Monetary Policy According to HANK

Greg Kaplan
Ben Moll
Gianluca Violante

FRBSF Conference on Macroeconomics and Monetary Policy, March 4, 2016

How monetary policy works in RANK models

- Total consumption response to a drop in real rates

$$C \text{ response} = \underbrace{\text{direct response to } r}_{>95\%} + \underbrace{\text{indirect effects due to } Y}_{<5\%}$$

- Direct response is everything, pure intertemporal substitution

How monetary policy works in RANK models

- Total consumption response to a drop in real rates

$$C \text{ response} = \underbrace{\text{direct response to } r}_{>95\%} + \underbrace{\text{indirect effects due to } Y}_{<5\%}$$

- Direct response is everything, pure intertemporal substitution

- But both theory and data suggest

  1. Low sensitivity of C to r
  2. Sizable sensitivity of C to Y
  3. Micro sensitivity vastly heterogeneous, depends crucially on household balance sheets

How monetary policy works in HANK

- HANK delivers realistic distributions of household wealth and MPCs

How monetary policy works in HANK

- HANK delivers realistic distributions of household wealth and MPCs

$$C \text{ response} = \underbrace{\text{direct response to } r}_{\text{RANK: >95\%}\quad\text{HANK: <15\%}} + \underbrace{\text{indirect effects due to } Y}_{\text{RANK: <5\%}\quad\text{HANK: >85\%}}$$

How monetary policy works in HANK

- HANK delivers realistic distributions of household wealth and MPCs

$$C \text{ response} = \underbrace{\text{direct response to } r}_{\text{RANK: >95\%}\quad\text{HANK: <15\%}} + \underbrace{\text{indirect effects due to } Y}_{\text{RANK: <5\%}\quad\text{HANK: >85\%}}$$

- Overall effect depends crucially on fiscal response, unlike in RANK

HANK: a framework for monetary policy analysis

Households

- Face uninsured idiosyncratic labor income risk
- Consume and supply labor
- Hold two assets: liquid and illiquid

HANK: a framework for monetary policy analysis

Households

- Face uninsured idiosyncratic labor income risk
- Consume and supply labor
- Hold two assets: liquid and illiquid
- Budget constraints (simplified version)

$$\frac{d}{dt}b_t = r^b b_t + w z_t \ell_t - c_t - d_t - \chi(d_t, a_t)$$

$$\frac{d}{dt}a_t = r^a a_t + d_t$$

  - b_t: liquid assets
  - d_t: illiquid deposits ($\gtrless 0$)
  - a_t: illiquid assets
  - χ: transaction cost function

- In equilibrium: $r^a > r^b$

HANK: a framework for monetary policy analysis

Households

- Face uninsured idiosyncratic labor income risk
- Consume and supply labor
- Hold two assets: liquid and illiquid
- Budget constraints (simplified version)

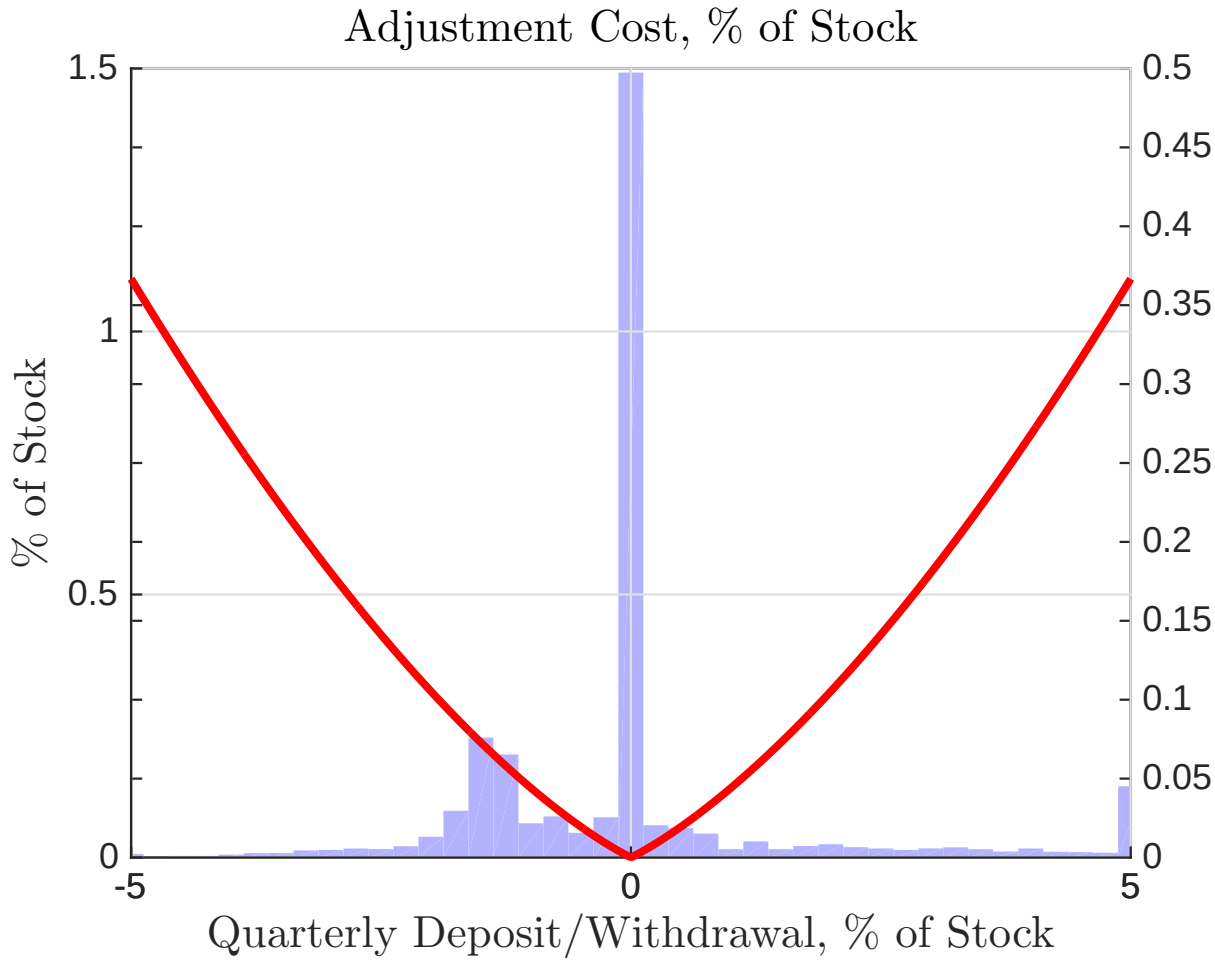
$$\frac{d}{dt}b_t = r^b b_t + w z_t \ell_t - c_t - d_t - \chi(d_t, a_t)$$

$$\frac{d}{dt}a_t = r^a a_t + d_t$$

  - b_t: liquid assets
  - d_t: illiquid deposits ($\gtrless 0$)
  - a_t: illiquid assets
  - χ: transaction cost function

- In equilibrium: $r^a > r^b$
- Full model: borrowing/saving rate wedge, housing, taxes/transfers

Kinked adjustment cost function $\chi(d, a)$



Remaining model ingredients

Firms

- Monopolistically competitive intermediate-good producers
- Quadratic price adjustment costs à la Rotemberg (1982)

Investment funds

- Intermediate illiquid assets/capital to producers

Government

- Issues liquid debt, spends, taxes

Monetary Authority

- Sets nominal rate on liquid assets based on a Taylor rule

Three key aspects of parameterization

1. Measurement and partition of asset categories into:
    - Liquid (cash, bank accounts + government/corporate bonds)
    - Illiquid productive (equity) vs non-productive (housing)

Three key aspects of parameterization

1. Measurement and partition of asset categories into:
    - Liquid (cash, bank accounts + government/corporate bonds)
    - Illiquid productive (equity) vs non-productive (housing)
2. Income process with leptokurtic income changes
    - Nature of earnings risk affects household portfolio

Three key aspects of parameterization

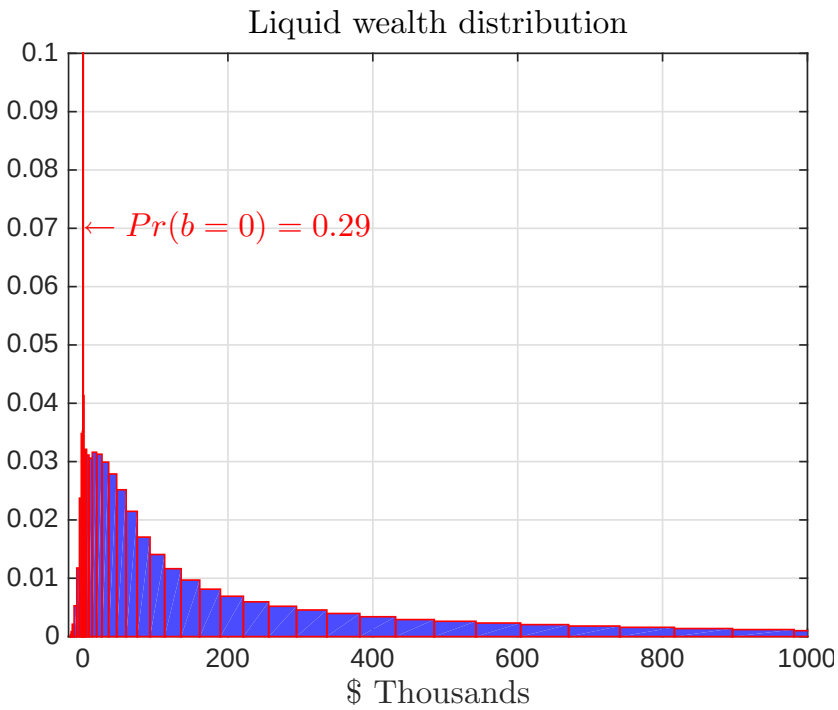
1. Measurement and partition of asset categories into:
    - Liquid (cash, bank accounts + government/corporate bonds)
    - Illiquid productive (equity) vs non-productive (housing)
2. Income process with leptokurtic income changes
    - Nature of earnings risk affects household portfolio
3. Adjustment cost function and discount rate
    - Match mean liquid/illiquid wealth and fraction HtM

