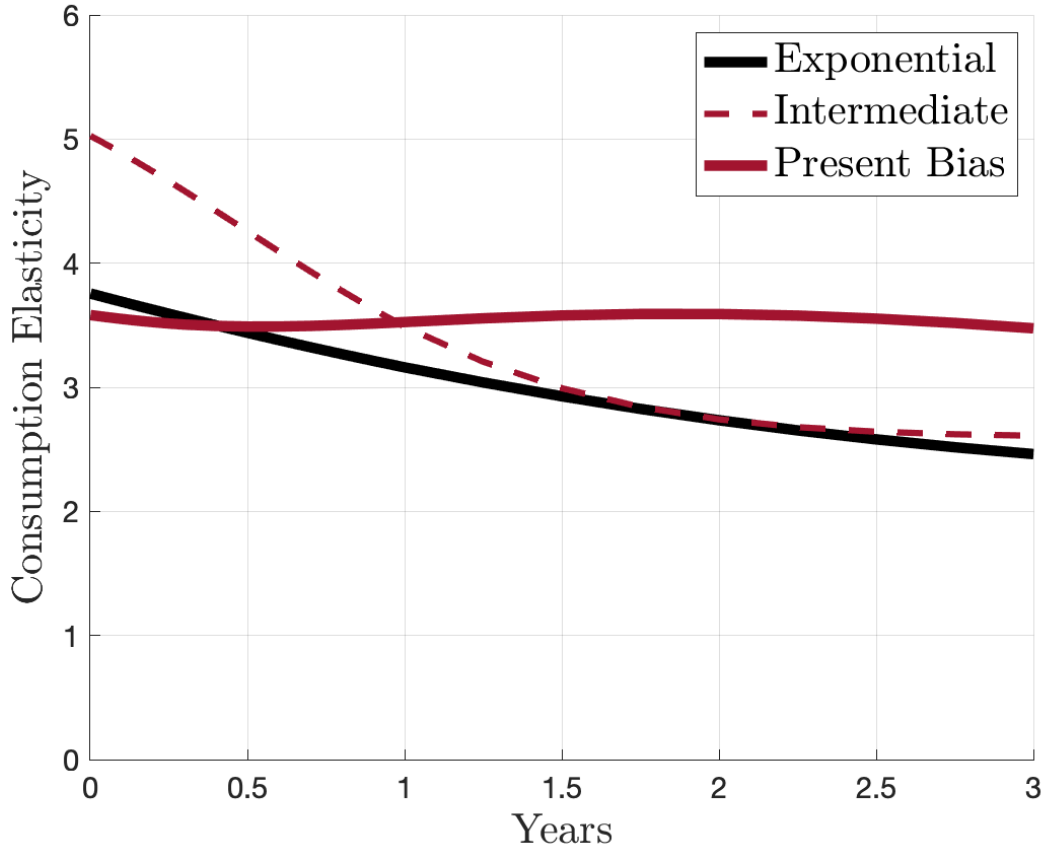


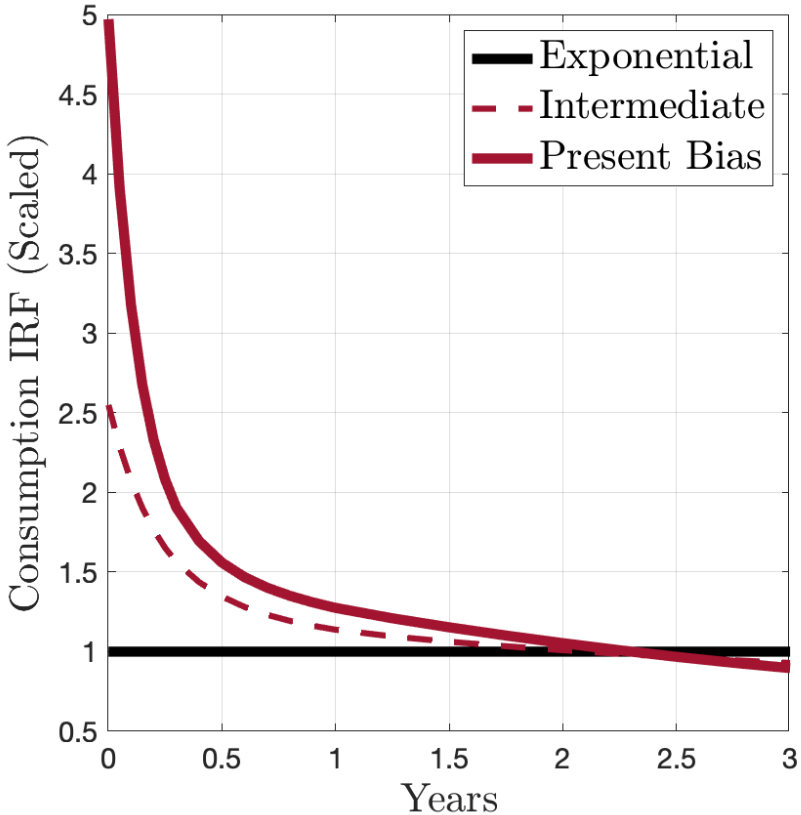
- Present bias amplifies the potency of monetary policy
  - Intuition: cash-out refis imitate liquidity-injection of FP
- **...but procrastination slows transmission speed**
  - Intuition: procrastination $\Longrightarrow$ cash-out channel operates more slowly

▸ Refi Regions ($\beta = 1$) ▸ MP Moments ▸ MP Decomposition

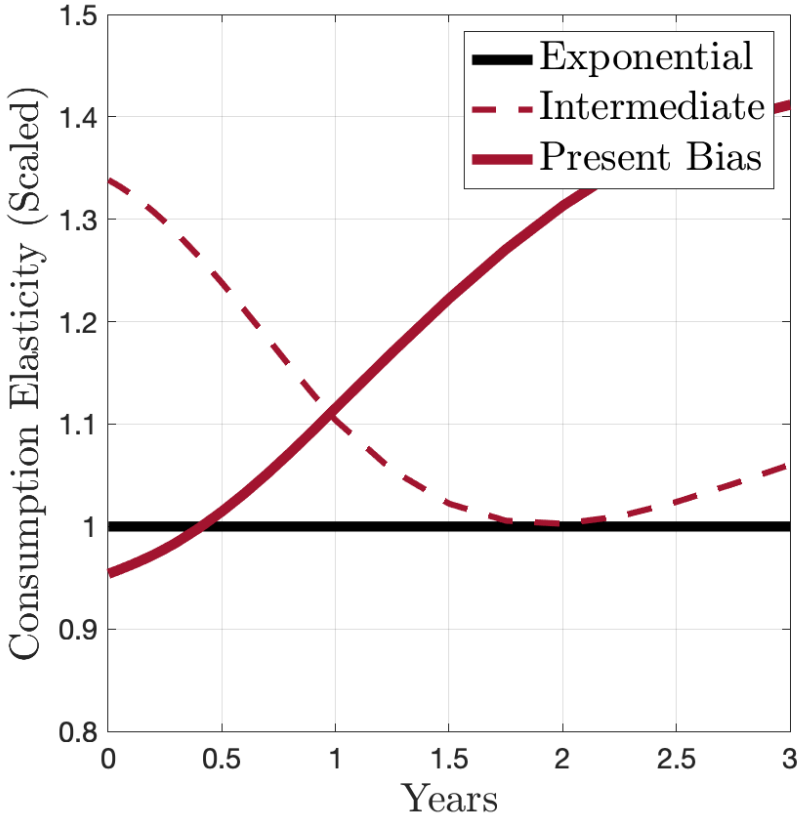
Summary: $\beta < 1$ on Magnitude and Timing

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

Fiscal Policy



Monetary Policy



- Fiscal Policy: $\beta < 1$ **amplifies potency**
- Monetary Policy: $\beta < 1$ **amplifies potency but slows transmission**

Conclusion

- "Positive Household Finance" matters for macro stabilization policy
  - Interaction of present bias and balance sheet complexity important

- Fiscal Policy
  - **Present bias amplifies potency**

- Monetary Policy
  - **Present bias amplifies potency**
    ... and generates a slow burn with respect to monetary transmission

Thank You!

Model: Discrete Adjustment and Refinancing

Back

- "(S,s)": Households can conduct two types of discrete adjustment
  1. Mortgage refinancing (with possibility of cash-out):
     - Fixed cost κ^{refi}
     - New mortgage rate $r_t^m = r_t + \omega^m$
     - Choose (b', m') such that:

$$m' \in [0, \theta h]$$
$$b' \geq \underline{b}$$
$$b' - m' = b_t - m_t - \kappa^{refi}$$

  2. Mortgage prepayment:
     - Fixed cost $\kappa^{prepay} \approx 0$
     - Choose (b', m') such that:

$$m' \in [0, m_t]$$
$$b' \geq \underline{b}$$
$$b' - m' = b_t - m_t - \kappa^{prepay}$$

- Stochastic effort cost e_t for discrete adjustments

Model: Refinancing Procrastination

Back

- Benefit of procrastinating (one instant in expectation):
  - Effort cost e_t discounted by β
- Cost of procrastinating (one instant in expectation):
  - 0
- Intuition robust to time-step $> dt$, but still "short"
  - In our model, average outstanding mortgage balance $\approx \$150,000$
  - Reducing mortgage rate by 1% cuts payments by:

$\$1,500$/year

$\$375$/quarter

$\$125$/month

– – – ––

$\$29$/week

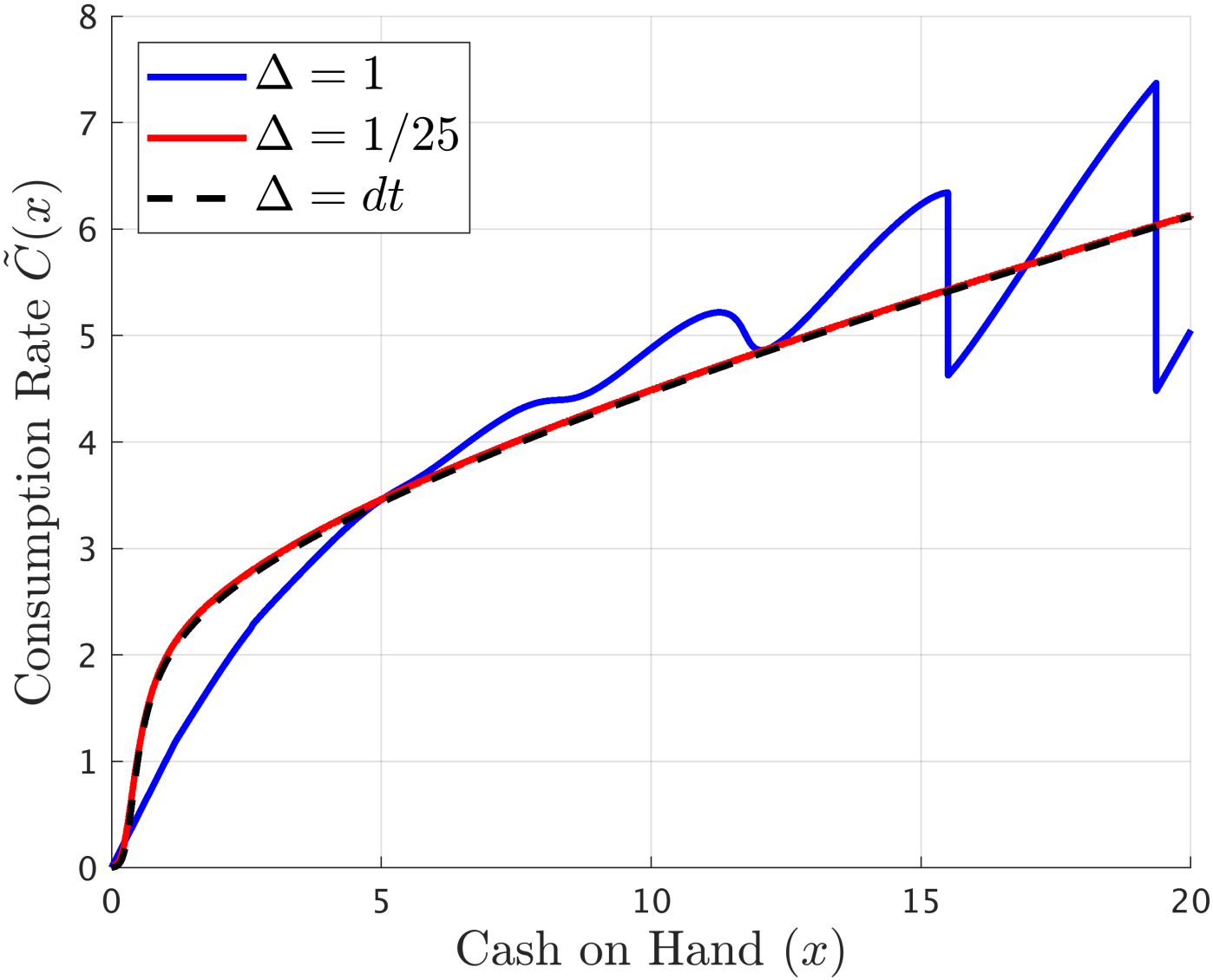
$\$4$/day

$\$0.17$/hour

  - Time-step matters: cost of procrastination depends on expected duration

Model: Laibson and Maxted (2020)

Back



Model: Sequence Problem ($\beta = 1$)

Back

- Household problem characterized by five state variables
  - Let $x_t = \{b_t, m_t, y_t, r_t^m, r_t\}$

- Households have CRRA utility over consumption $u'(c) = c^{-\gamma}$

- Value function $v(x_0)$ for exponential ($\beta = 1$) agent:

$$v(x_0) = \max_{\{c_t\},\tau} \mathbb{E}_0 \int_0^\tau e^{-\rho t} u(c_t) dt + e^{-\rho\tau} v^*(x_\tau), \text{ where}$$

$$v^*(x_t) = \max_{b',m'} \; v(b', m', y_t, r_t^{m'}, r_t) \text{ and } b' - m' = b_t - m_t - \kappa$$

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Details: HJB Quasi-Variational Inequality

