Monetary Policy According to HANK

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ECB Conference on Household Finance and Consumption

HANK: Heterogeneous Agent New Keynesian models

- Framework for quantitative analysis of aggregate fluctuations and macroeconomic policy

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  2. Nominal price rigidities

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- Today: Transmission mechanism for conventional monetary policy

- Main result: Stark difference between HANK and $\underbrace{\text{RANK}}_{\text{Repr. Agent NK}}$

Monetary transmission in RANK and HANK

$$dC = \underbrace{\frac{\partial C}{\partial r} dr}_{\text{direct response to } r} + \underbrace{\frac{\partial C}{\partial Y} dY}_{\text{indirect GE response due to } Y}$$

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HANK: <25%	HANK: >75%

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- RANK view:
  - MPC out of r strong b/c of intertemporal substitution
  - MPC out of Y weak b/c the RA is a PIH consumer

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- RANK view:
  - MPC out of r strong b/c of intertemporal substitution
  - MPC out of Y weak b/c the RA is a PIH consumer
- HANK view:
  - MPC out of r weak b/c several effects offset int. substitution
  - MPC out of Y strong b/c of sizable share of HtM households

Why does this difference matter?

- Suppose Fed wants to stimulate C
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- HANK view:
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  - through fiscal policy reaction or an investment boom
  - Responsiveness of C_t to i_t may be largely out of Fed's control

Model

Building blocks

Households

- Face uninsured idiosyncratic labor income risk
- Save in two assets (liquid and illiquid), consume and supply labor

Firms

- Monopolistic competition for intermediate-good producers
- Quadratic price adjustment costs à la Rotemberg (1982)

Investment fund

- Intermediates illiquid assets/capital to producers

Government

- Issues liquid debt, spends, taxes, and transfers lump-sum

Monetary authority

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

Households

$$\max_{\{c_t, \ell_t, \quad\}_{t \ge 0}} \mathbb{E}_0 \int_0^\infty e^{-(\rho+\lambda)t} u(c_t, \ell_t, \quad) dt \quad \text{s.t.}$$

$$\dot{b}_t = r_t^b(b_t) b_t + \qquad w_t z_t \ell_t \qquad - c_t$$

$$z_t = \text{ some Markov process}$$

$$b_t \ge -\underline{b}$$

- c_t: non-durable consumption
- b_t: liquid assets
- z_t: individual productivity
- ℓ_t: hours worked
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$$\dot{b}_t = r_t^b(b_t) b_t + \qquad w_t z_t \ell_t \qquad -d_t - \chi(d_t, a_t) - c_t$$

$$\dot{a}_t = r_t^a \qquad a_t \qquad +d_t$$

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- c_t: non-durable consumption
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- Adjustment cost function

$$\chi(d,a) = \chi_0 |d| + \chi_1 \left|\frac{d}{a}\right|^{\chi_2} a$$

  - Linear component: inaction region
  - Convex component: finite deposit rates

Households

$$\max_{\{c_t, \ell_t, d_t\}_{t \geq 0}} \mathbb{E}_0 \int_0^\infty e^{-(\rho+\lambda)t} u(c_t, \ell_t, h_t) dt \quad \text{s.t.}$$

$$\dot{b}_t = r_t^b(b_t) b_t + (1-\xi) w_t z_t \ell_t - \tilde{T}\left(w_t z_t \ell_t\right) - d_t - \chi(d_t, a_t) - c_t$$

$$\dot{a}_t = r_t^a (1-\omega) a_t + \xi w_t z_t \ell_t + d_t$$

$$h_t = \omega a_t$$

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- χ: transaction cost function
- $\tilde{T}$: labor income tax/transfer
- ξ: direct deposits
- h_t: housing services

Households

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- Households are price-takers wrt: $\{\Psi_t\}_{t\geq 0} = \left\{w_t, r_t^a, r_t^b, \tilde{T}_t\right\}_{t\geq 0}$
- The stationary recursive solution of hh problem:
  1. decision rules: $c(a,b,z;\Psi), d(a,b,z;\Psi), \ell(a,b,z;\Psi)$
  2. stationary distribution: $\mu(da,db,dz;\Psi)$

Firms

- Representative competitive final goods producer:

$$Y = \left(\int_0^1 y_j^{\frac{\varepsilon-1}{\varepsilon}} dj \right)^{\frac{\varepsilon}{\varepsilon-1}} \quad \Rightarrow \quad y_j = \left(\frac{p_j}{P} \right)^{-\varepsilon} Y$$