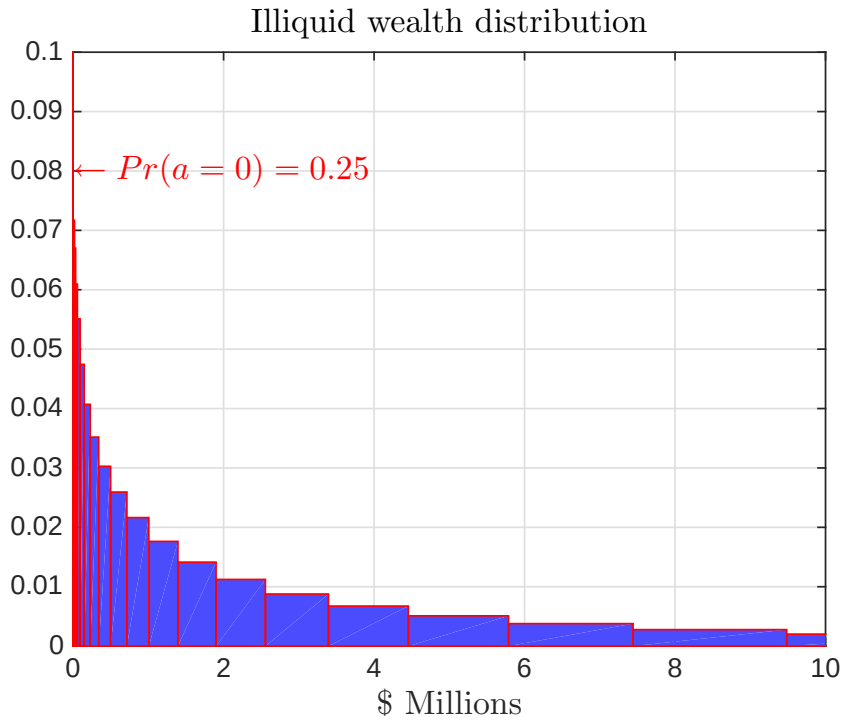
Three key aspects of parameterization

1. Measurement and partition of asset categories into:
    - Liquid (cash, bank accounts + government/corporate bonds)
    - Illiquid productive (equity) vs non-productive (housing)
2. Income process with leptokurtic income changes
    - Nature of earnings risk affects household portfolio
3. Adjustment cost function and discount rate
    - Match mean liquid/illiquid wealth and fraction HtM

- Preferences: GHH over consumption and labor supply
- Production side: standard calibration of NK models

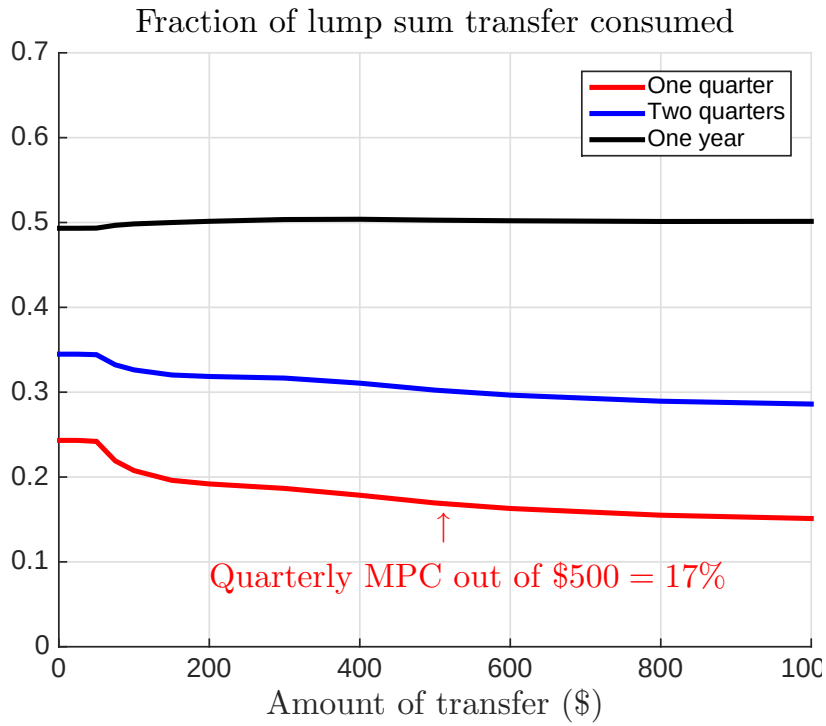
Model matches key feature of U.S. wealth distribution

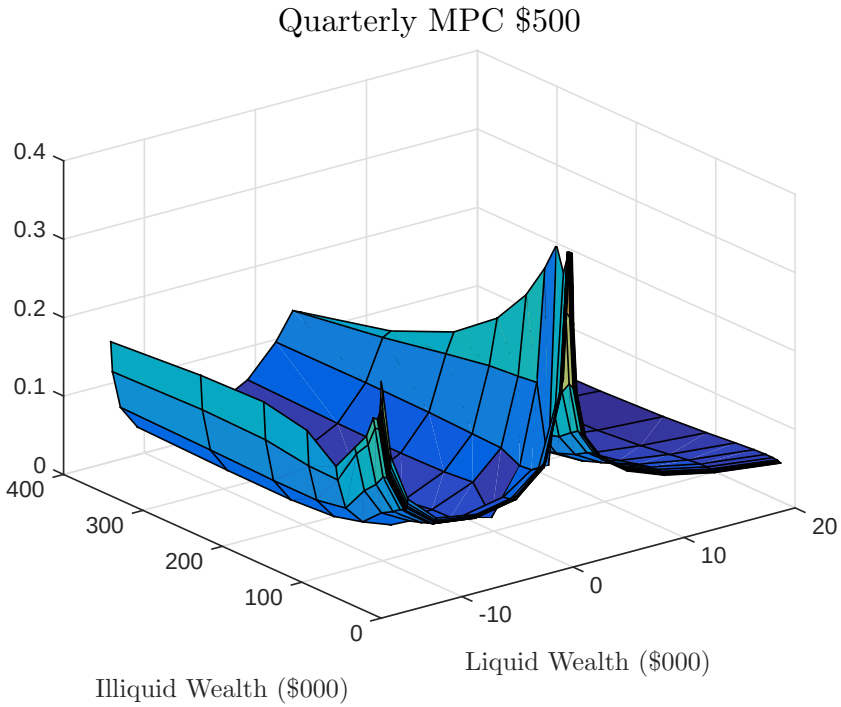




	Data	Model
Mean illiquid assets (rel to GDP)	2.920	2.920
Mean liquid assets (rel to GDP)	0.260	0.263
Poor hand-to-mouth	10%	12%
Wealthy hand-to-mouth	20%	17%

Model generates high and heterogeneous MPCs





Transmission of monetary policy shock to C

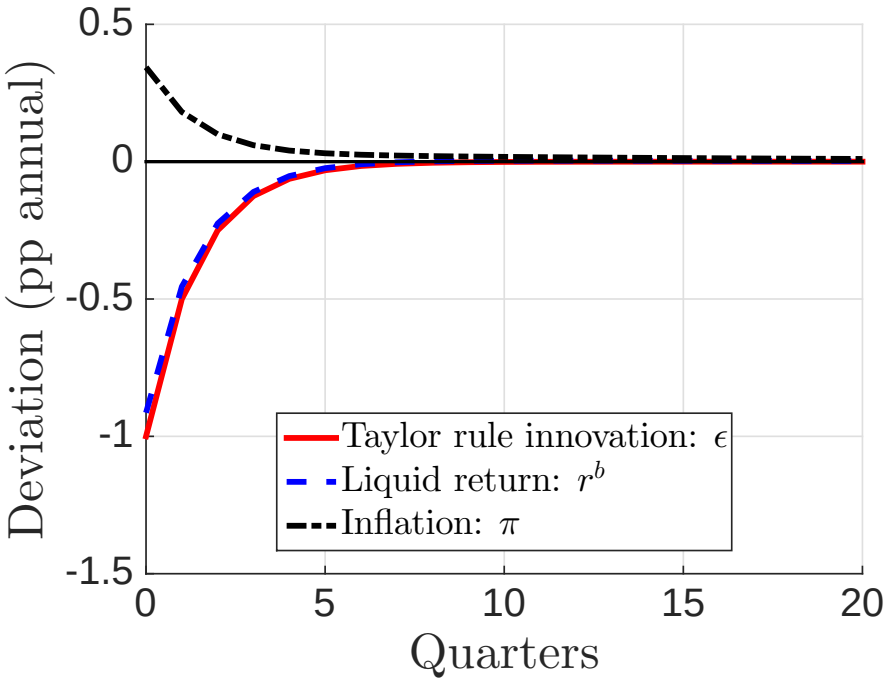
Innovation $\epsilon < 0$ to the Taylor rule: $i = \bar{r}^b + \phi\pi + \epsilon$