Back

$$
\begin{aligned}
\min \Bigg\{ & \rho v(x) - \max_{c} \{ u(c) + \partial_b v(x)(y_t + r_t b_t + \omega^{cc} b_t^- - (r_t^m + \xi) m_t - c_t) \\
& - \partial_m v(x)(\xi m_t) \\
& + \sum_{y' \neq y_t} \lambda^{y'} \left[v(b_t, m_t, y', r_t, r_t^m) - v(b_t, m_t, y_t, r_t, r_t^m) \right] \\
& + \sum_{r' \neq r_t} \lambda^{r'} \left[v(b_t, m_t, y_t, r', r_t^m) - v(b_t, m_t, y_t, r_t, r_t^m) \right] \\
& + \lambda^R \left[v^R(x) - v(x) \right] \\
& + \lambda^F \left[v^*(x) - v(x) \right] \}, \\
& v(x) - v^*(x) \Bigg\} \\
& = 0
\end{aligned}
$$

Model: Other Structural Assumptions

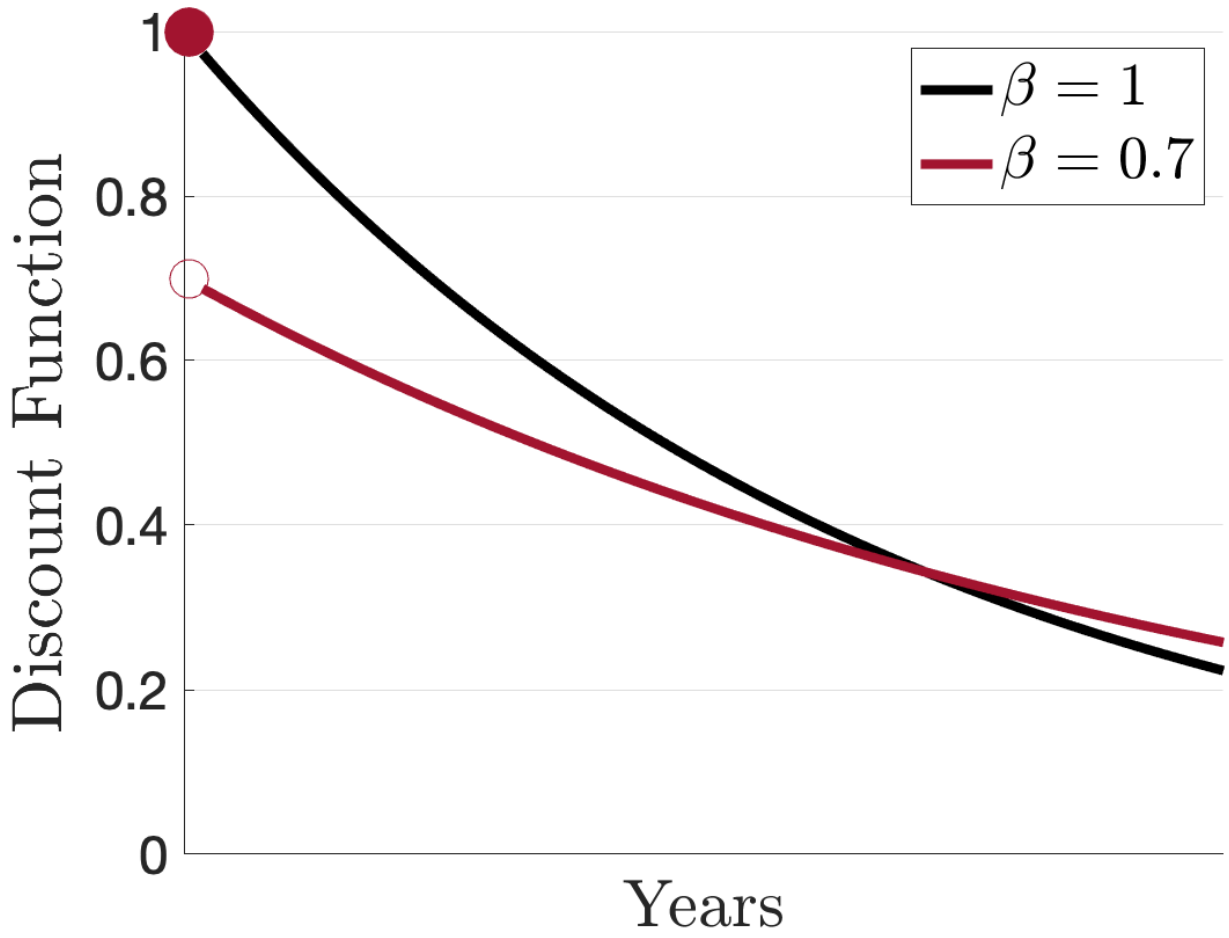
Back

- Blanchard-Yaari retirement at rate λ^R
  - Retirement value of $v^R(b,m) = \frac{u(y_L+\bar{r}(h-m+b))}{\rho}$
  - Replaced by households with $m_t = \theta h$ and $b_t \sim U[0, y_L]$

- Forced refinancing at rate λ^F
  - Captures various reasons for mortgage pre-payment (e.g., moving)
  - Assume households refinance optimally when forced

Model: Time Preferences

Back



Model: Naive Present Bias and Consumption

Back

- In discrete-time, current-value function given by (no adjustment):

$$w(x_0) = \max_c \; u(c)\Delta + \beta e^{-\rho\Delta} v(x_\Delta)$$

  - Note: $v(x)$ is *expected* value function for $\beta = 1$ (naivete)

- Taking $\Delta \to 0$ gives present-biased FOC:

$$\frac{\partial u(c)}{\partial c} = \beta \frac{\partial v}{\partial b}$$

(i.e., MU of consumption = MV of liquid wealth)

Model: Present Bias and Consumption

Back

- Notation: $x = (b, m, y, r^m, r, e)$
- Assumption: CRRA utility $\quad u'(c) = c^{-\gamma}$

Proposition (Present Bias and Consumption)

Consumption obeys Euler equation:

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

Model: Naive Present Bias and Refinancing

Back

- Current-value function for naive present-biased agent (no effort costs):

$$w(x_0) = \max\left\{ \max_c \; u(c)\Delta + \beta e^{-\rho\Delta} v(x_\Delta), \quad w^*(x_0) \right\},$$

where $w^*(x_0)$ is current-value after refinancing optimally

  - Note: $v(x)$ is *expected* value function for $\beta = 1$ (naivete)

- (Outer max) Taking $\Delta \to 0$, refinancing decision independent of β:

$$\max\left\{ \max_c \; u(c)\Delta + \beta v(x_\Delta), \quad \max_c \; u(c)\Delta + \beta v(x^*_\Delta) \right\}$$

Refinancing Decisions: (i) which x to refi; (ii) reallocation across b, m

Model: Naive Present Bias and Refinancing

Back

- Notation: $x = (b, m, y, r^m, r, e)$
- $\mathfrak{R} : x \to \{0, 1\}$ denotes mortgage adjustment (No/Yes)
- $m' : x \to [0, \theta h]$ denotes new mortgage conditional on adjustment
- $b' : x \to [\underline{b}, \infty)$ denotes new liq. wealth conditional on adjustment

Proposition (Present Bias and Refinancing)

1. *$m'(x)$ and $b'(x)$ are independent of β*
2. (a) *For $e = 0$, $\mathfrak{R}(x)$ is independent of β*
   (b) *For $e > 0$, $\mathfrak{R}(x) = 0$ if $\beta < 1$*

Model: Short Time-Steps and Refinancing

Back

- Why does refinancing only affect future selves?

  Three Intuitions:

  1. Delays to refinancing mean current self won't get cash
  2. Better to put "one-day splurge" on credit card (unless at $\underline{b}$)
  3. At 1-day frequency, overconsume $\sim$ \$100 (or \$36,500 per year!)
     Not going to pay $\kappa^{refi} \approx \$5,000$ in future to consume extra \$100 today

- Formally only need intuition #3, but others help

Externally Calibrated Parameters

Back

	Description	Value	Target / Source
Preferences			
γ	Risk Aversion	2	Literature
ϕ	Procrastination Decay Rate	$-\log(0.5)$	Andersen et al. (2020)
Income			
y_t	Transitory Income	$\{0.75, 0.98, 1.28\}$	Guerrieri and Lorenzoni (2017)
A^y	Income Transition Matrix	(see paper)	Guerrieri and Lorenzoni (2017)
Interest Rates			
r_t	Short Rate	$\{-1\%, 0\%, 1\%, 2\%\}$	10-Year TIPS
A^r	Short Rate Transition Matrix	(see paper)	10-Year TIPS
ω^{cc}	Credit Card Wedge	10.3%	Credit Card - 10-Yr Treasury Spread
ω^m	Mortgage Wedge	1.7%	30-Yr FRM - 10-Yr Treasury Spread
Assets and Liabilities			
h	House Value	3.1	2016 SCF
θ	Max LTV	0.8	Greenwald (2018)
ξ	Mortgage Paydown	0.035	20 Year Half-Life
κ^{prepay}	Prepayment Fixed Cost	0.002	Numerical Stability
κ^{refi}	Refi Fixed Cost	0.05	FRB Documentation
$\underline{b}$	Credit Limit	$-\frac{1}{3}$	2016 SCF
Other Structural Assumptions			
λ^F	Rate of Forced Refi	$\frac{1}{15}$	2016 CPS Avg. Moving Rate
λ^R	Retirement Rate	$\frac{1}{30}$	Average Working Life
-	Birth Distribution	$m_0 = \theta h, b_0 \sim U(0, y_L)$	Lifecycle Dynamics

Calibration: SCF Details

Back

- 2016 SCF wave used to calibrate household wealth accumulation
  - Illiquid wealth (LTV) identifies ρ
  - Liquid credit card debt identifies β

- Sample restrictions to align data with model:
  - Head in labor force, aged 25-66, owns a home, possesses credit card
  - Home value to income ratio between the 25th and 75th percentile
  - Credit card borrowing adjusted by a factor of 1.5 due to underreporting (see Zinman (2015) and Beshears et al. (2019, Appendix C))

- Calculate LTV and credit card debt to permanent income
  - Use reported "normal income" as measure of permanent income

Internally Calibrated Parameters: Discount Rates

Back

- Calibrate discount function to match empirical wealth moments
- Using 2016 SCF wave of homeowners:
  - Calibrate ρ to match average LTV
  - Calibrate β to match average credit card debt to income ratio

	Data	**Exponential Benchmark**	Intermediate Case	**Present-Bias Benchmark**
Discount Function				
β	-	1	0.70	0.83
ρ	-	1.47%	0.64%	0.97%
Calibration Targets				
LTV	0.54	**0.54**	**0.54**	**0.54**
Avg. C.C. Debt	0.09	0.03	**0.09**	**0.09**
Share C.C. Debt > 0	60%	26%	52%	47%

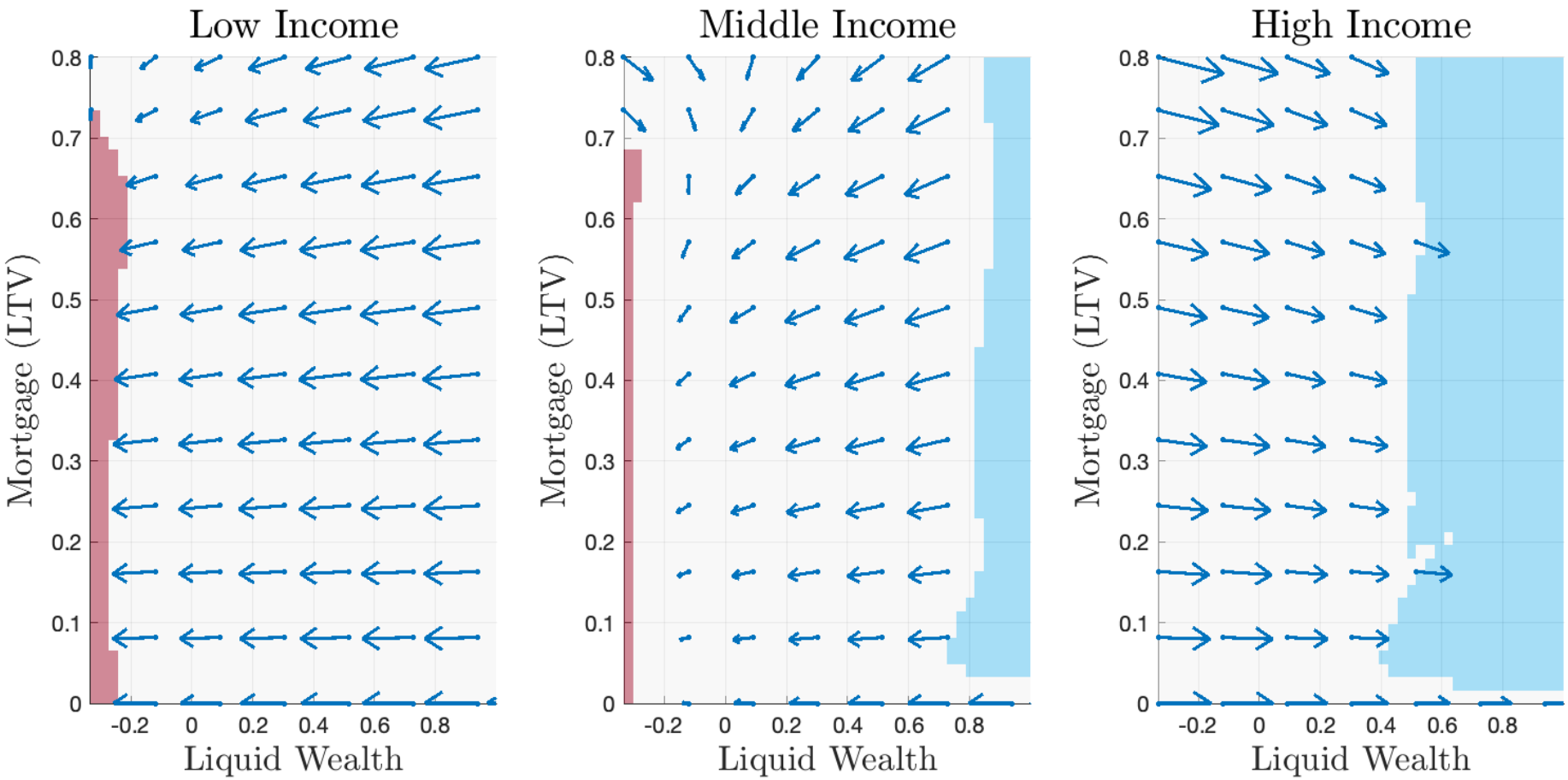
Model Steady State

Back

	Exponential	Intermediate	Present Bias
Avg. c	0.93	0.92	0.93
(y_L, y_M, y_H)	(0.84, 0.93, 1.02)	(0.83, 0.93, 1.01)	(0.81, 0.94, 1.03)
Avg. Quarterly MPC ($1,000)	4.3%	8.5%	12.5%
(y_L, y_M, y_H)	(5.2, 5.3, 2.3)	(14.8, 8.5, 2.1)	(25.8, 9.8, 2.5)
Avg. Quarterly MPC ($10,000)	4.2%	6.2%	8.7%
(y_L, y_M, y_H)	(5.2, 5.0, 2.1)	(10.6, 6.2, 1.8)	(17.5, 6.7, 2.2)
Avg. Quarterly MPX ($1,000)	13.7%	23.9%	31.7%
Avg. Quarterly MPX ($10,000)	13.2%	19.3%	26.2%
Share $b = 0$	5.9%	6.3%	4.7%
Share $b < 0$	25.8%	52.2%	46.9%
Share $b = \underline{b}$	0.2%	9.3%	13.1%