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- Monopolistically competitive intermediate goods producers:
  - Technology: $y_j = Z k_j^{\alpha} n_j^{1-\alpha} \quad \Rightarrow \quad m = \frac{1}{Z} \left(\frac{r}{\alpha} \right)^{\alpha} \left(\frac{w}{1-\alpha} \right)^{1-\alpha}$
  - Set prices subject to quadratic adjustment costs:

$$\Theta \left(\frac{\dot{p}}{p} \right) = \frac{\theta}{2} \left(\frac{\dot{p}}{p} \right)^2 Y$$

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Exact NK Phillips curve: $\left(r^a - \frac{\dot{Y}}{Y} \right) \pi = \frac{\varepsilon}{\theta} (m - \bar{m}) + \dot{\pi}, \quad \bar{m} = \frac{\varepsilon - 1}{\varepsilon}$

Competitive investment fund sector

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- Competition among funds implies illiquid asset return

$$r^a = \left(r^k - \delta\right) + q$$

Monetary authority and government

- Taylor rule

$$i = \bar{r}^b + \phi\pi + \epsilon, \quad \phi > 1$$

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- Progressive tax on labor income:

$$\tilde{T}(wz\ell) = -T + \tau wz\ell$$

- Government budget constraint (in steady-state)

$$G + T + r^b B^g = \tau \int [wz\ell(a,b,z)]\, d\mu$$

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- Ricardian equivalence fails $\Rightarrow$ this matters!

Parameterization

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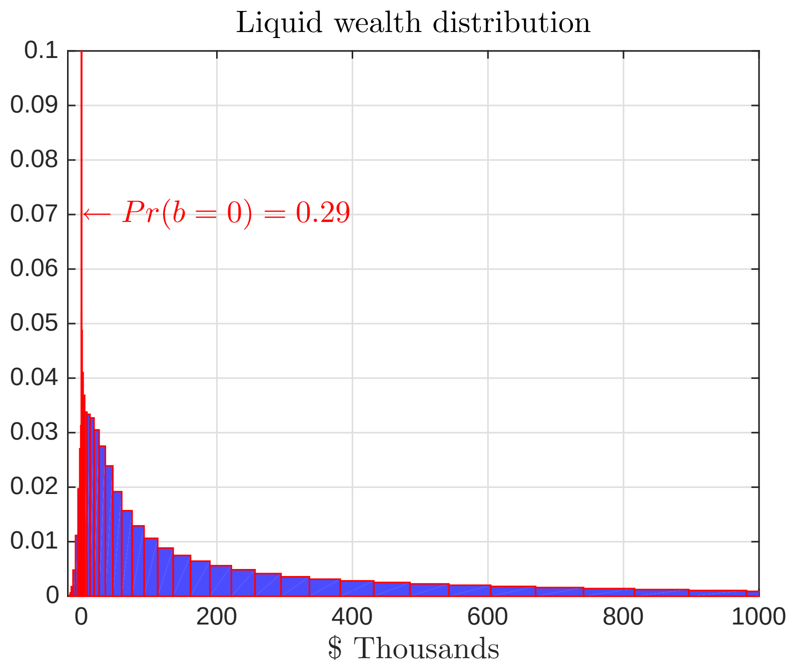
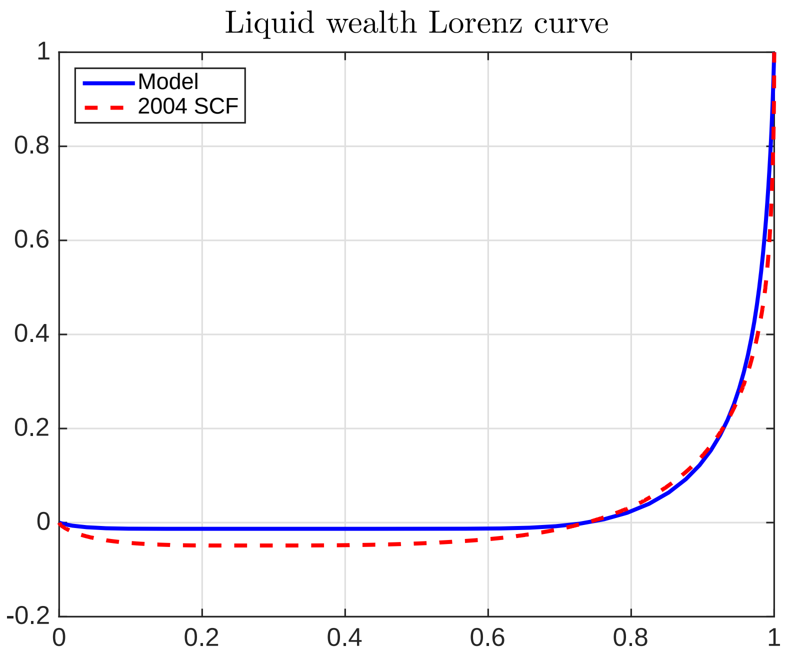
- Production side: standard calibration of NK models