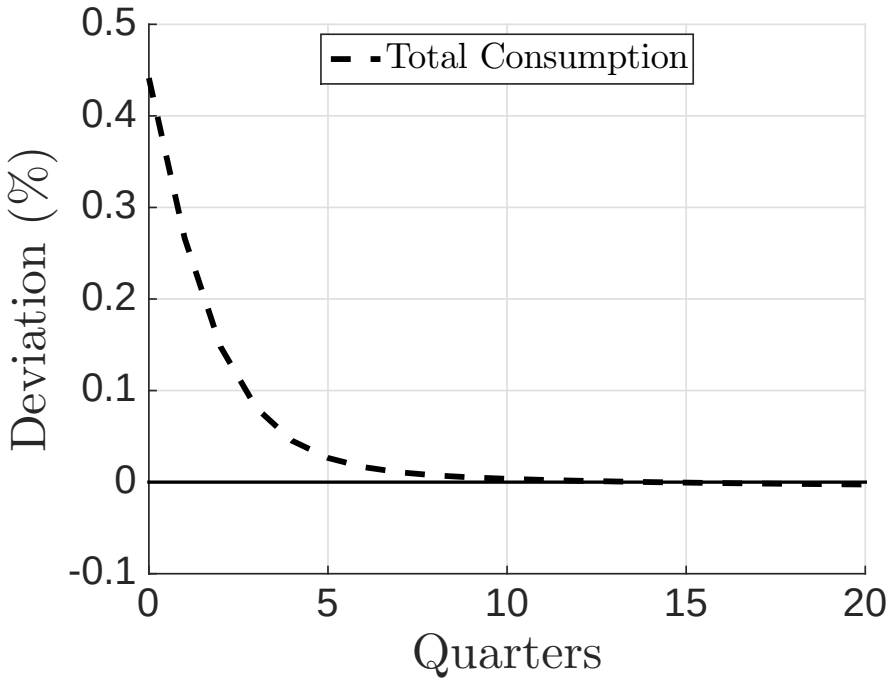
- All experiments: $\epsilon_0 = -0.0025$, i.e. -1% annualized

Transmission of monetary policy shock to C

Innovation $\epsilon < 0$ to the Taylor rule: $i = \bar{r}^b + \phi\pi + \epsilon$

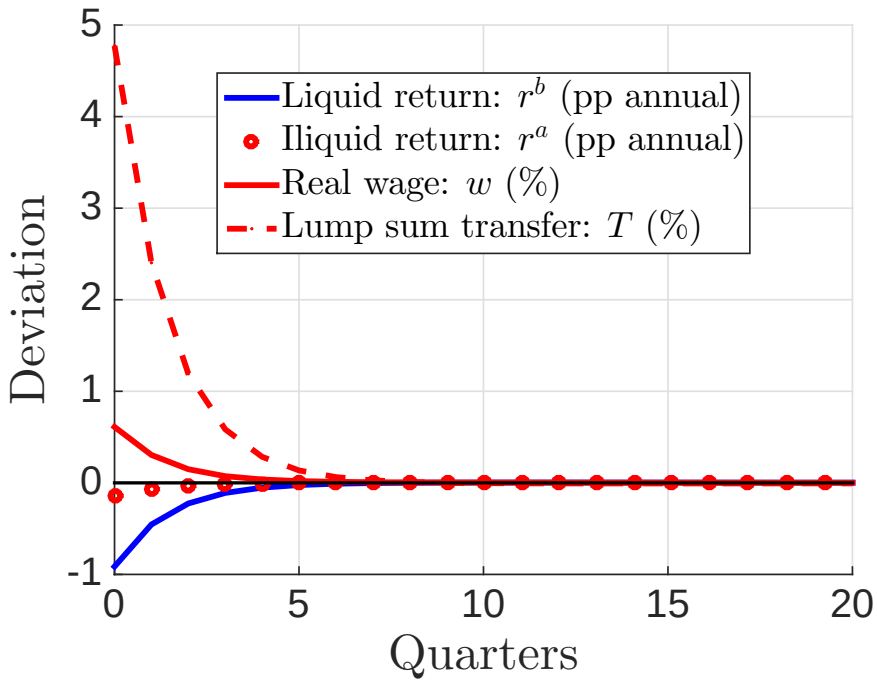
- All experiments: $\epsilon_0 = -0.0025$, i.e. -1% annualized

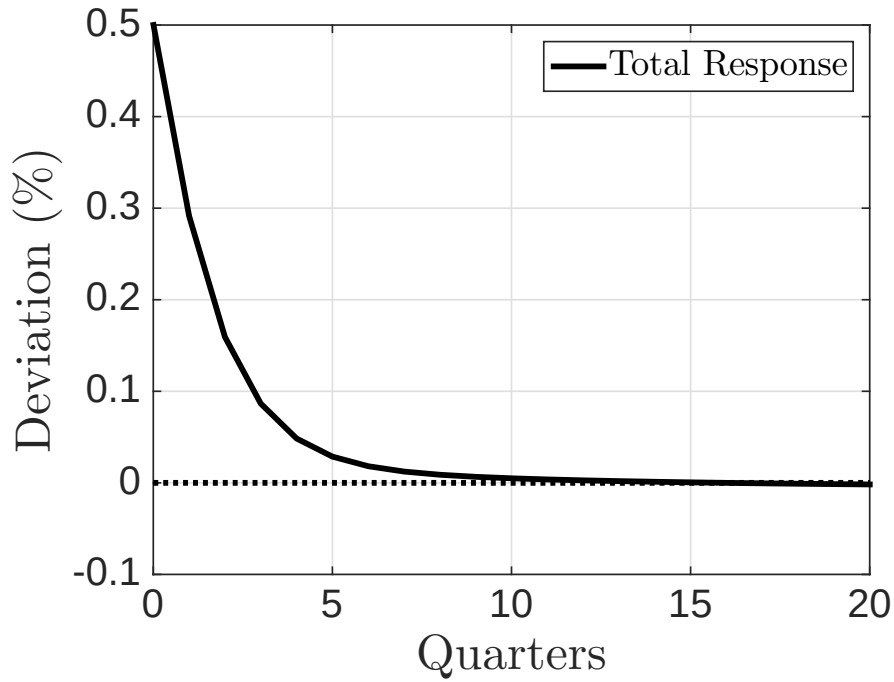




Transmission of monetary policy shock to C

$$dC_0 = \int_0^\infty \frac{\partial C_0}{\partial r_t^b} dr_t^b dt + \int_0^\infty \left(\frac{\partial C_0}{\partial r_t^a} dr_t^a + \frac{\partial C_0}{\partial w_t} dw_t + \frac{\partial C_0}{\partial T_t} dT_t \right) dt$$

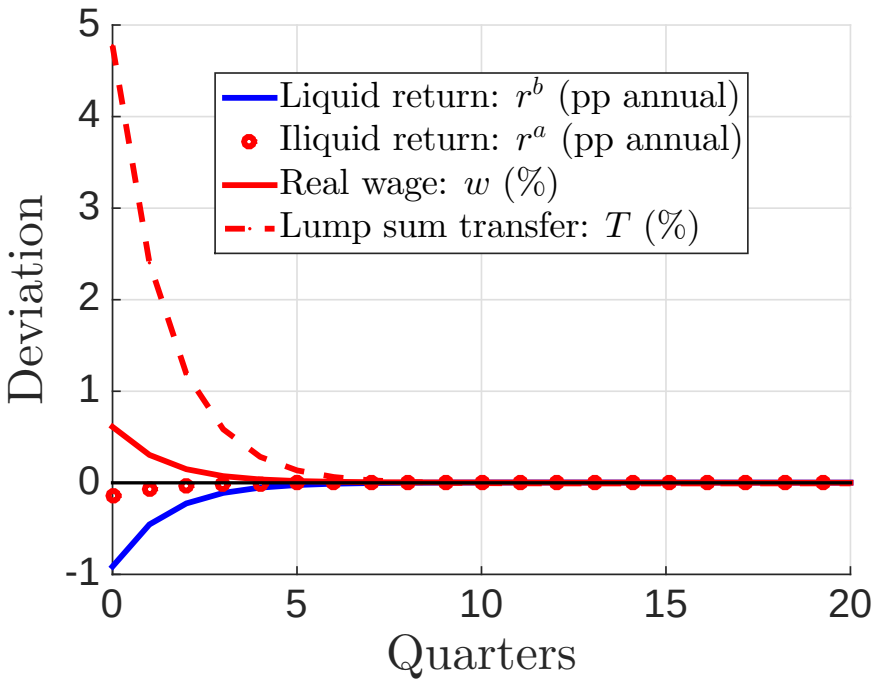


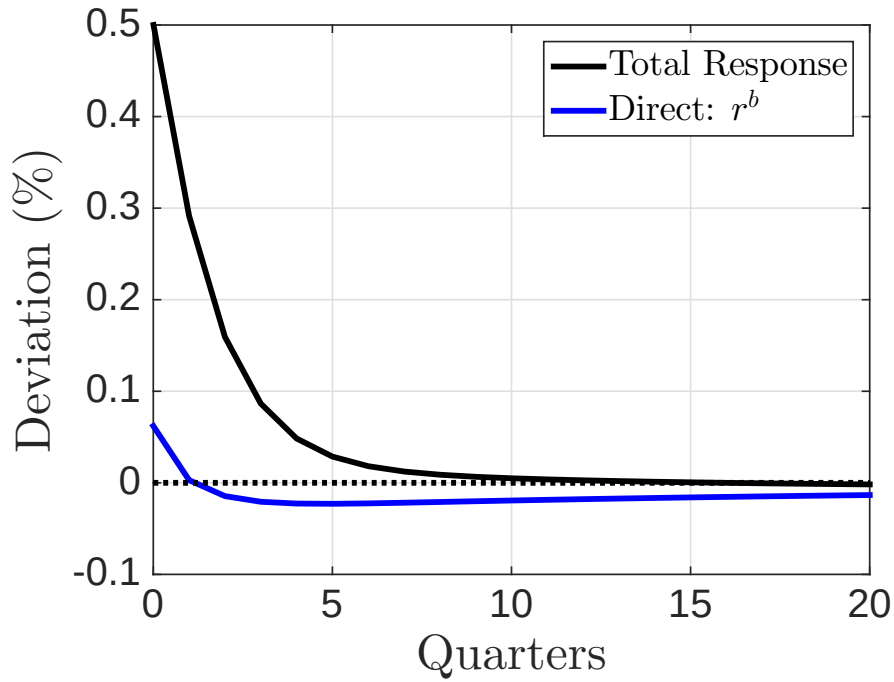


Transmission of monetary policy shock to C

$$dC_0 = \int_0^\infty \frac{\partial C_0}{\partial r_t^b} dr_t^b dt + \int_0^\infty \left(\frac{\partial C_0}{\partial r_t^a} dr_t^a + \frac{\partial C_0}{\partial w_t} dw_t + \frac{\partial C_0}{\partial T_t} dT_t \right) dt$$