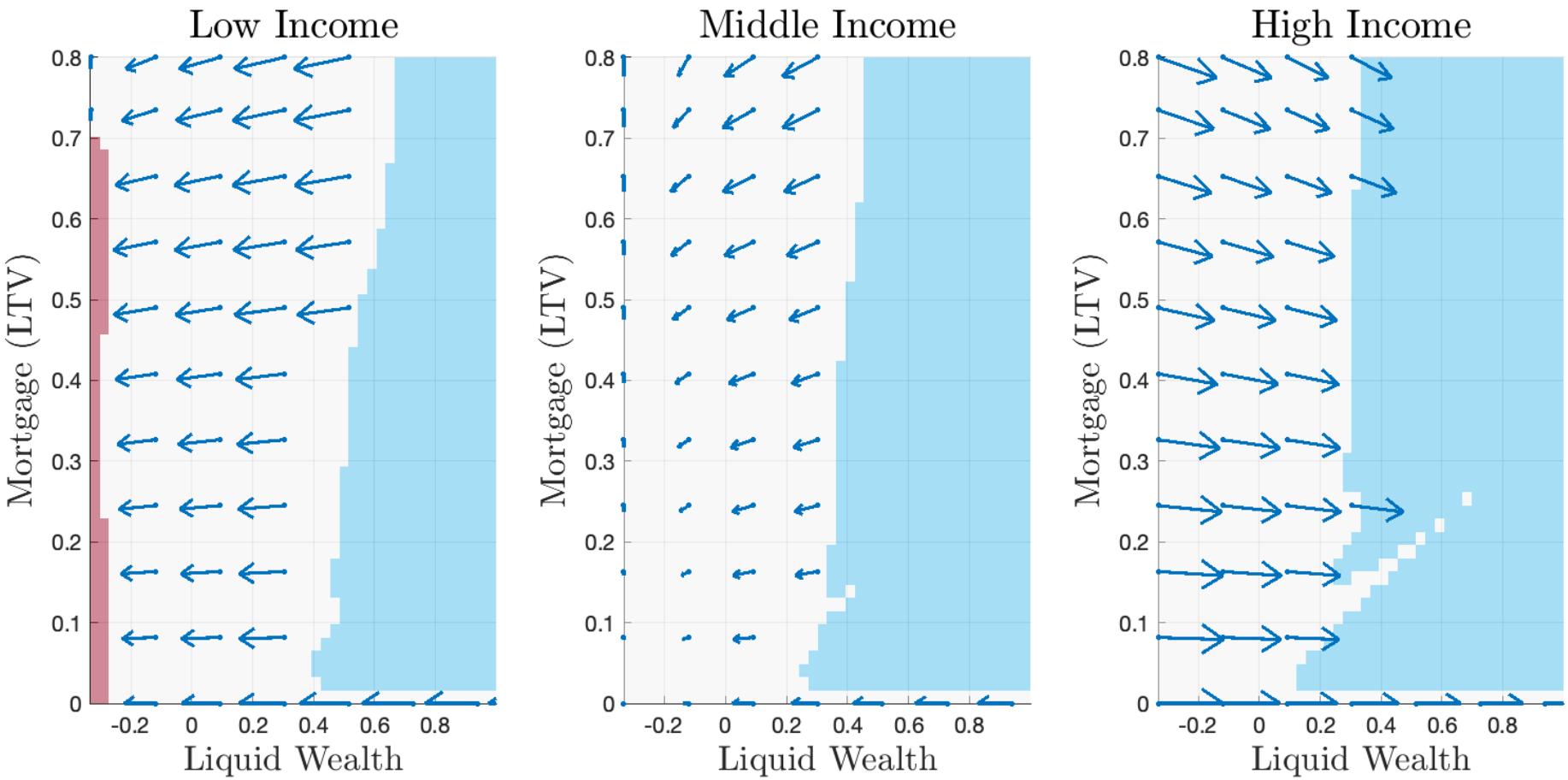
Steady State: Phase Diagram ($\beta = 1$)

Back



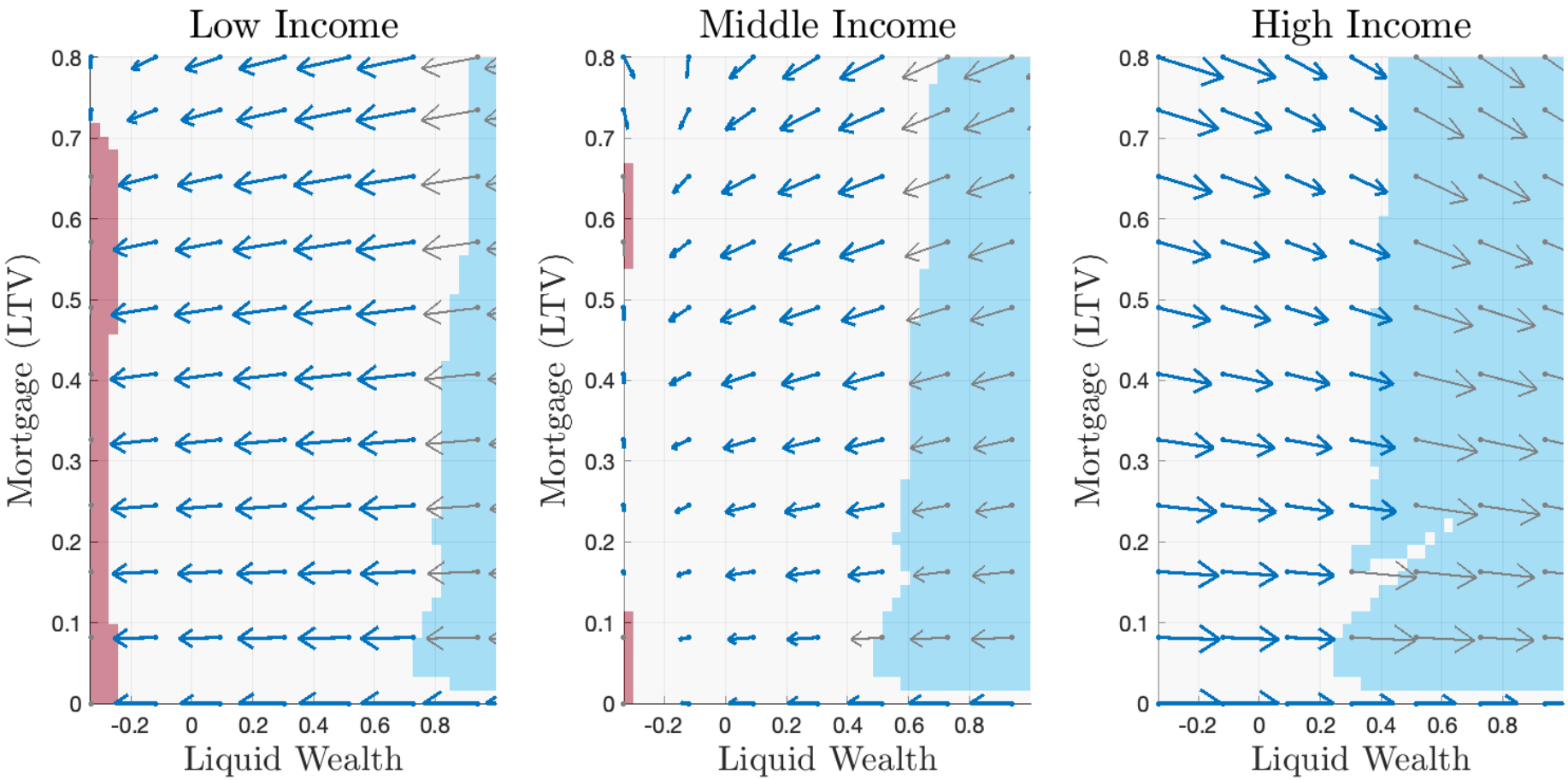
Steady State: Phase Diagram (Intermediate)

Back



Steady State: Phase Diagram (Present Bias)

Back



Aside: Present Bias and Refinancing

Back

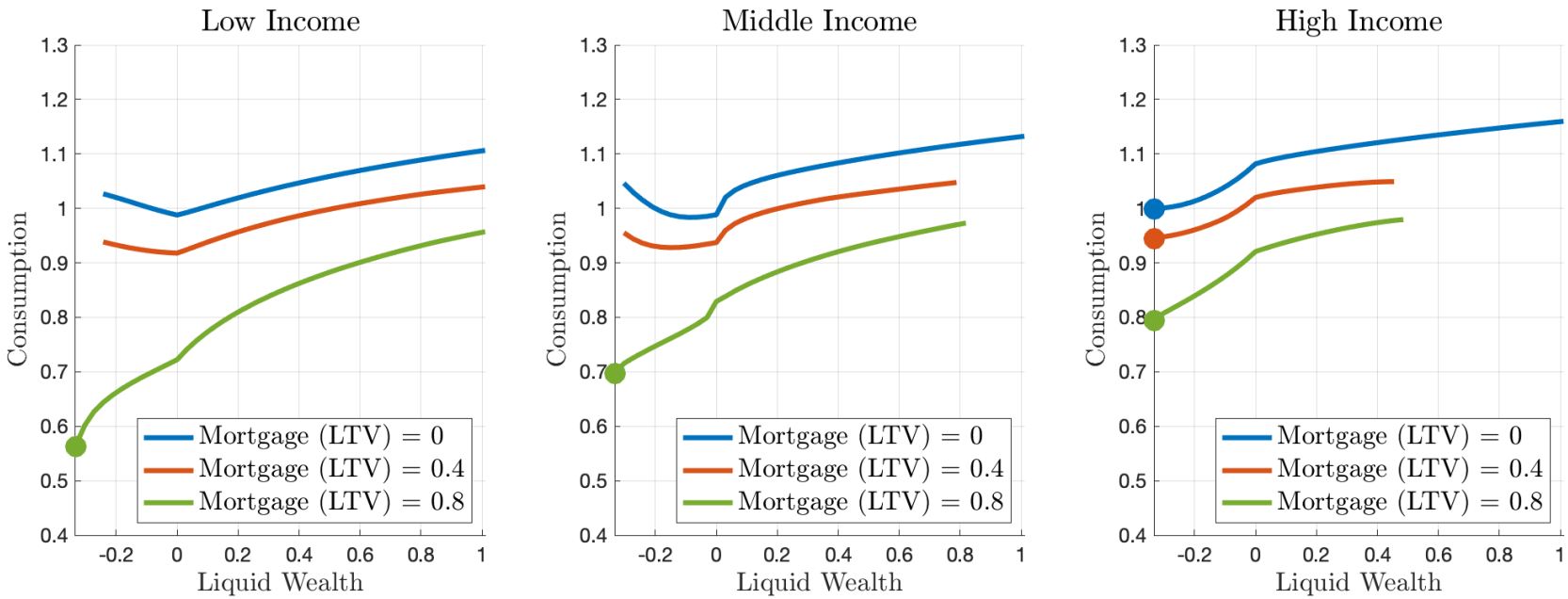
- There's an informal intuition floating around that present bias incentivizes households to extract equity from their homes in order to finance short-term consumption

- Does present bias incentivize home-equity extraction?

- Model shows that it's complicated:
  - $-$ Conditional on x, the refinancing region depends on ρ but not β
  - $-$ Procrastination slows down refinancing
  - $+$ Present bias generates credit card debt, incentivizing cash-out refis

Steady State: Consumption ($\beta = 1$)

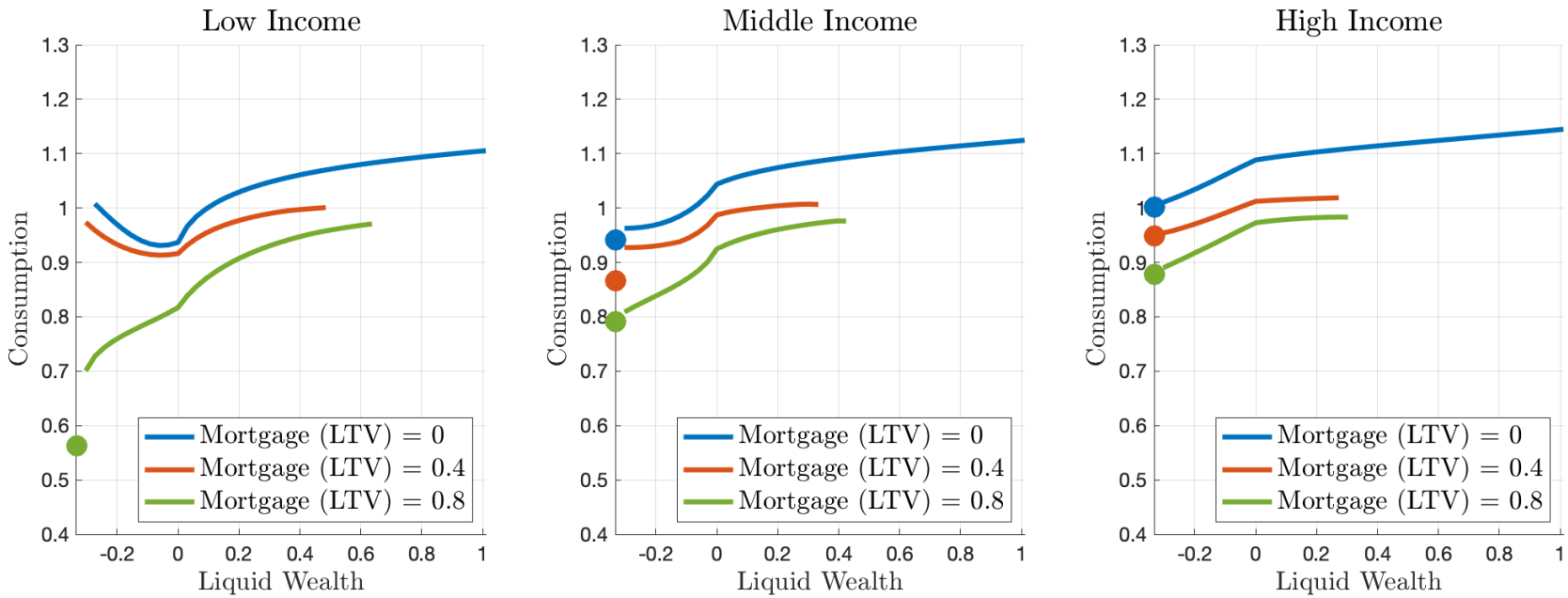
Back



- Large MPCs at soft constraint ($b = 0$) for middle income households

Steady State: Consumption (Intermediate)

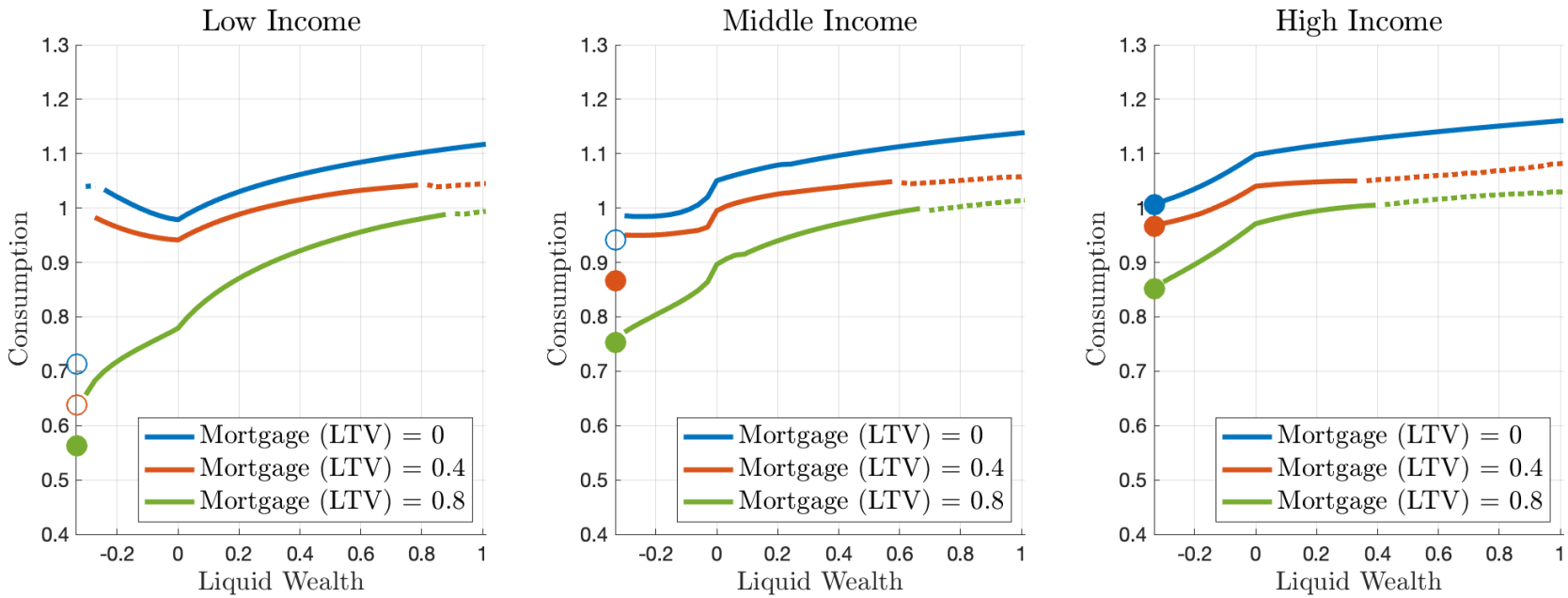
Back



- **Consumption discontinuity** at $\underline{b}$ for low and middle income households

Steady State: Consumption (Present Bias)

Back

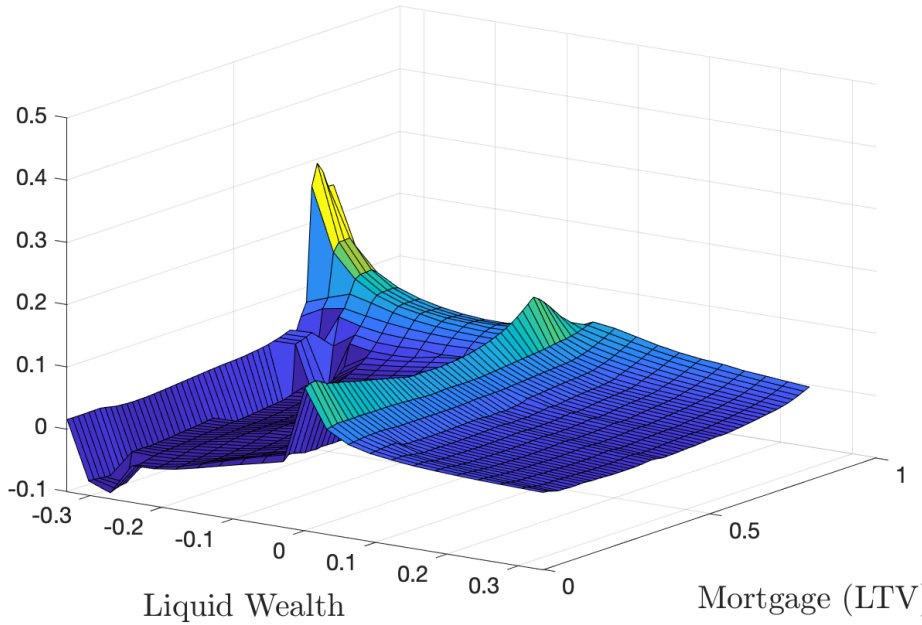


- **Consumption discontinuity** at $\underline{b}$ for low and middle income households

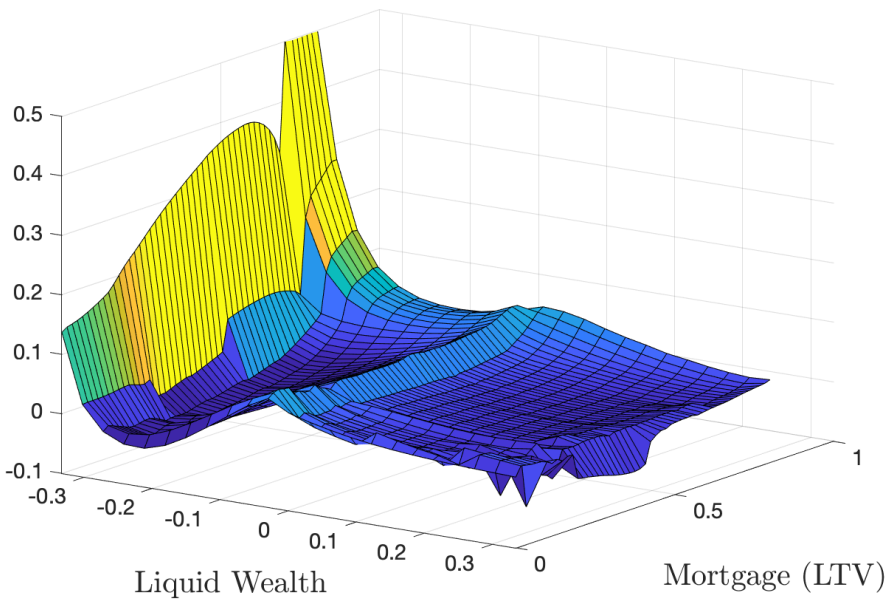
Model Steady State: Quarterly MPCs

Back

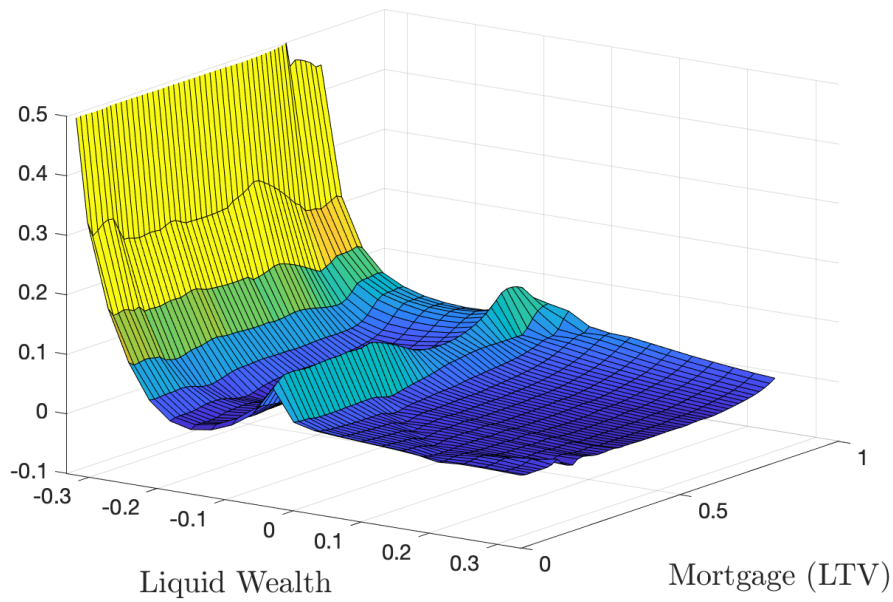
$\beta = 1$



$\beta < 1,\ NP$

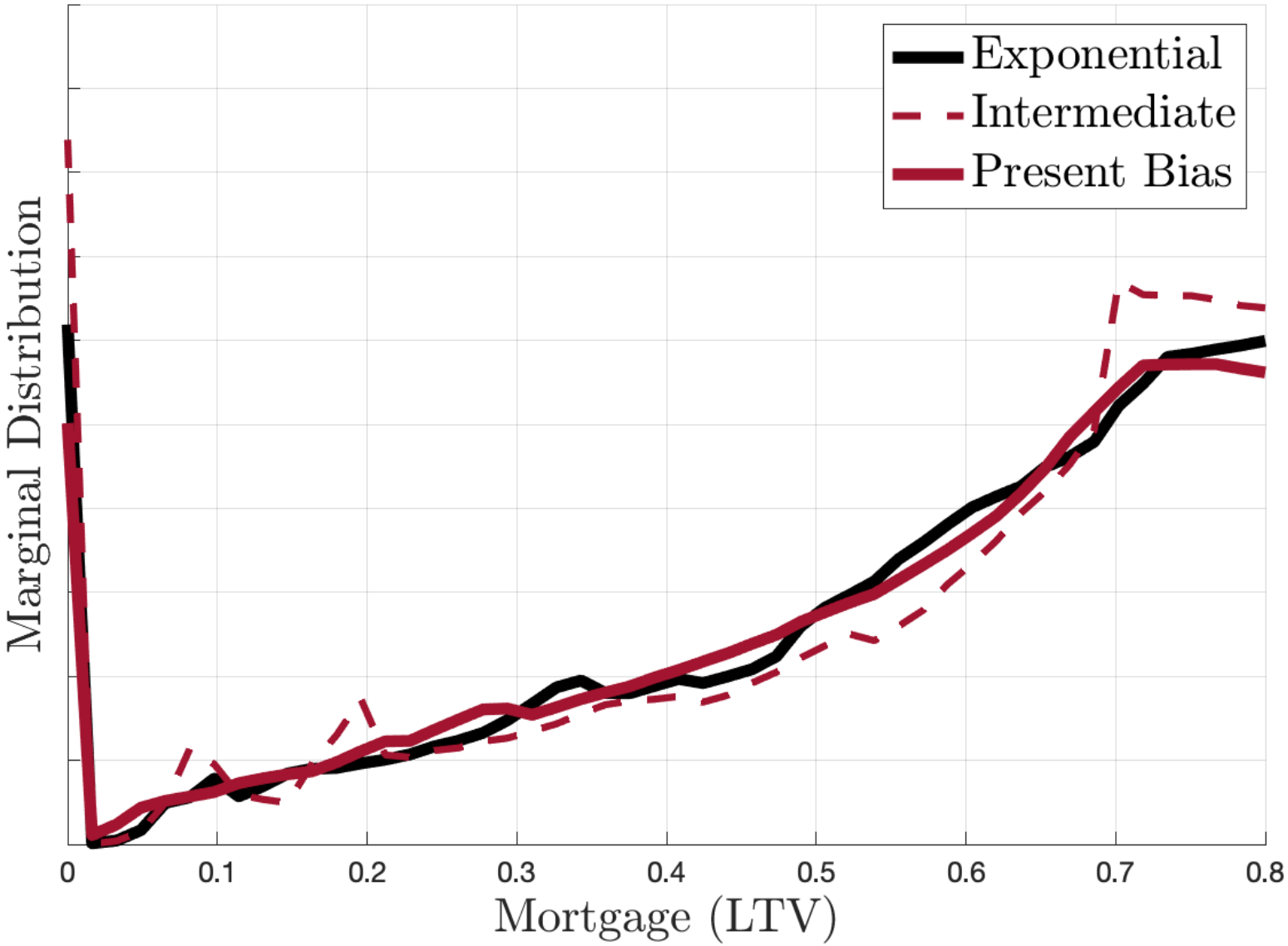


$\beta < 1,\ P$



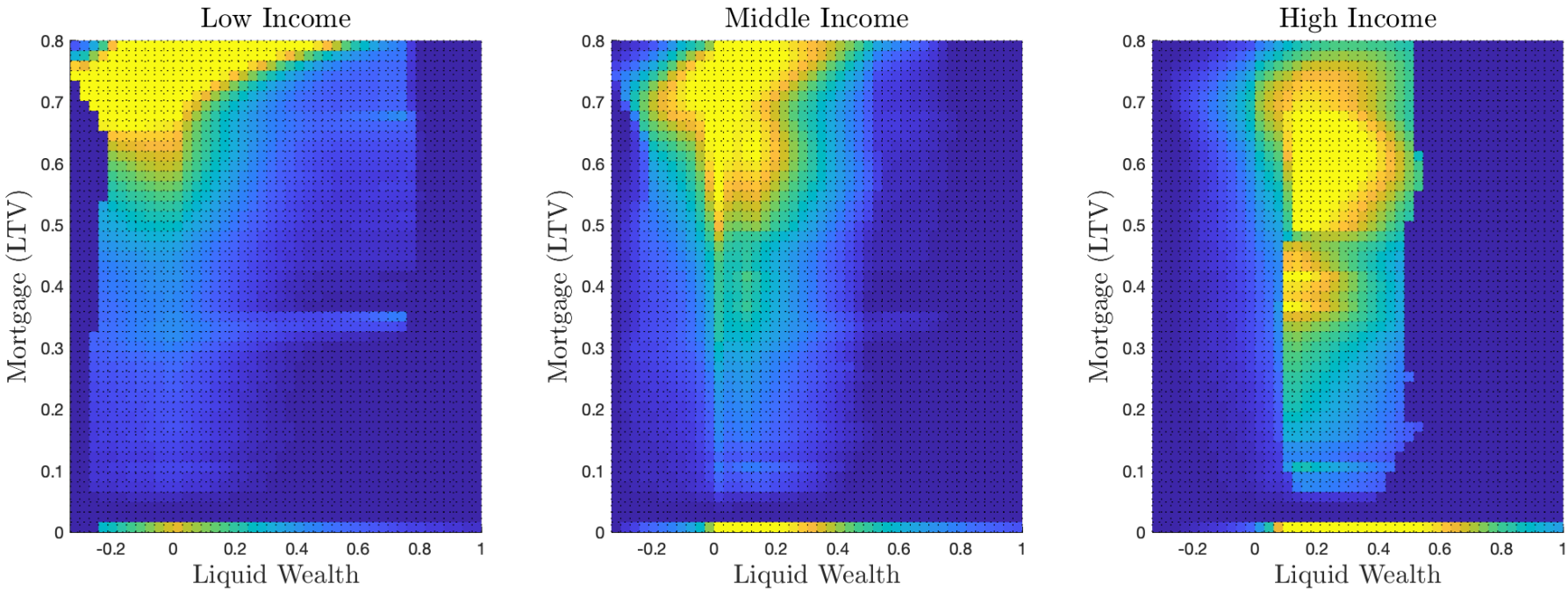
Model Steady State: Stationary Distribution