Intertemporal substitution channel: direct effects from $r^b \downarrow$

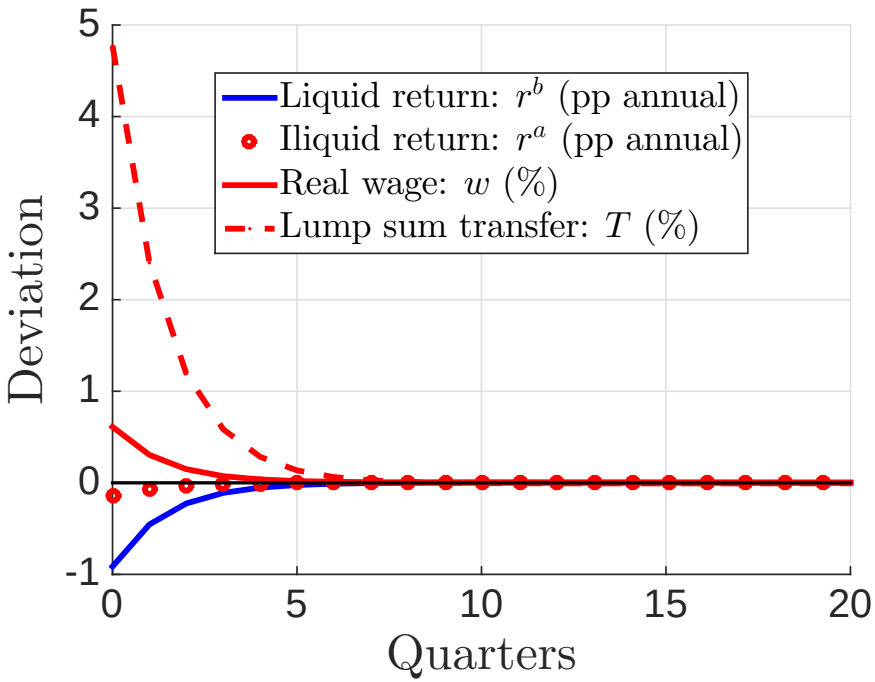


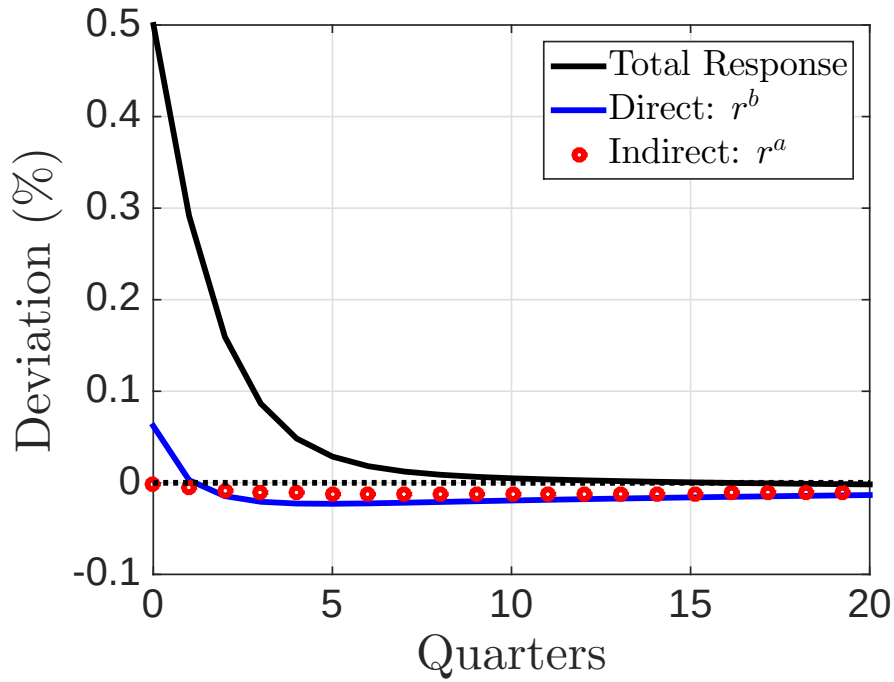


Transmission of monetary policy shock to C

$$dC_0 = \int_0^\infty \frac{\partial C_0}{\partial r_t^b} dr_t^b dt + \int_0^\infty \left(\frac{\partial C_0}{\partial r_t^a} dr_t^a + \frac{\partial C_0}{\partial w_t} dw_t + \frac{\partial C_0}{\partial T_t} dT_t \right) dt$$

Portfolio reallocation channel: indirect effects from $r^a \uparrow$

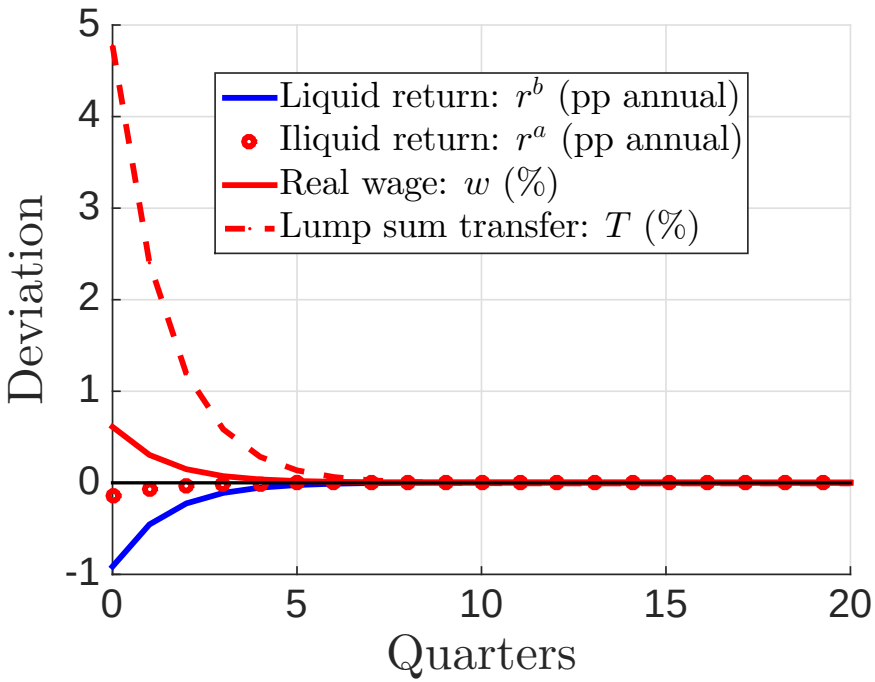


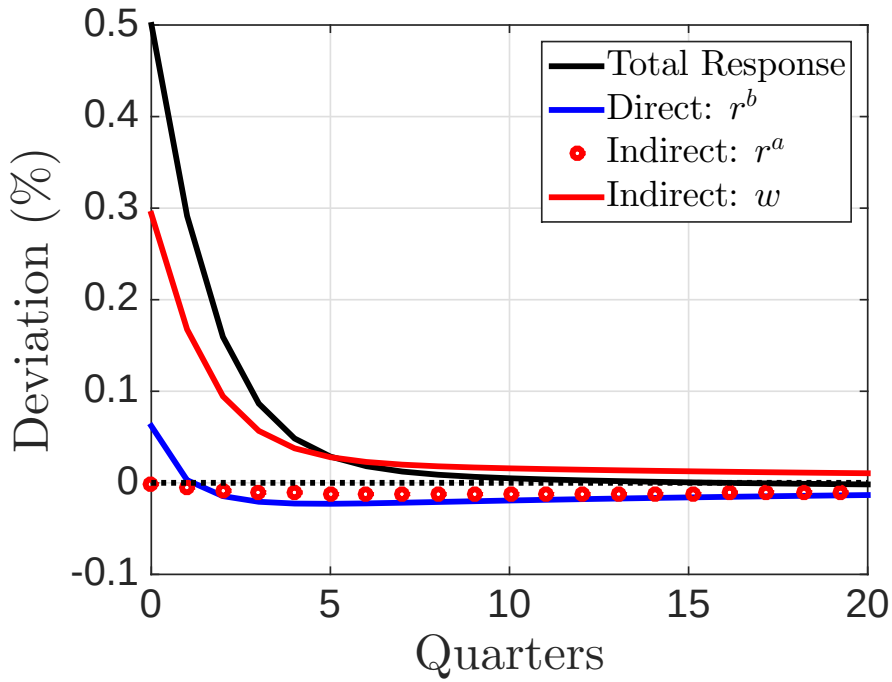


Transmission of monetary policy shock to C

$$dC_0 = \int_0^\infty \frac{\partial C_0}{\partial r_t^b} dr_t^b dt + \int_0^\infty \left(\frac{\partial C_0}{\partial r_t^a} dr_t^a + \frac{\partial C_0}{\partial w_t} dw_t + \frac{\partial C_0}{\partial T_t} dT_t \right) dt$$