Back



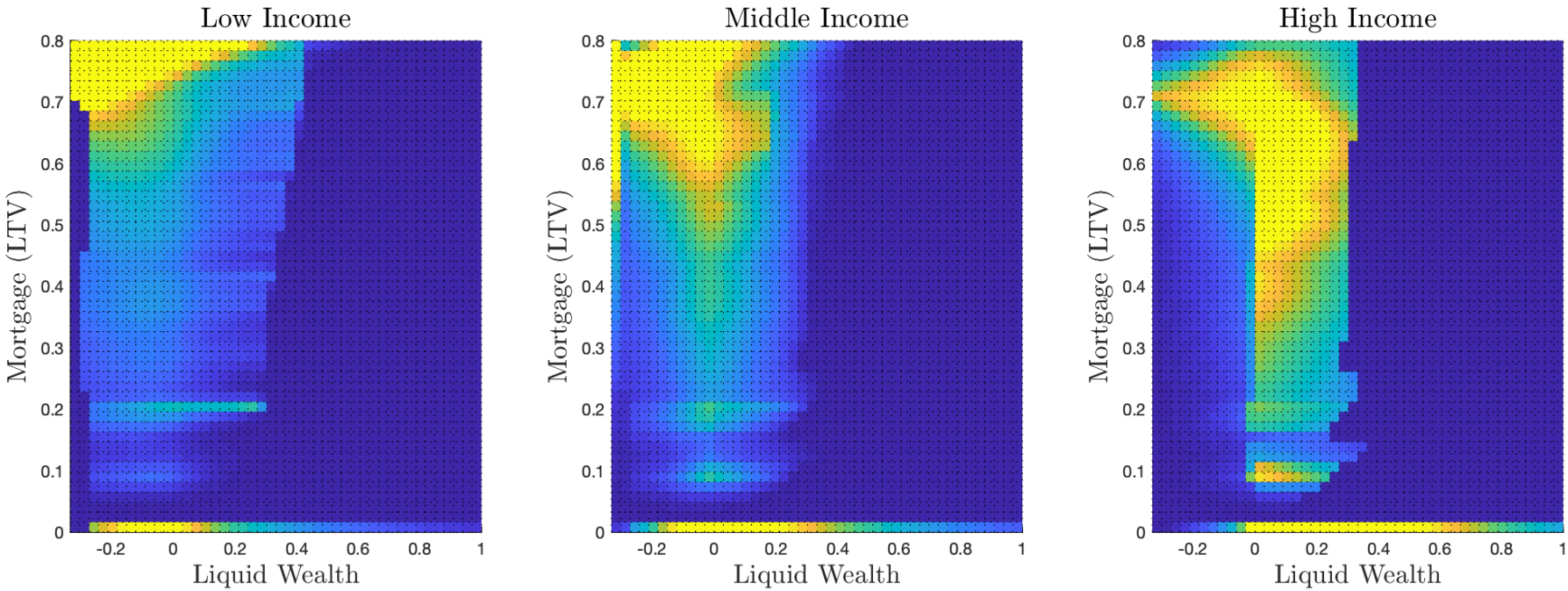
Steady State: Stationary Dist. ($\beta = 1$)

Back



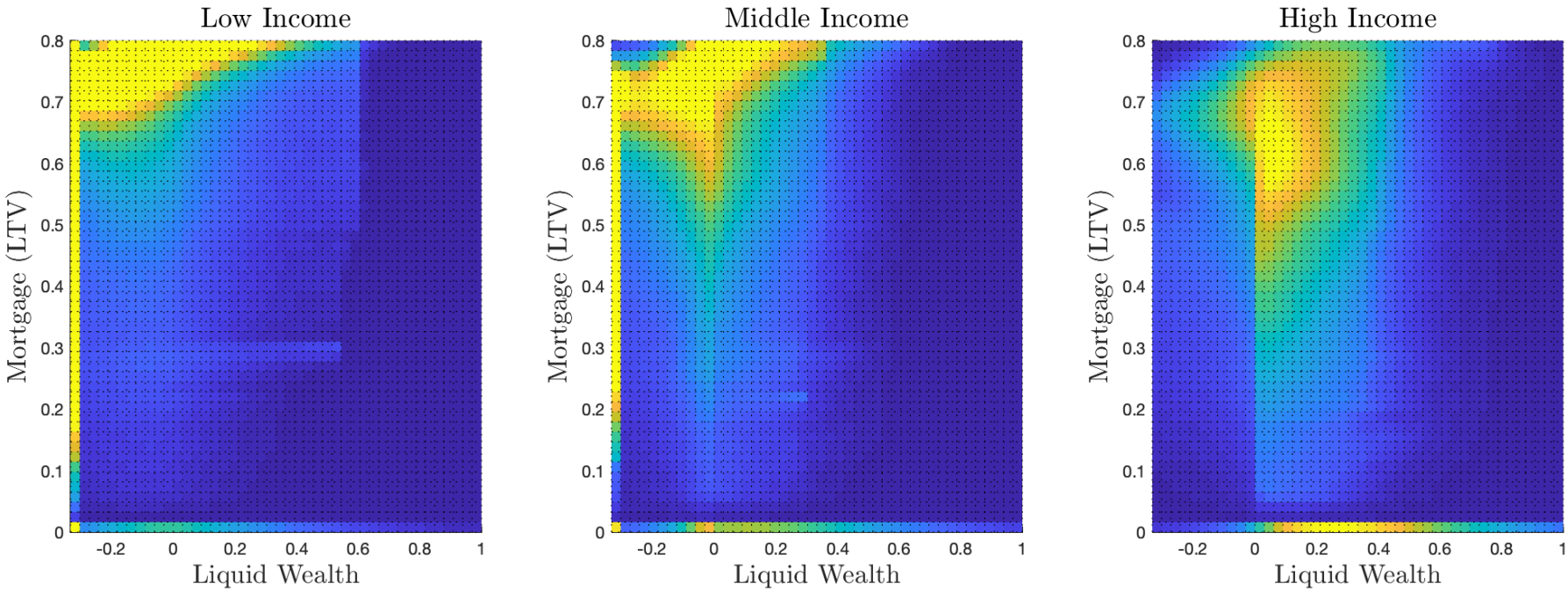
Steady State: Stationary Dist. (Intermediate)

Back



Steady State: Stationary Dist. (Present Bias)

Back



Fiscal Policy: Consumption IRF Explanation

Back

- τ-year MPC = integral of Consumption IRF from 0 to τ
  - Consumption IRF at point x:

$$IRF_t(x) = \frac{\partial}{\partial b}\mathbb{E}\left[c(x_t)|x_0 = x\right]$$

  - MPC at point x:

$$\begin{aligned} MPC_\tau(x) &= \frac{\partial}{\partial b}\mathbb{E}\left[\int_0^\tau c(x_t)dt|x_0 = x\right] \\ &= \int_0^\tau IRF_t(x)dt \end{aligned}$$

Fiscal Policy: Household MPCs

Back

$1000 MPCs

	Exponential	Intermediate	Present Bias
$\frac{1}{4}$ Year MPC	4%	9%	13%
1 Year MPC	15%	22%	28%
2 Year MPC	26%	34%	41%
3 Year MPC	35%	42%	49%

- Note: τ-year MPC is integral of Consumption IRF from 0 to τ

Fiscal Policy: Household MPCs

Back

\$1000 MPCs and MPXs

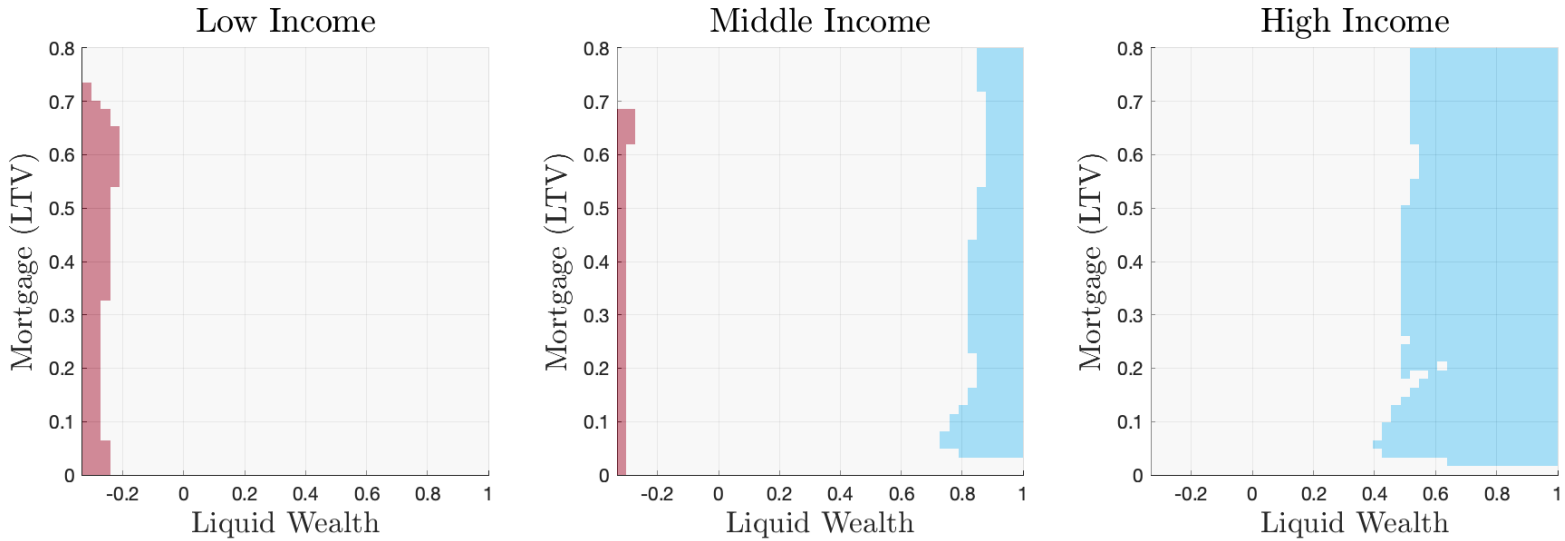
	Exponential	Intermediate	Present Bias
$\frac{1}{4}$ Year MPC	4%	9%	13%
1 Year MPC	15%	22%	28%
2 Year MPC	26%	34%	41%
3 Year MPC	35%	42%	49%
$\frac{1}{4}$ Year MPX	14%	24%	32%
1 Year MPX	22%	30%	37%
2 Year MPX	31%	39%	46%
3 Year MPX	39%	46%	53%

- Note: τ-year MPC is integral of Consumption IRF from 0 to τ

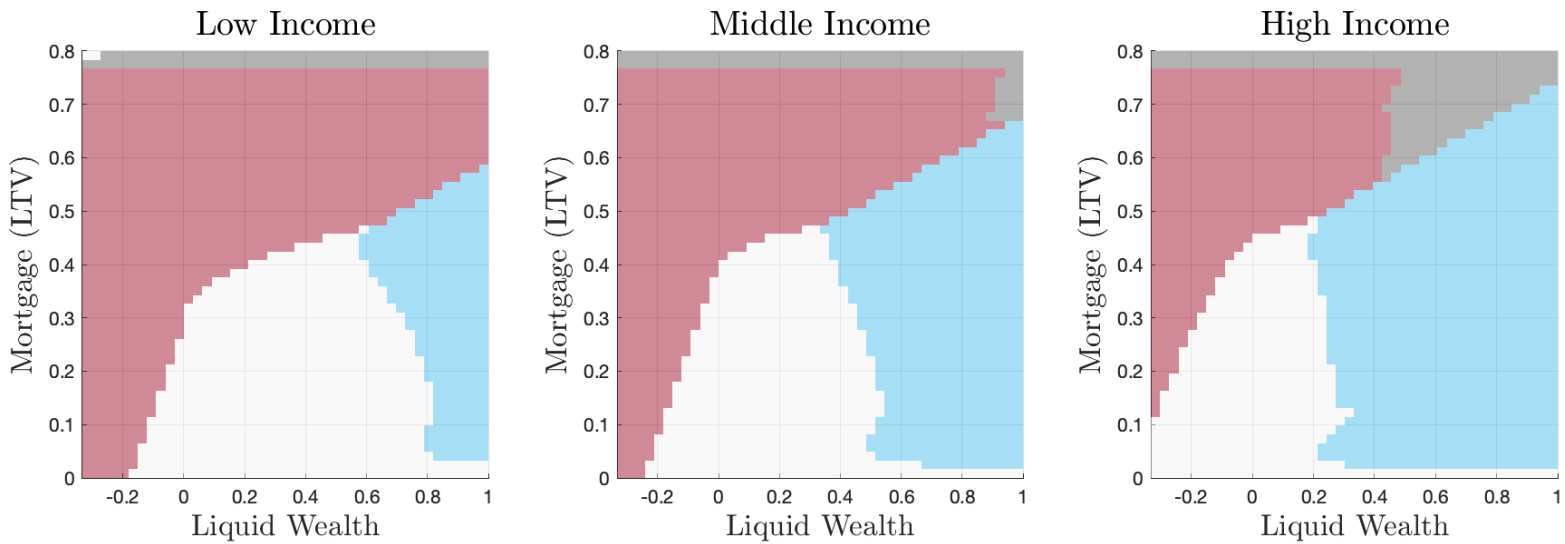
Monetary Policy: Refinancing ($\beta = 1$)

Back

- Steady State: $r_t = 1\%$ and $r_t^m = 1\% + \omega^m$ ▸ Intermediate ▸ Present Bias



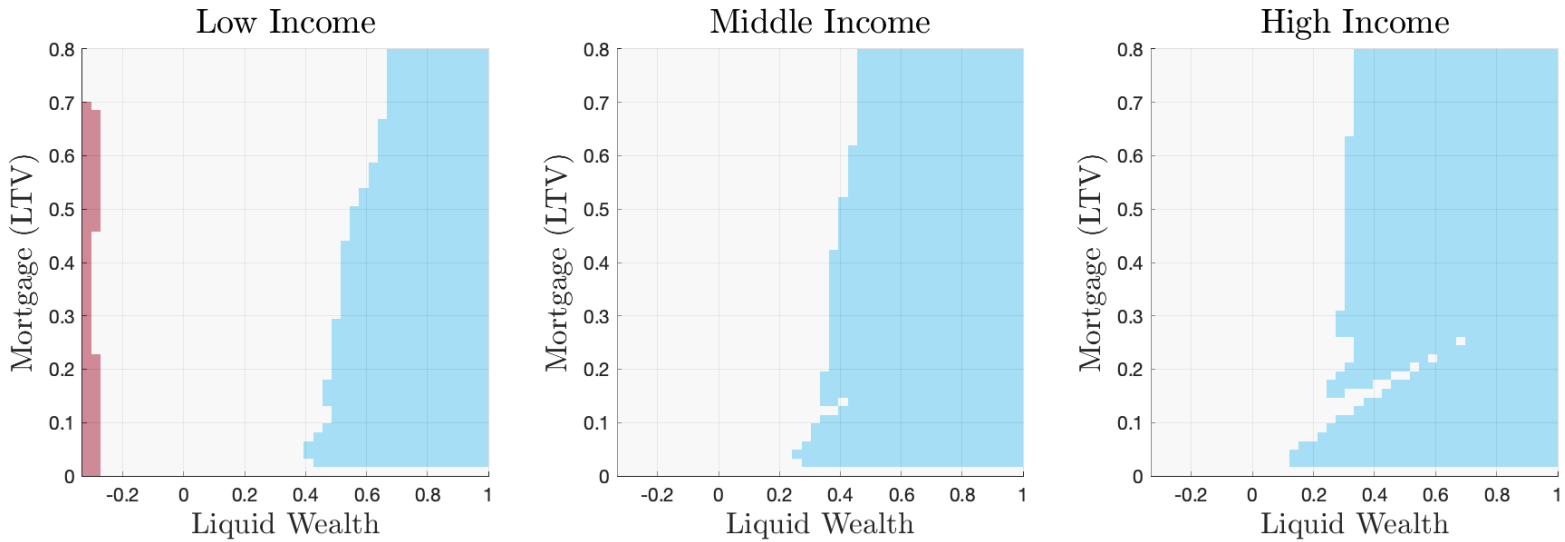
- Interest Rate Cut: $r_t = 0\%$ and $r_t^m = 1\% + \omega^m$



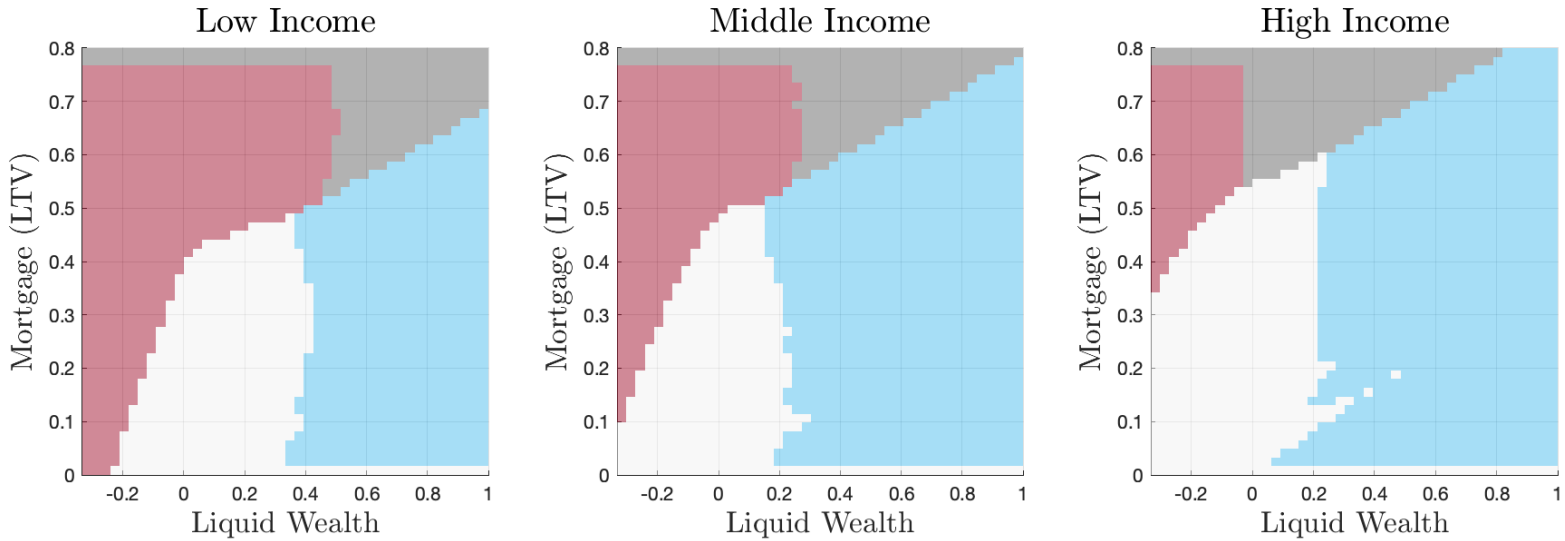
Monetary Policy: Refinancing (Intermediate)

Back

- Steady State: $r_t = 1\%$ and $r_t^m = 1\% + \omega^m$



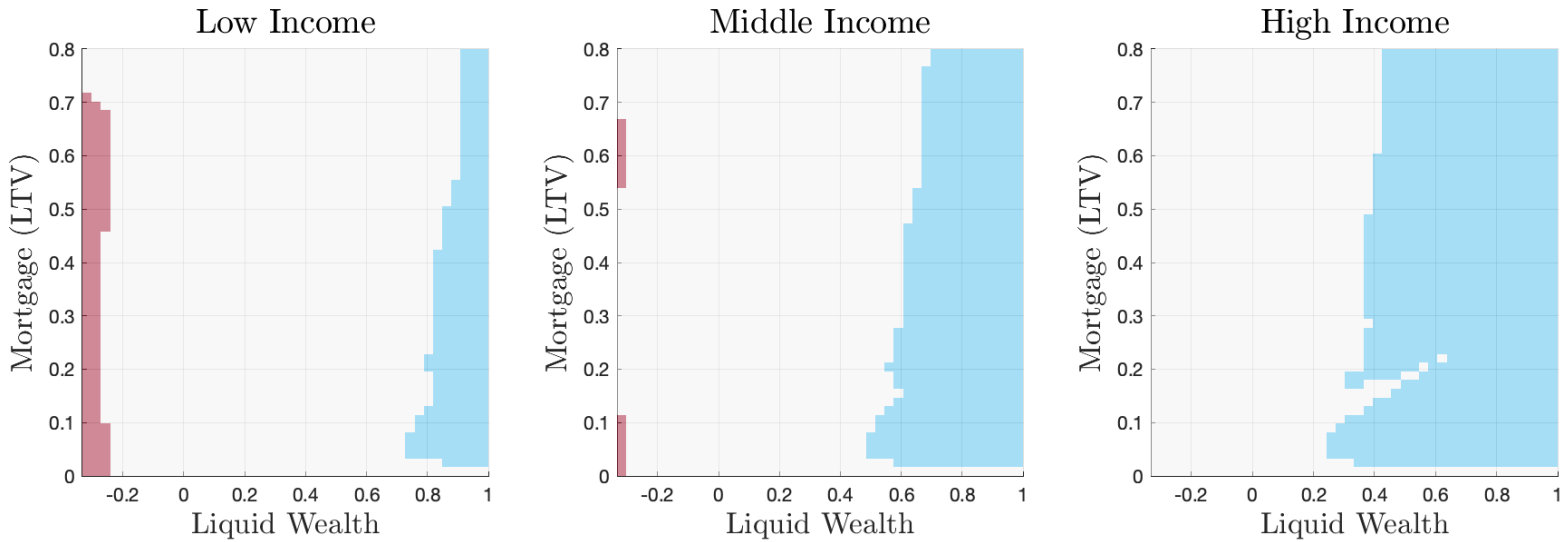
- Interest Rate Cut: $r_t = 0\%$ and $r_t^m = 1\% + \omega^m$



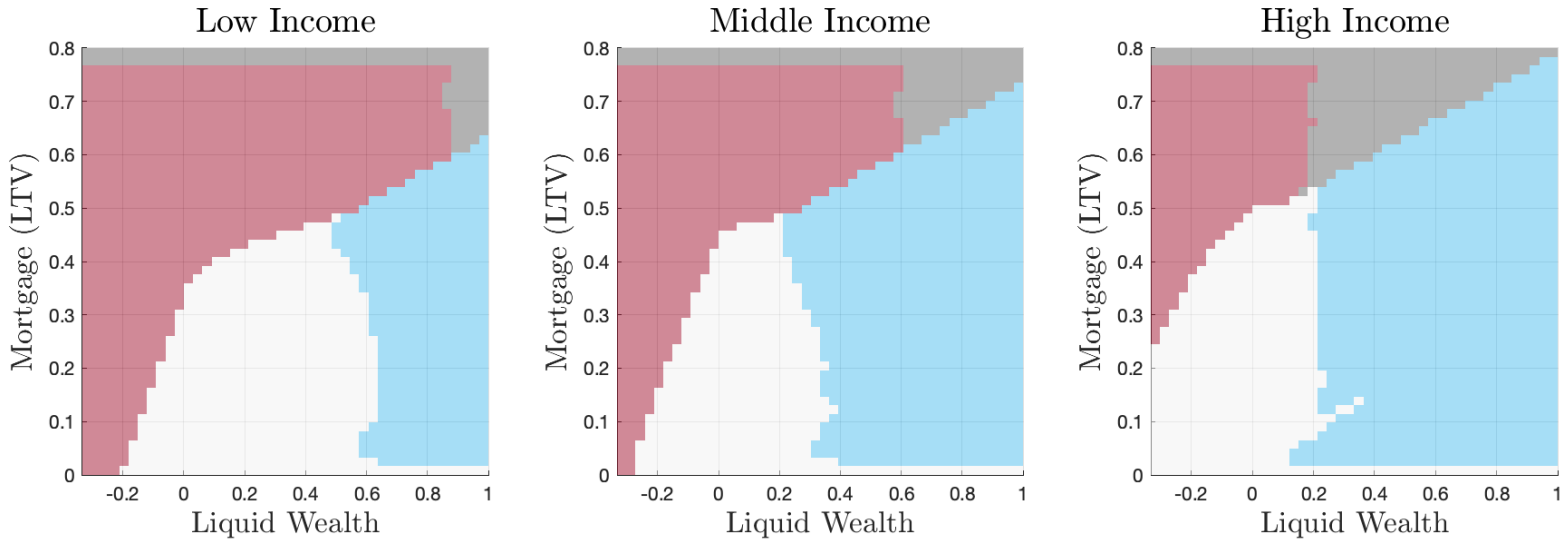
Monetary Policy: Refinancing (Present Bias)

Back

- Steady State: $r_t = 1\%$ and $r_t^m = 1\% + \omega^m$



- Interest Rate Cut: $r_t = 0\%$ and $r_t^m = 1\% + \omega^m$



Monetary Policy: Refi Moments

Back

	Exponential	Intermediate	Present Bias
Share Refi Region (On Impact)	73.1%	68.5%	74.9%
(Share Cash Out)	81.0%	66.8%	77.3%
$\frac{1}{4}$ Year Realized Refi	75.2%	71.0%	13.6%
1 Year Realized Refi	80.0%	76.5%	42.0%
2 Year Realized Refi	84.5%	81.2%	62.7%
3 Year Realized Refi	87.8%	84.6%	74.3%
Average Refi Amount	0.31	0.17	0.29

Monetary Policy: Decomposition

Back

- Decompose on-impact consumption response into:
  1. Direct effect on liquid wealth (no refis allowed)
  2. 1 + rate-refis (no cash-out refis allowed)
  3. 1 + 2 + cash-outs (full model)