Labor demand channel: indirect effects from $w \uparrow$

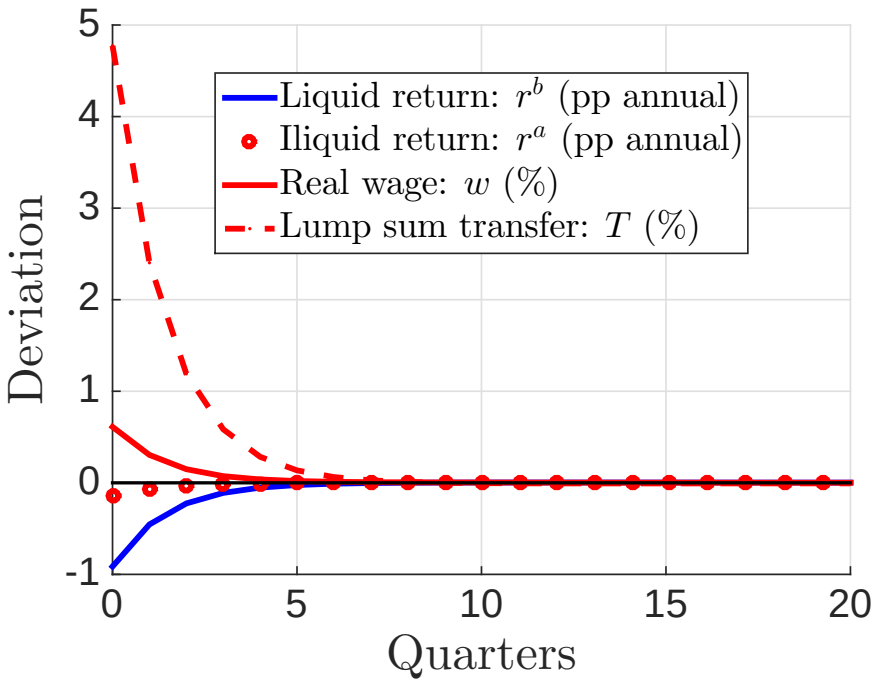


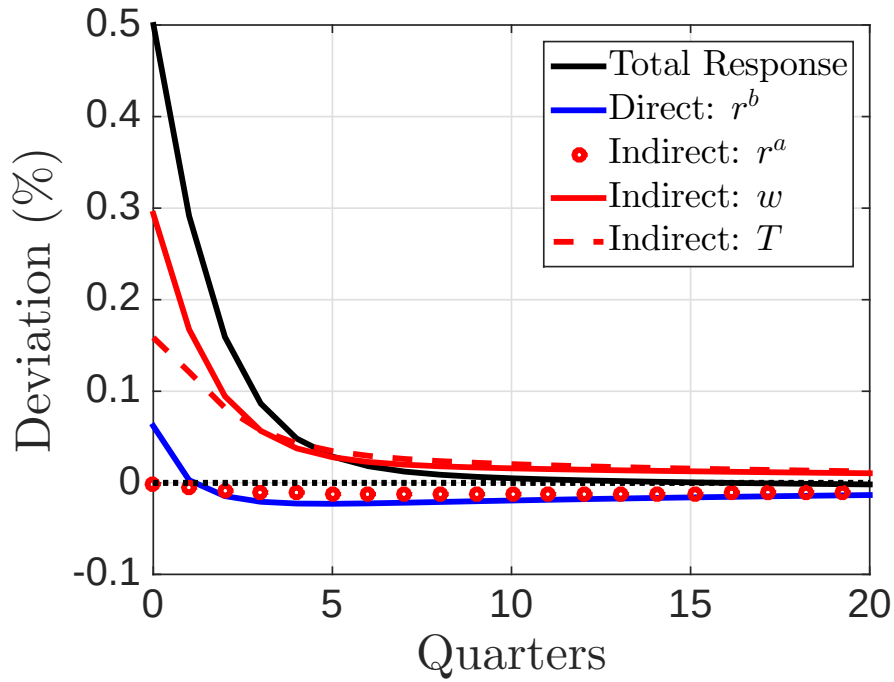


Transmission of monetary policy shock to C

$$dC_0 = \int_0^\infty \frac{\partial C_0}{\partial r_t^b} dr_t^b dt + \int_0^\infty \left(\frac{\partial C_0}{\partial r_t^a} dr_t^a + \frac{\partial C_0}{\partial w_t} dw_t + \frac{\partial C_0}{\partial T_t} dT_t \right) dt$$

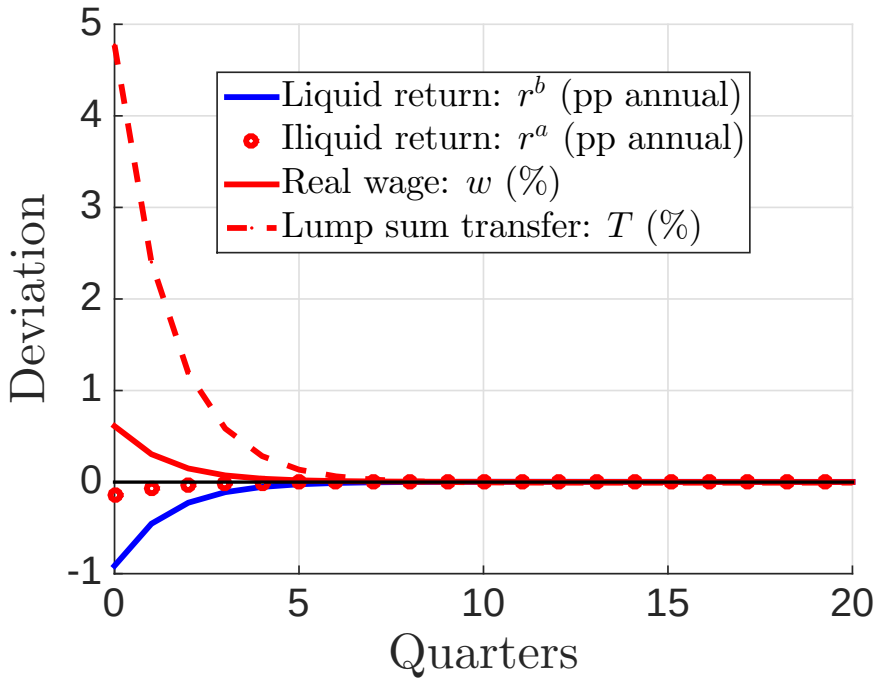
Fiscal policy channel: indirect effects from $T \uparrow$ due to $r^b \times$ debt $\downarrow$

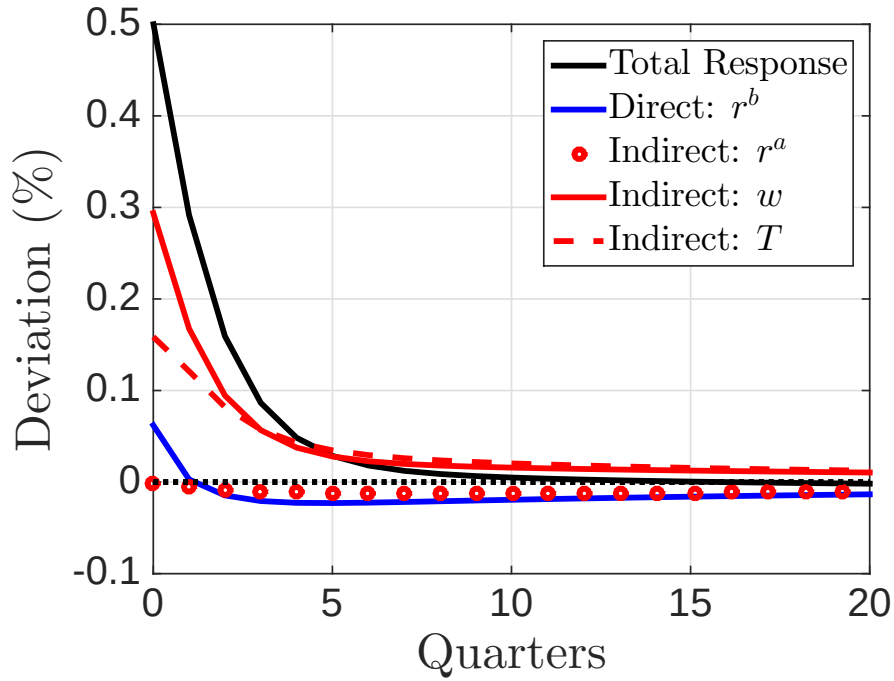




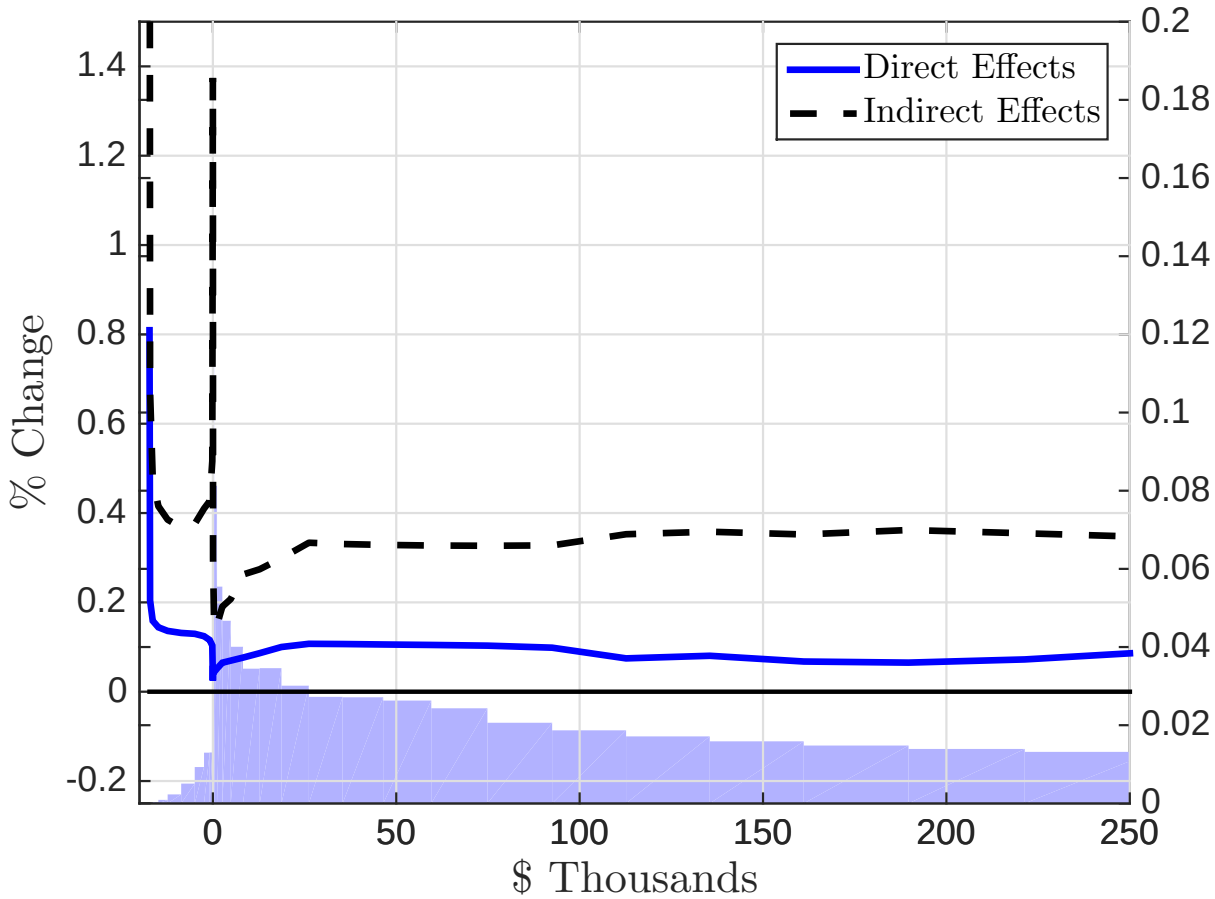
Transmission of monetary policy shock to C

$$dC = \underbrace{\int_0^\infty \frac{\partial C_0}{\partial r_t^b} dr_t^b dt}_{12\%} + \underbrace{\int_0^\infty \left(\frac{\partial C_0}{\partial r_t^a} dr_t^a + \frac{\partial C_0}{\partial w_t} dw_t + \frac{\partial C_0}{\partial T_t} dT_t \right) dt}_{88\%}$$