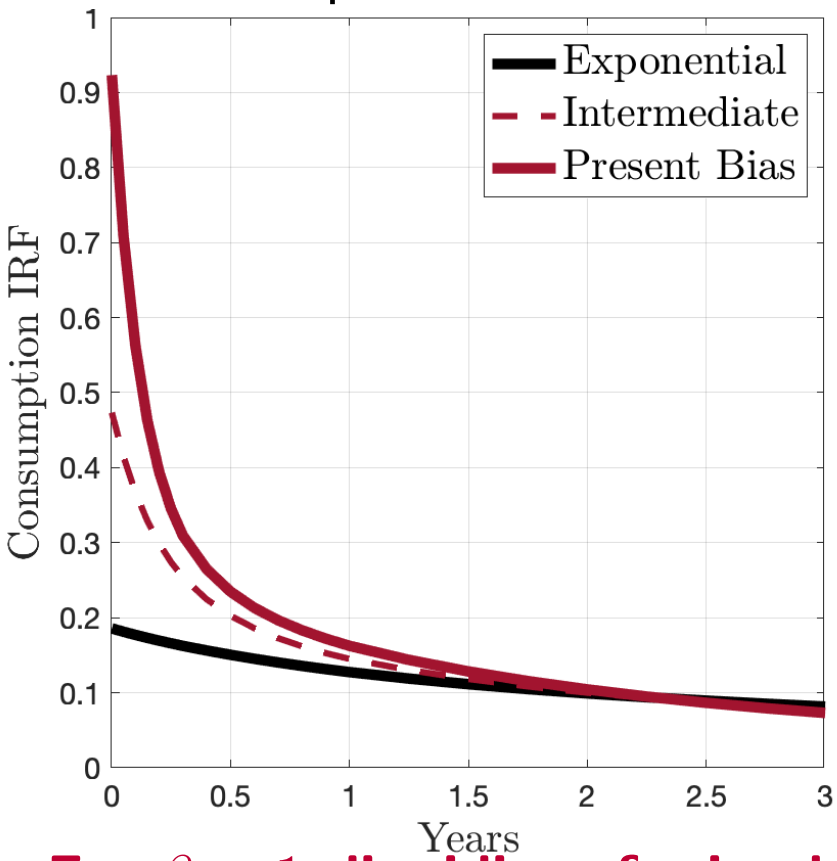
	Exponential	Intermediate	Present Bias
Step 1. No Refis	0.79 (21%)	0.89 (18%)	0.83 (23%)
Step 2. No Cash-Outs	1.74 (46%)	2.08 (41%)	1.81 (50%)
Step 3. Full Response	3.76 (100%)	5.03 (100%)	3.58 (100%)

Fiscal Policy: Liquid vs. Illiquid Stimulus

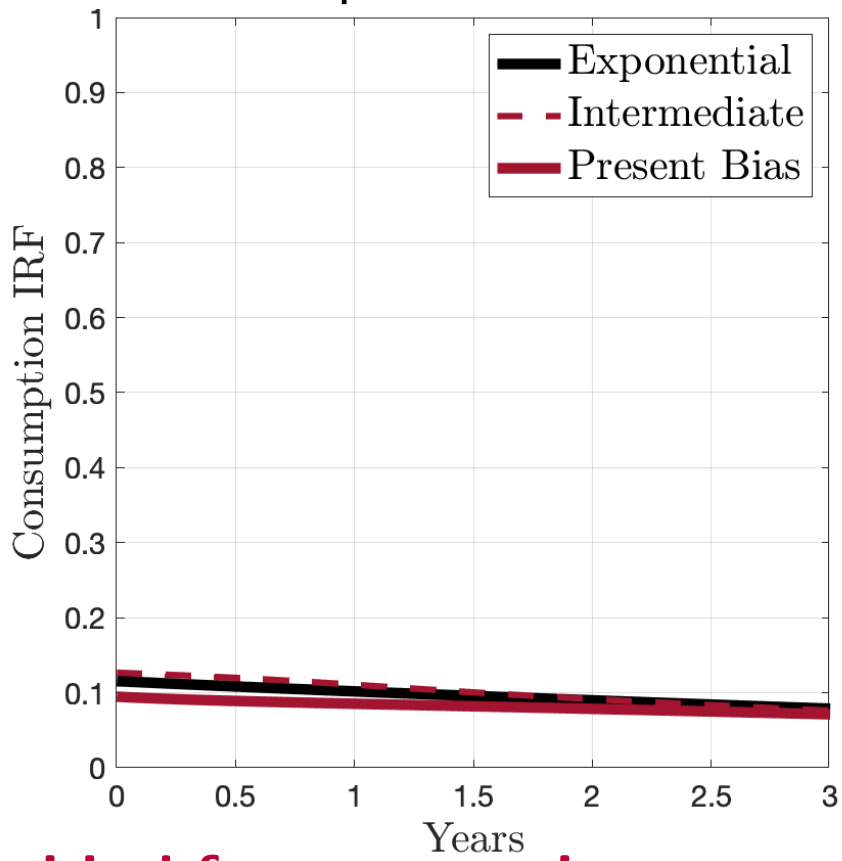
Back

- In response to 07-08 Financial Crisis, a combination of liquid and illiquid fiscal transfers were used (e.g., stimulus checks vs. mortgage reductions)

Liquid Transfer



Illiquid Transfer



- **For $\beta < 1$, liquidity of stimulus critical for consumption response**
  - High MPCs come from liquidity-constrained households

Theory: MPCs versus MPXs

Back

- In our model (as most others), focus on utility-generating consumption
  - Durables key differentiator between expenditure vs. consumption
- Empirical literature often estimates both
  - Expenditure used especially when imputing from balance-sheet data
- **Propose simple/general technology to bridge gap!**
  - Key: extension with durables that's **isomorphic** to benchmark model

Proposition (Marginal Propensity for Expenditure)

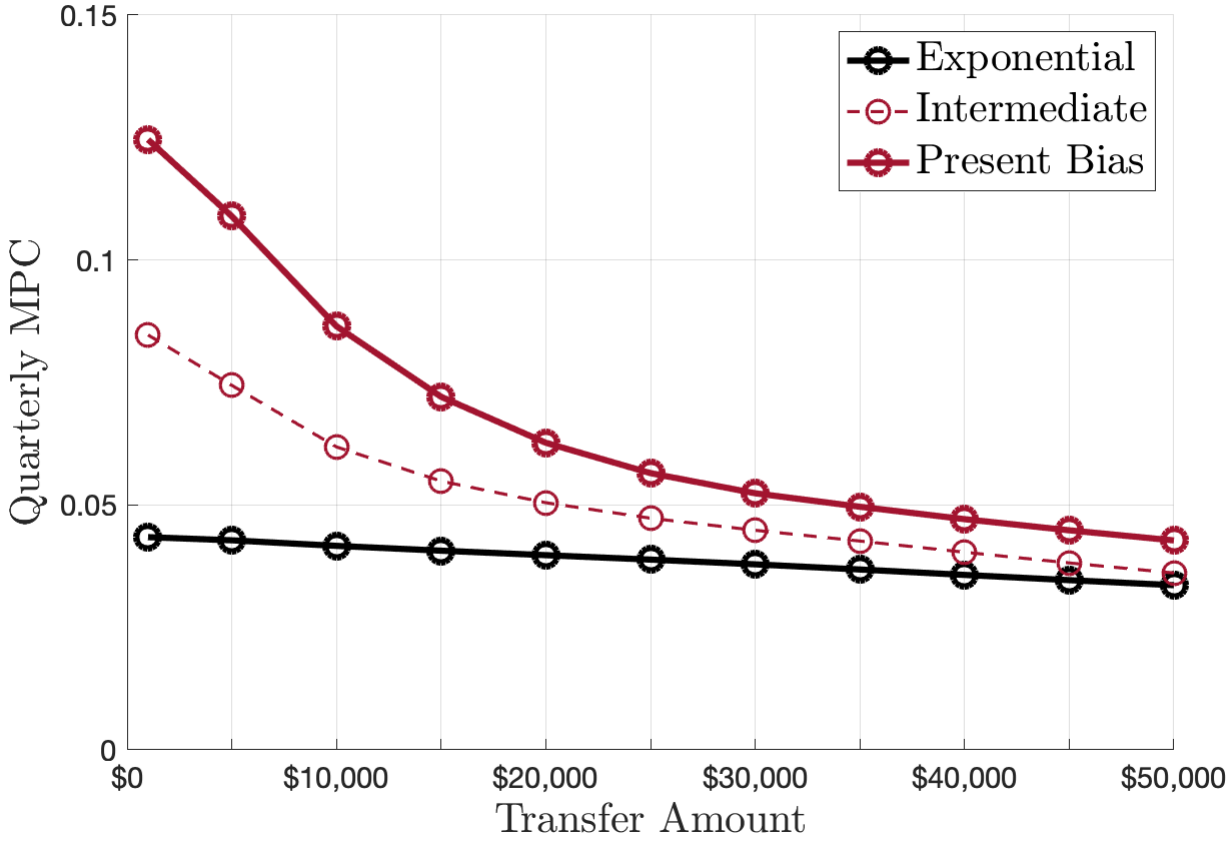
The Marginal Propensity for Expenditure (MPX) is given by:

$$MPX_\tau(x) = MPC_\tau(x) + \frac{s}{\nu + r_0} \times \frac{\partial}{\partial b}\mathbb{E}\left[c(x_\tau)|x_0 = x\right],$$

where s is durable share of consumption and ν is depreciation rate

Extension: Large $ Fiscal Policy

Back

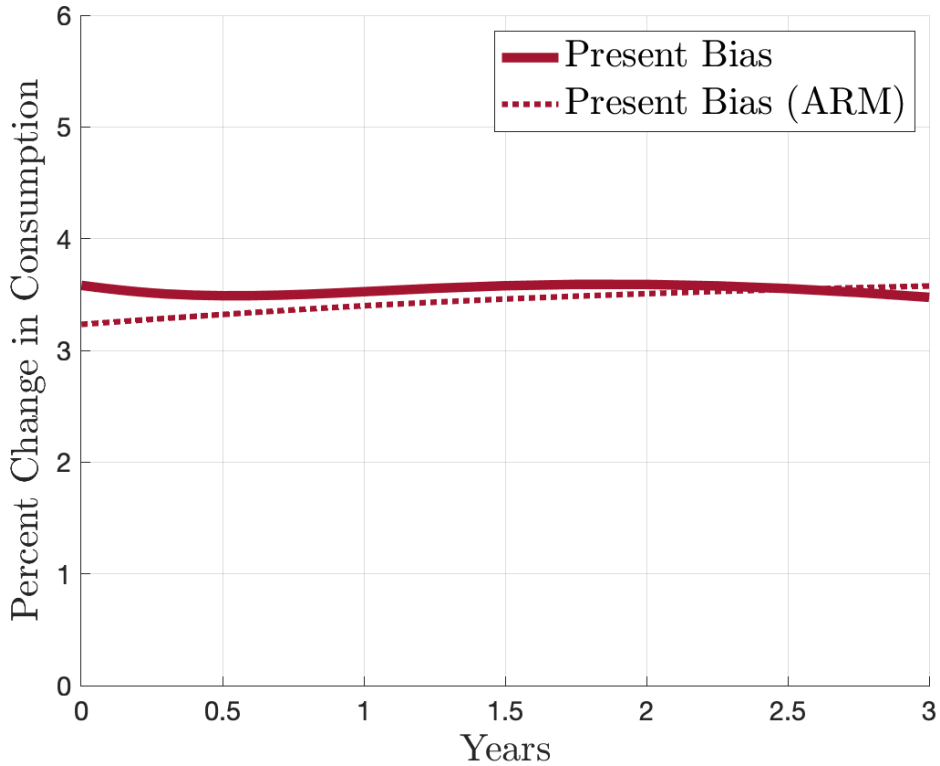


- **Even for large transfers, FP a powerful policy tool when $\beta < 1$**

Extension: A Call to ARMs?

Back

- Study monetary policy in ARM environment
  - Since 07-08 Crisis, economists have called for downwardly flexible mortgages (like ARMs) to improve potency of monetary policy

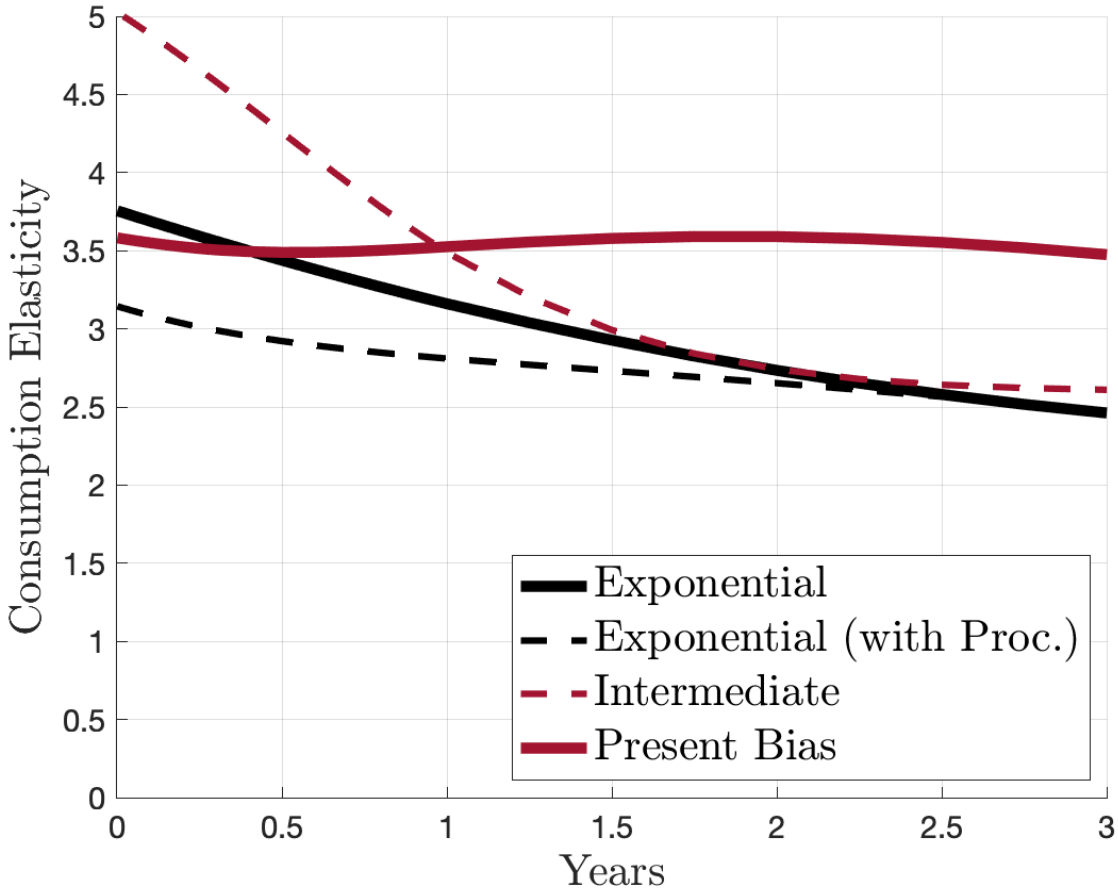


- **Present bias creates a tradeoff between FRMs and ARMs**
  - ARM Benefit: fast pass-through of policy to r^m (offsets procrastination)
  - ARM Cost: reduces cash-out channel of monetary policy
  - ARM=Fast+small stimulus to all; FRM=slow+large stimulus to some

Extension: Procrastination Sensitivity

Back

- Introduce procrastination to $\beta = 1$ case (dashed black line)

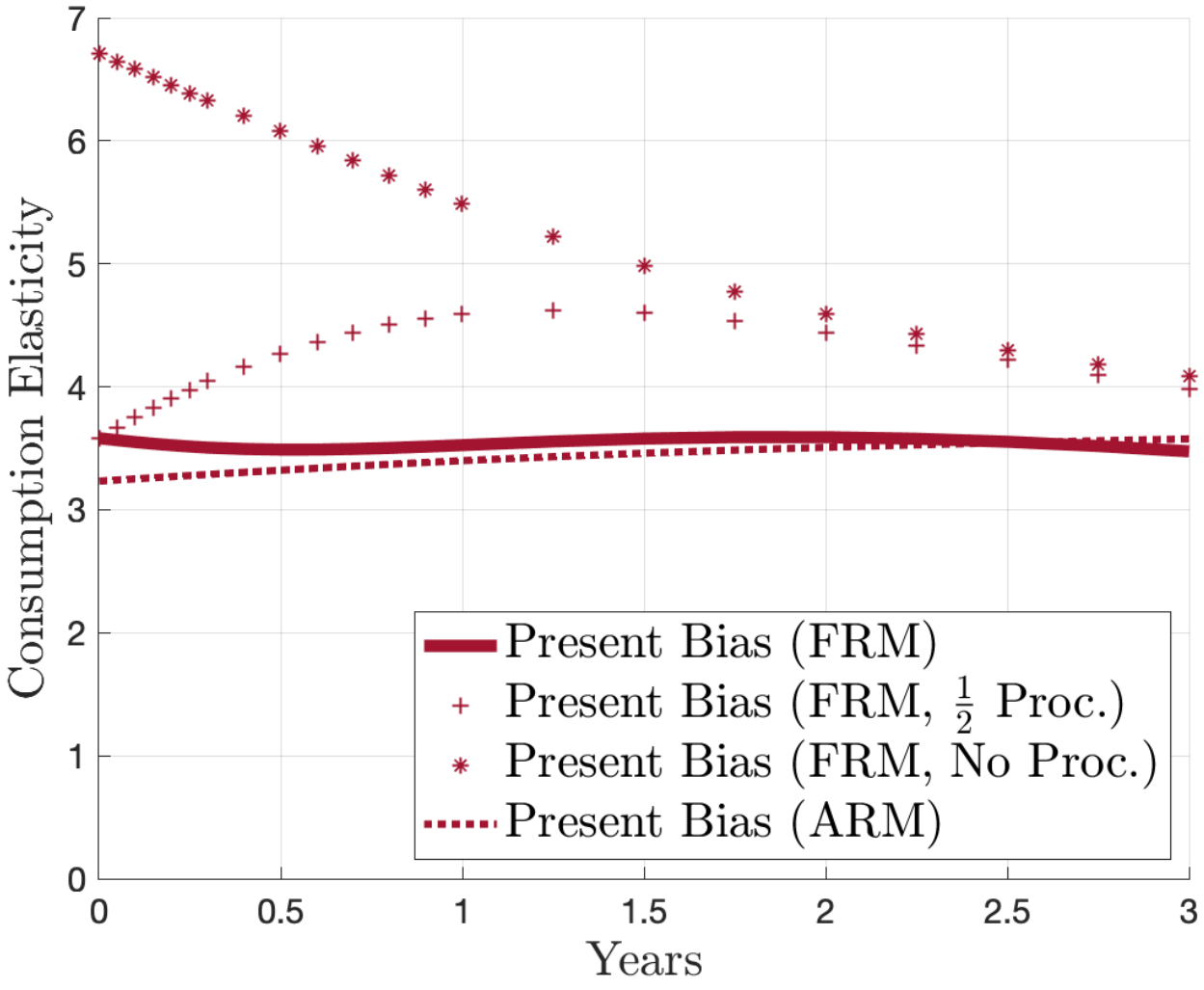


- $\beta < 1$ **economy more sensitivity to procrastination**
  - Intuition: fewer constrained $\beta = 1$ households $\Longrightarrow$ smooth out refi delays

Extension: MP with Procrastination Reduction

Back

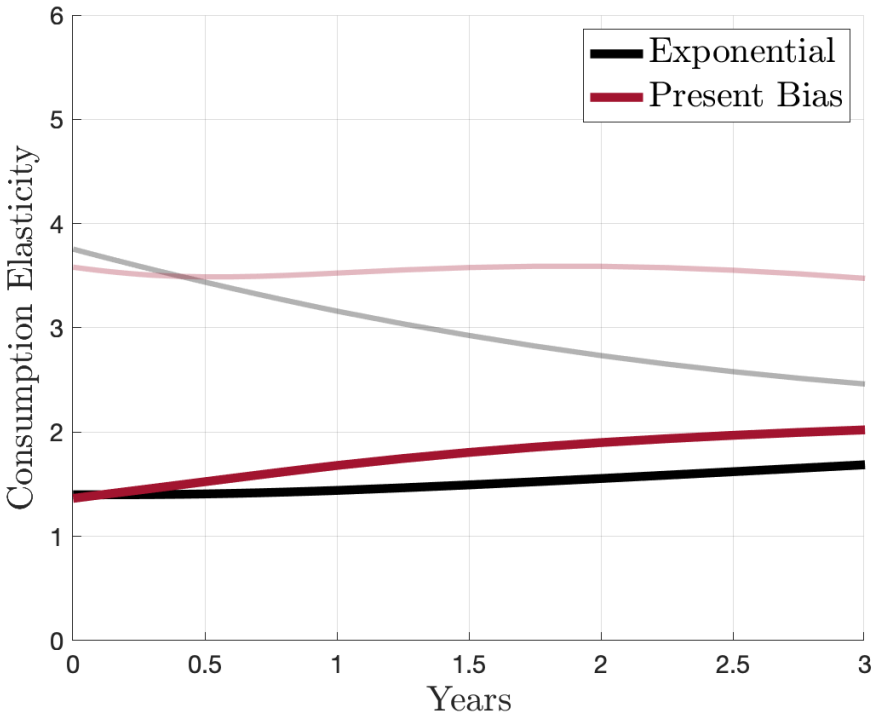
- Experiment: turn down procrastination at time of MP shock
  (see Andersen et al. (2020) for discussion)



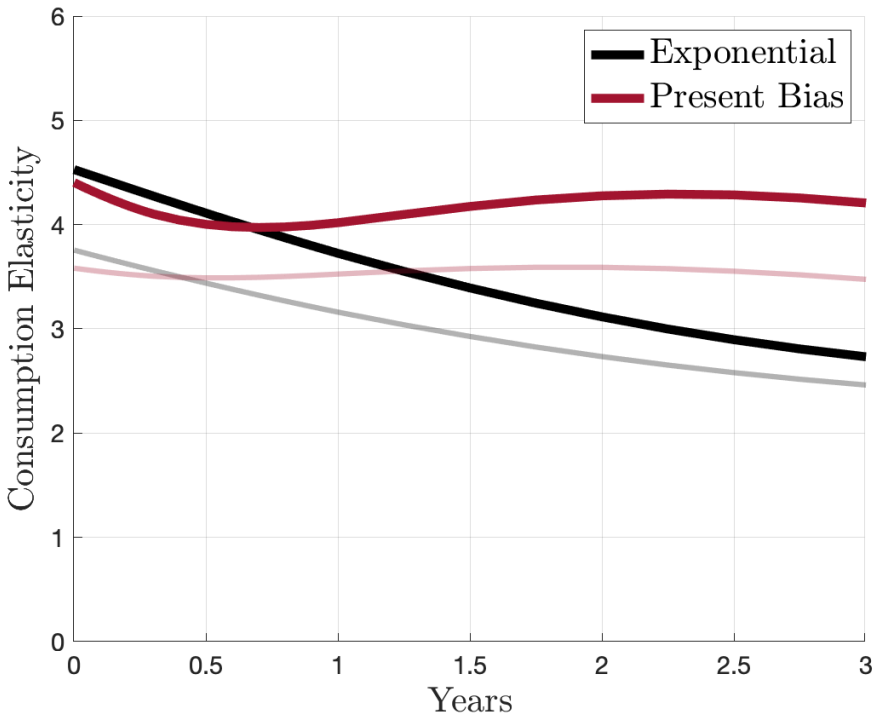
Robustness: Monetary Policy & House Price Shocks

Back

-25% House Price Shock



+25% House Price Shock

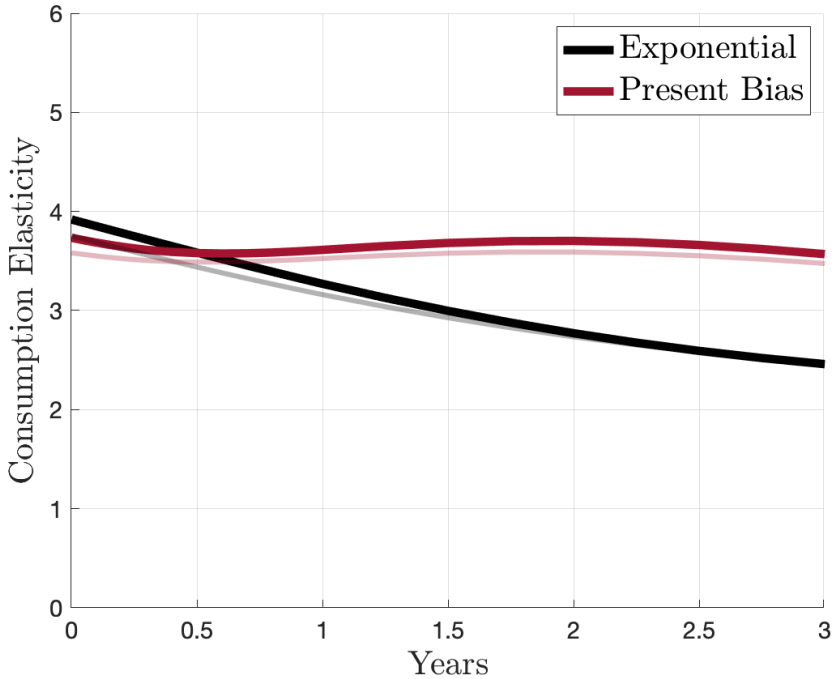


- Main result holds: $\beta < 1$ **amplifies consumption response to MP**

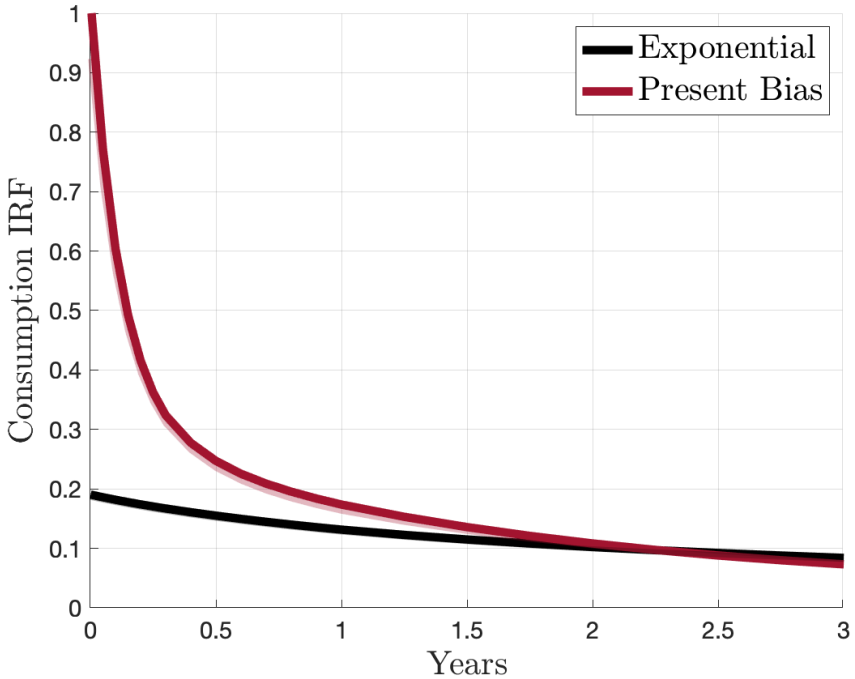
Robustness: Policy and Income Shocks

Back

Monetary Policy: -5% Income Shock



Fiscal Policy: -5% Income Shock



- Results not sensitive to recessionary income shocks

Fiscal Policy: GE Considerations

Back

- Conjecture present bias continues to amplify fiscal policy in GE
  - "Keynesian Cross" logic
  - Primary GE effect through labor income $\uparrow$
  - Since $\beta < 1$ increases MPCs, $\beta < 1$ likely amplifies indirect effect

Monetary Policy: GE Considerations

Back

- Conjecture present bias continues to amplify monetary policy in GE
  - "Keynesian Cross" logic
  - Primary GE effect through labor income $\uparrow$
  - Since $\beta < 1$ increases MPCs, $\beta < 1$ likely amplifies indirect effect
  - Also, additional GE effects through stock / house valuation changes

Why Present Bias?

Back

- $\beta < 1$ model replicates range of patterns from household finance lit. that have collectively proven difficult to fit with exponential discounting
  - Consumption
    - ✓ **MPCs for small shocks** (Parker et al., 2013)
    - ✓ **MPCs for large shocks** (Fagereng et al., 2019)
    - ✓ **Intertemporal MPCs** (Auclert et al., 2018)
    - ✓ **Different MPCs from liquid vs. illiquid transfers** (Ganong and Noel, 2018)
    - ✓ **Cons. fxn with discontinuity at borrowing limit** (Ganong and Noel, 2017)
  - Wealth
    - ✓ **High interest credit card borrowing by homeowners** (SCF, 2016)
    - ✓ **Buildup of liquidity-constrained households** (Gross and Souleles, 2002)
    - ✓ LTV distribution (SCF, 2016)
  - Refinancing
    - ✓ **Refinancing inertia** (Andersen et al., 2020)
    - ✓ Cash-out share of refis (Chen et al., 2019)
    - ✓ Cash-out magnitude (Bhutta and Keys, 2016)

- Above, **red bullets** only matched with $\beta < 1$