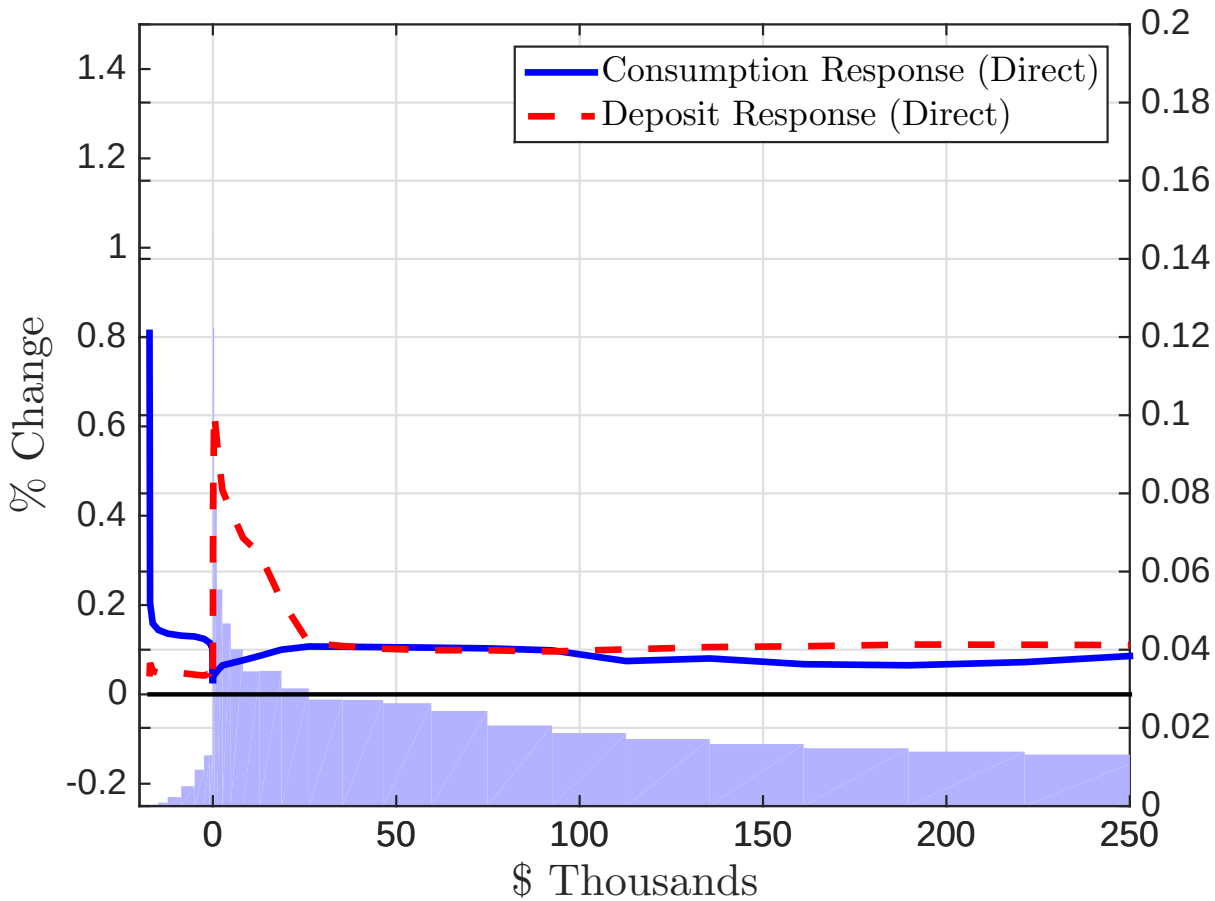


Transmission across the liquid wealth distribution



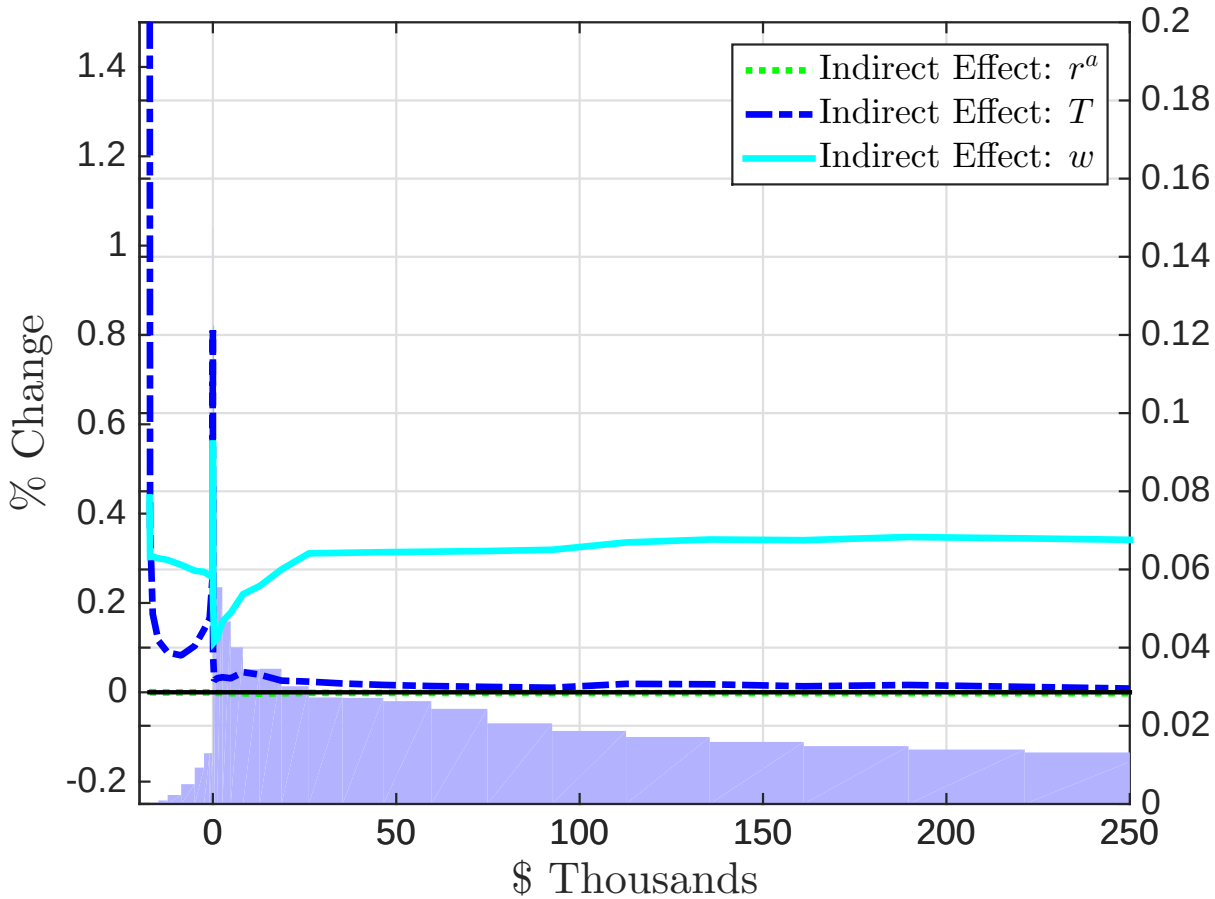
- Agg. elasticity = c-weighted average of elasticity for given b

Why small direct effects?



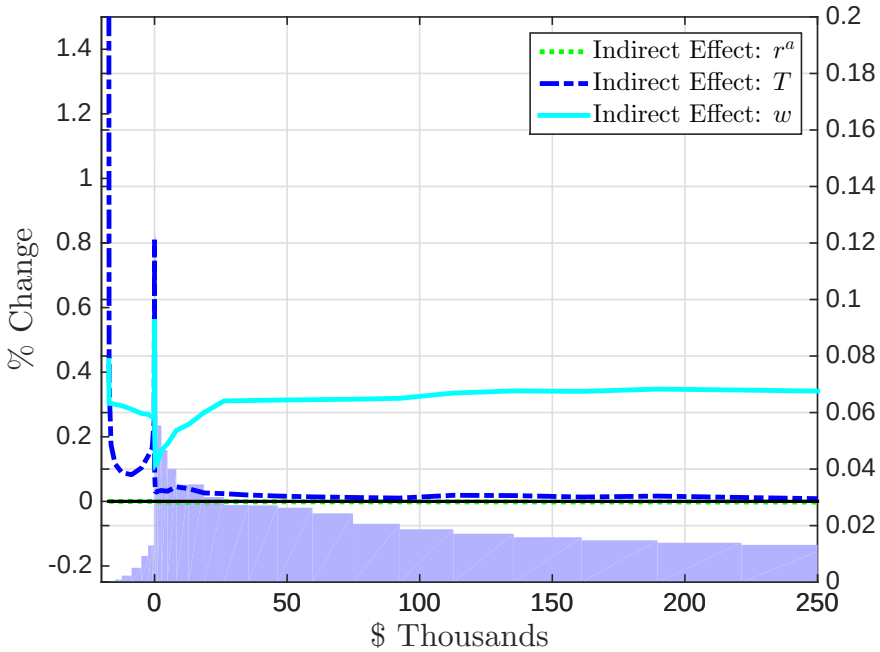
- Intertemporal substitution: (+) for non-HtM
- Income effect: (-) for rich households
- Portfolio reallocation: (-) for those with low but $>$ 0 liquid wealth

Why large indirect effects?

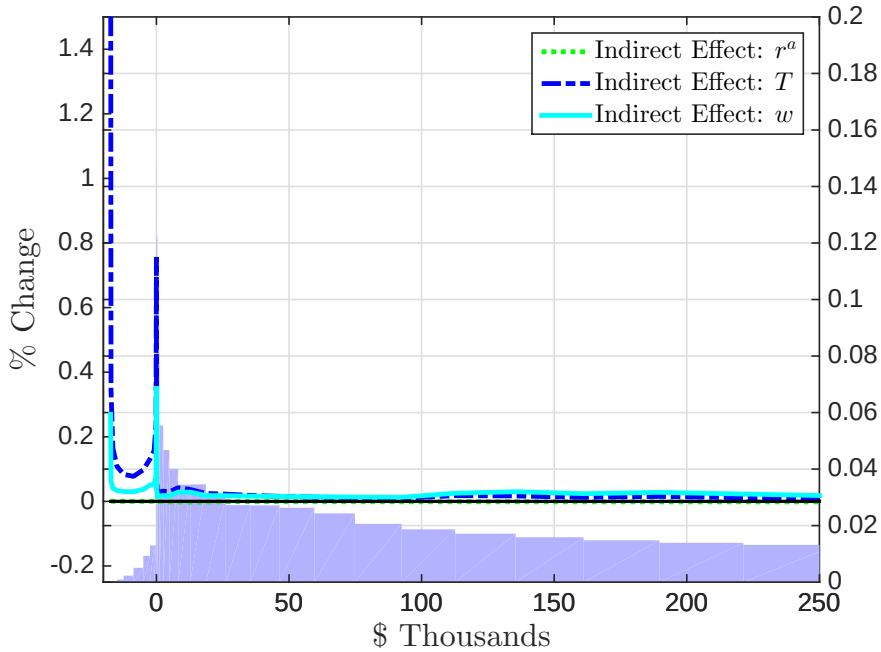


- c response to (w, T) income: (+) and strong for HtM
- GHH $\Rightarrow$ (c, ℓ) complementarity: (+) for non-HtM

Shutting down (c, ℓ) complementarity



(a) Baseline



(b) No complementarity

Importance of fiscal response

	T adjusts (1)	G adjusts (2)	B^g adjusts (3)
Change in r^b (pp)	-0.23%	-0.21%	-0.25%
Change in Y_0 (%)	0.41%	0.81%	0.13%
Implied elasticity Y_0	-1.77	-3.86	-0.52
Change in C_0 (%)	0.50%	0.64%	0.19%
Implied elasticity C_0	-2.20	-3.05	-0.77
Component of Change in C due to:			
Direct effect: r^b	12%	9%	37%
Indirect effect: w	59%	91%	48%
Indirect effect: T	32%	0%	15%
Indirect effect: r^a	0%	0%	0%

Monetary policy transmission in HANK $\neq$ RANK

Reason:

- Intertemporal substitution weak, indirect GE channels strong
- Both hand-to-mouth and wealthy households important

Monetary policy transmission in HANK $\neq$ RANK

Reason:

- Intertemporal substitution weak, indirect GE channels strong
- Both hand-to-mouth and wealthy households important

Why care? Suppose Fed wants to stimulate C

RANK view:

- Sufficient to influence real rates $\{r_t\}$
- Household intertemporal substitution does the rest

Monetary policy transmission in HANK $\neq$ RANK

Reason:

- Intertemporal substitution weak, indirect GE channels strong
- Both hand-to-mouth and wealthy households important

Why care? Suppose Fed wants to stimulate C

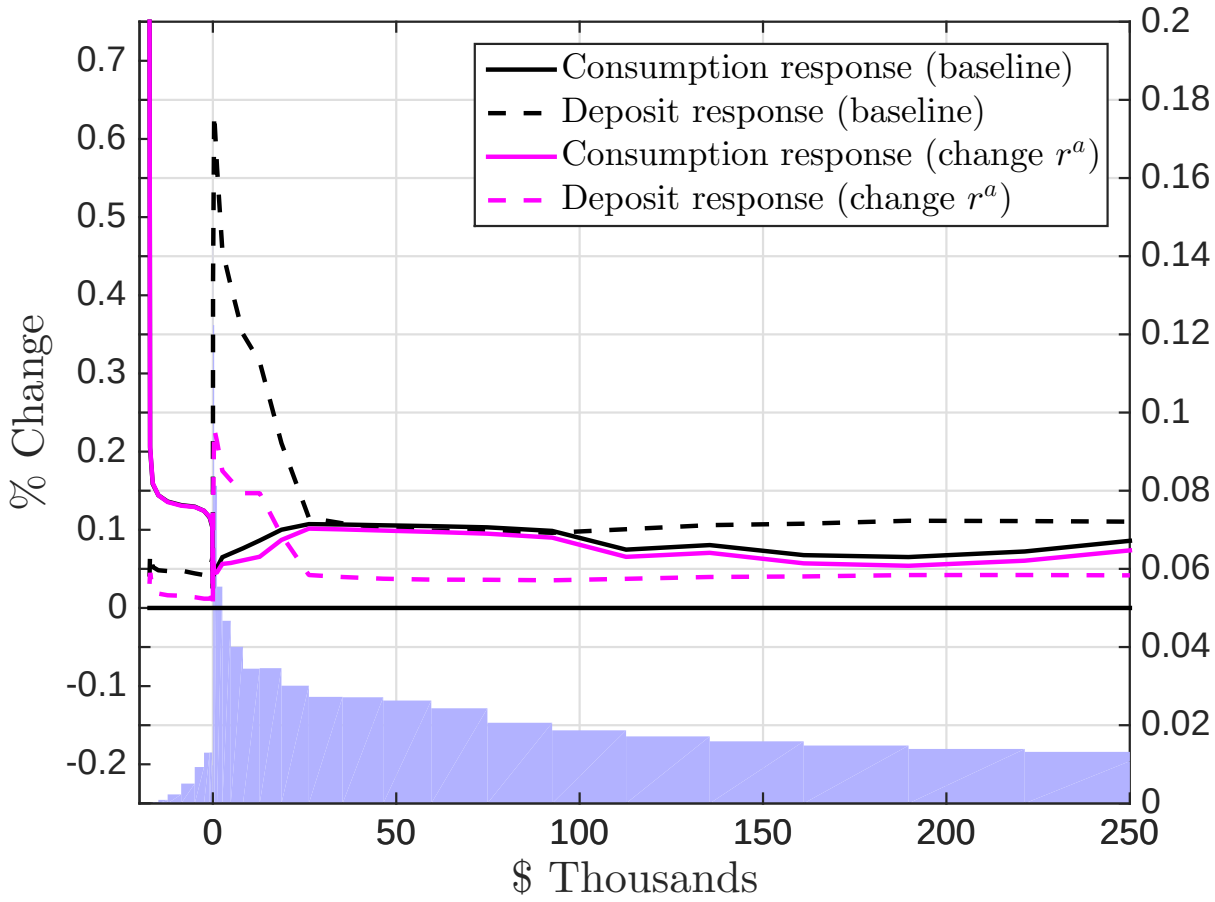
RANK view:

- Sufficient to influence real rates $\{r_t\}$
- Household intertemporal substitution does the rest

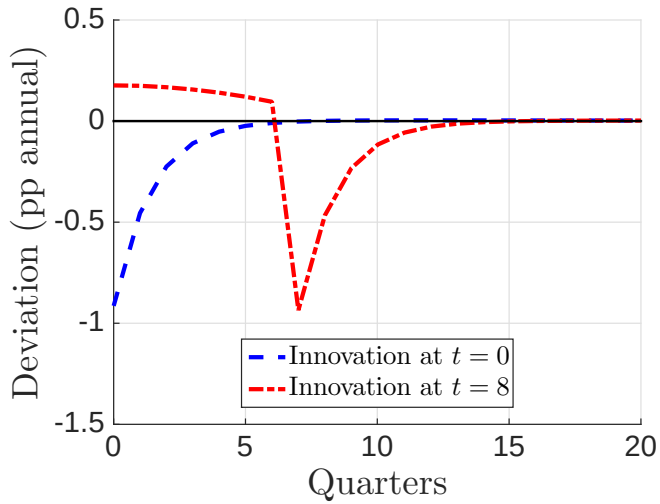
HANK view:

- Rely heavily on GE feedbacks to boost hh labor income
- Through fiscal policy reaction or an investment boom
- Responsiveness of C to i is partly (largely?) out of Fed's control

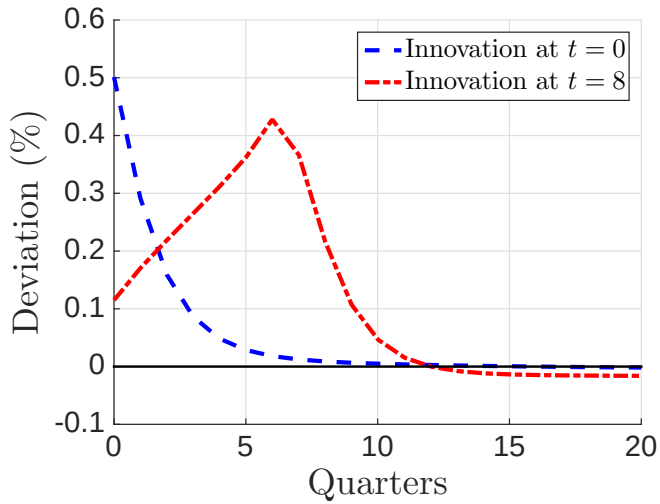
Direct effect when $\Delta r^a = \Delta r^b$



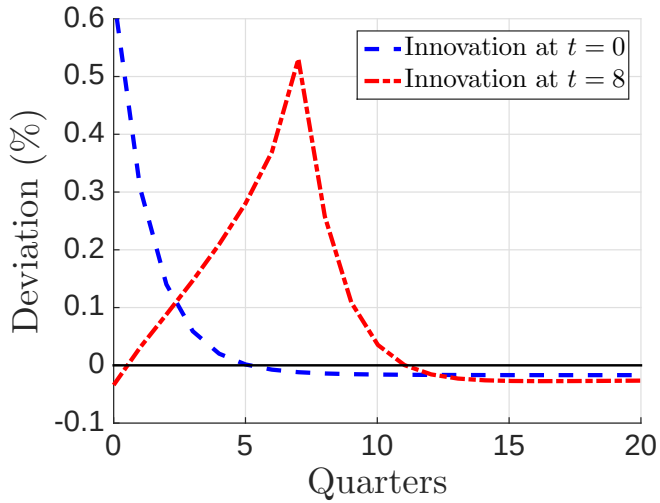
Forward Guidance: $\epsilon_t < 0$ at $t = 8$ (2 years)



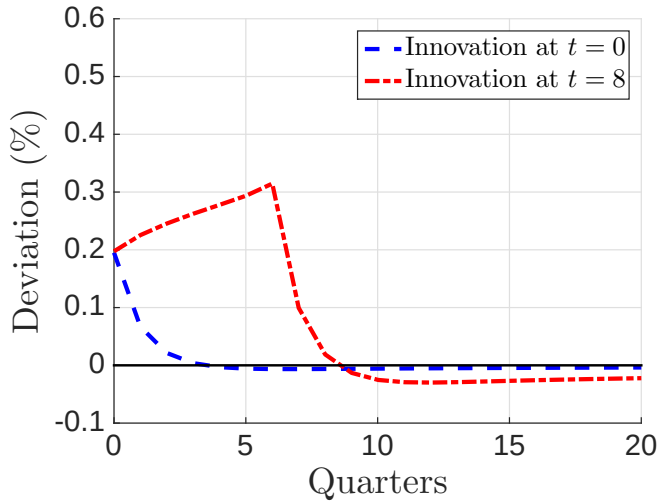
(a) Interest rate response



(b) C: transfers adjusting



(c) C: G adjusting



(d) C: B^g adjusting

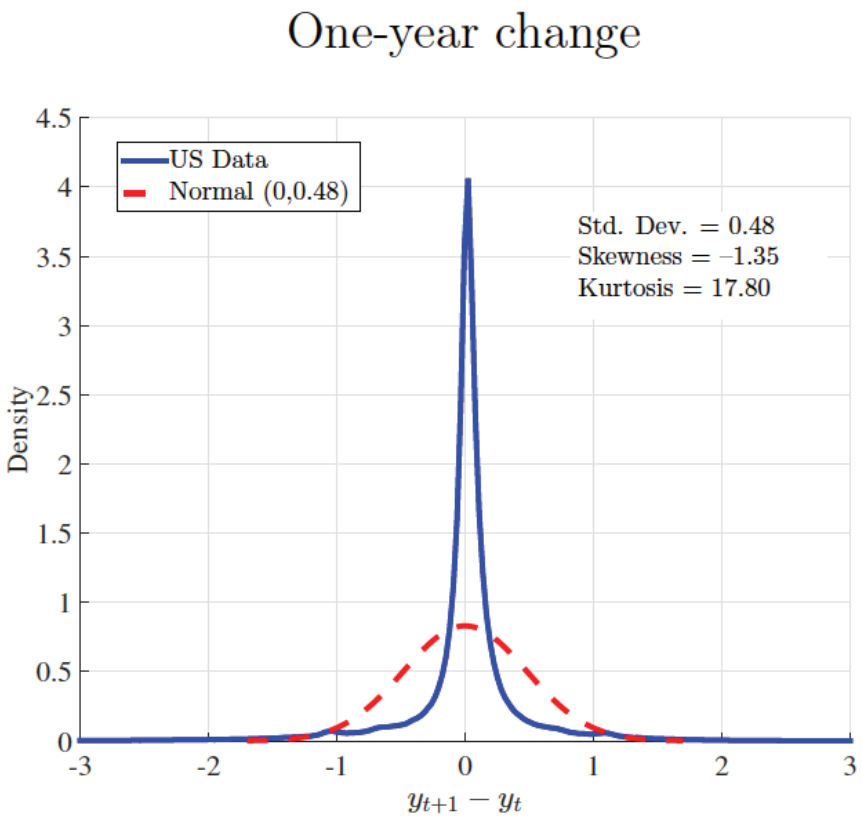
Fifty shades of K

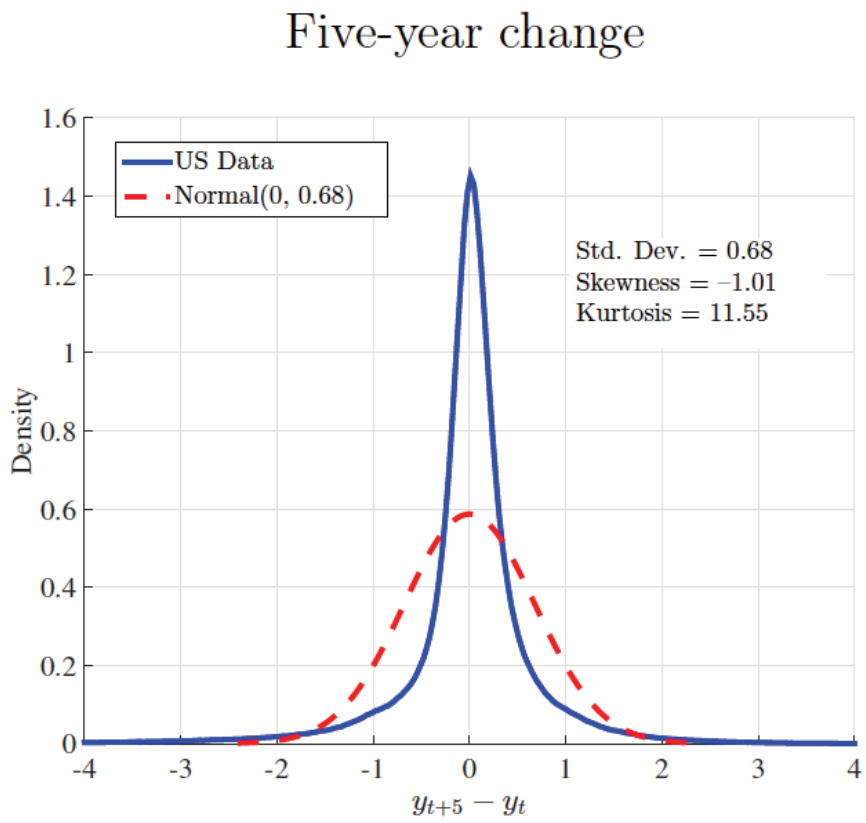
	Liquid	Illiquid	Total
Non-productive	Household deposits net of revolving debt Corp & Govt bonds $B^h = 0.26$	$0.6\times$ net housing $0.6\times$ net durables $\omega A = 0.79$	1.05
Productive		Indirectly held equity Directly held equity Noncorp bus equity $0.4\times$ housing, durables $(1-\omega)A = 2.13$	2.13 K
Total	$-B^g = 0.26$	$A = 2.92$	3.18

- Quantities are multiples of annual GDP
- Sources: Flow of Funds and SCF 2004

back

Leptokurtic earnings changes (Guvenen et al)





Key idea: normally distributed jumps = kurtosis at discrete time intervals

Leptokurtic earnings changes (Guvenen et al.)

Key idea: normally distributed jumps = kurtosis at discrete time intervals

Moment	Data	Model	Moment	Data	Model
Variance: annual log earns	0.70	0.70	Frac 1yr change $< 10\%$	0.54	0.56
Variance: 1yr change	0.23	0.23	Frac 1yr change $< 20\%$	0.71	0.67
Variance: 5yr change	0.46	0.46	Frac 1yr change $< 50\%$	0.86	0.85
Kurtosis: 1yr change	17.8	16.5			
Kurtosis: 5yr change	11.6	12.1			

back

Description		Value	Target / Source
Preferences			
λ	Death rate	1/180	Av. lifespan 45 years
γ	Risk aversion	1	
φ	Frisch elasticity (GHH)	0.5	
ψ	Disutility of labor	27	Av. hours worked equal to 1/3
ζ	Weight on housing	0.15	
ρ	Discount rate (pa)	4.7%	Internally calibrated
Production			
ε	Demand elasticity	10	Profit share 10 %
α	Capital share	0.33	
δ	Depreciation rate (p.a.)	10%	
θ	Price adjustment cost	100	Slope of Phillips curve, $\varepsilon/\theta = 0.1$
Government			
τ	Proportional labor tax	0.25	
T	Lump sum transfer (rel GDP)	0.075	40% hh with net govt transfer
$\bar{g}$	Govt debt to annual GDP	0.26	government budget constraint
Monetary Policy			
ϕ	Taylor rule coefficient	1.25	
r^b	Steady state real liquid return (pa)	2%	
Housing			
ω	Fraction of illiquid assets in housing	0.25	Flow of Funds 2004
r^h	Net housing return (pa)	1.5%	Kaplan and Violante (2014)
Illiquid Assets			
r^a	Illiquid asset return (pa)	6.5%	Equilibrium outcome
Borrowing			
r^{borr}	Borrowing rate (pa)	8.4%	Internally calibrated
$\underline{b}$	Borrowing limit	-0.42	$1 \times$ quarterly labor inc