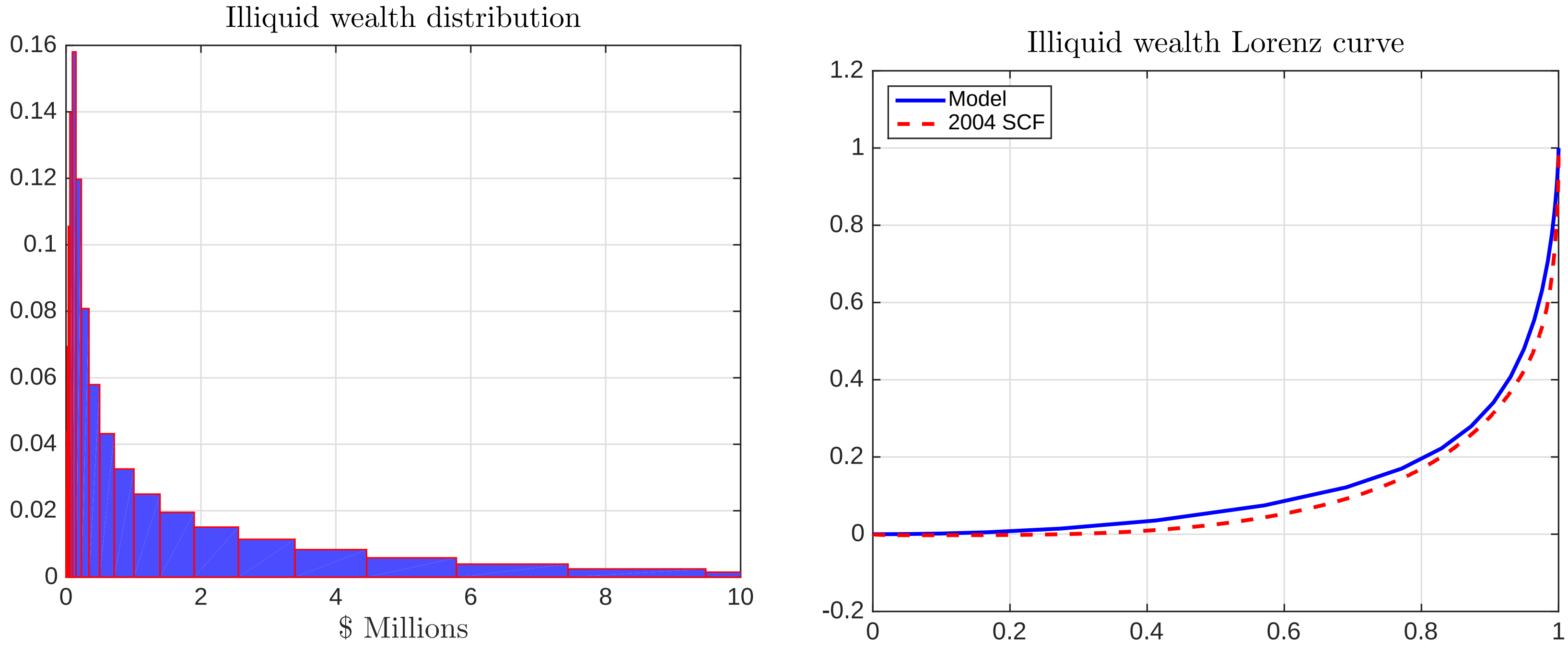
Wealth distributions: Liquid wealth





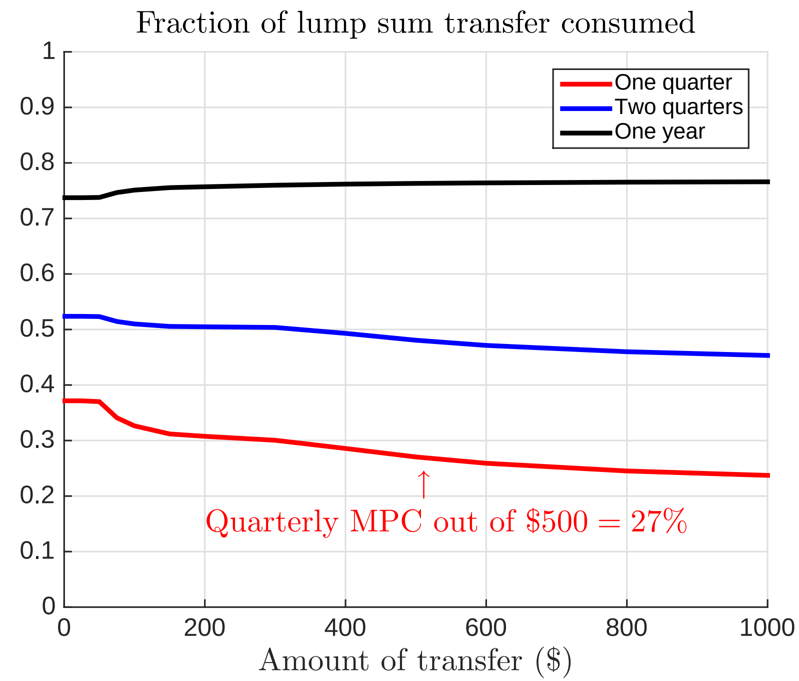
- Top 10% share: Model: 87%, SCF 2004: 89%
- Top 1% share: Model: 36%, SCF 2004: 51%
- Gini coefficient: Model: 0.87, SCF 2004: 0.98

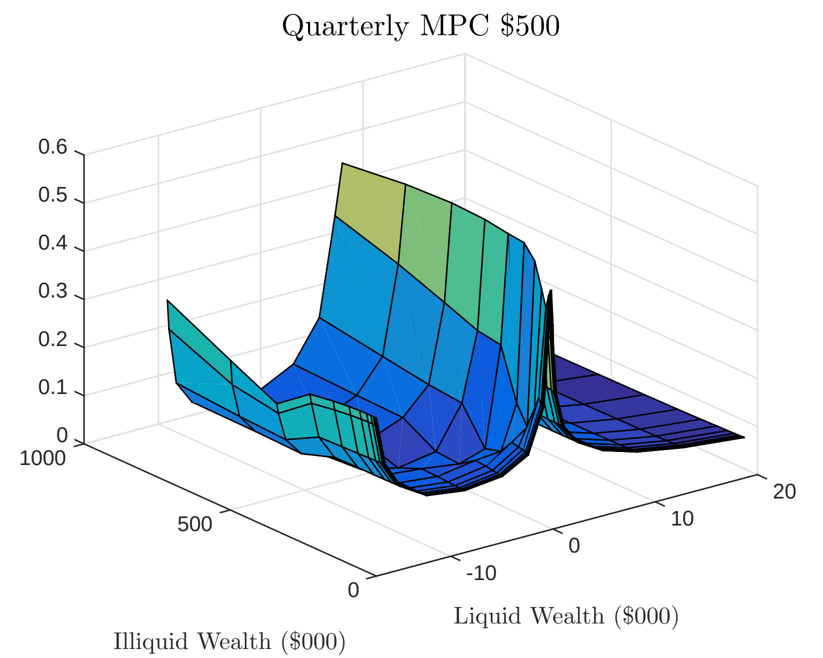
Wealth distributions: Illiquid wealth



- Top 10% share: Model: 59%, SCF 2004: 61%
- Top 1% share: Model: 19%, SCF 2004: 25%
- Gini coefficient: Model: 0.66, SCF 2004: 0.81

MPC heterogeneity





- Realistic representation of micro consumption behavior

RESULTS

Total effect of monetary policy shock

- Innovation $\epsilon < 0$ to the Taylor rule: $i = \bar{r}^b + \phi\pi + \epsilon$
- All experiments: $\epsilon_0 = -0.0025$, i.e. -1% annualized

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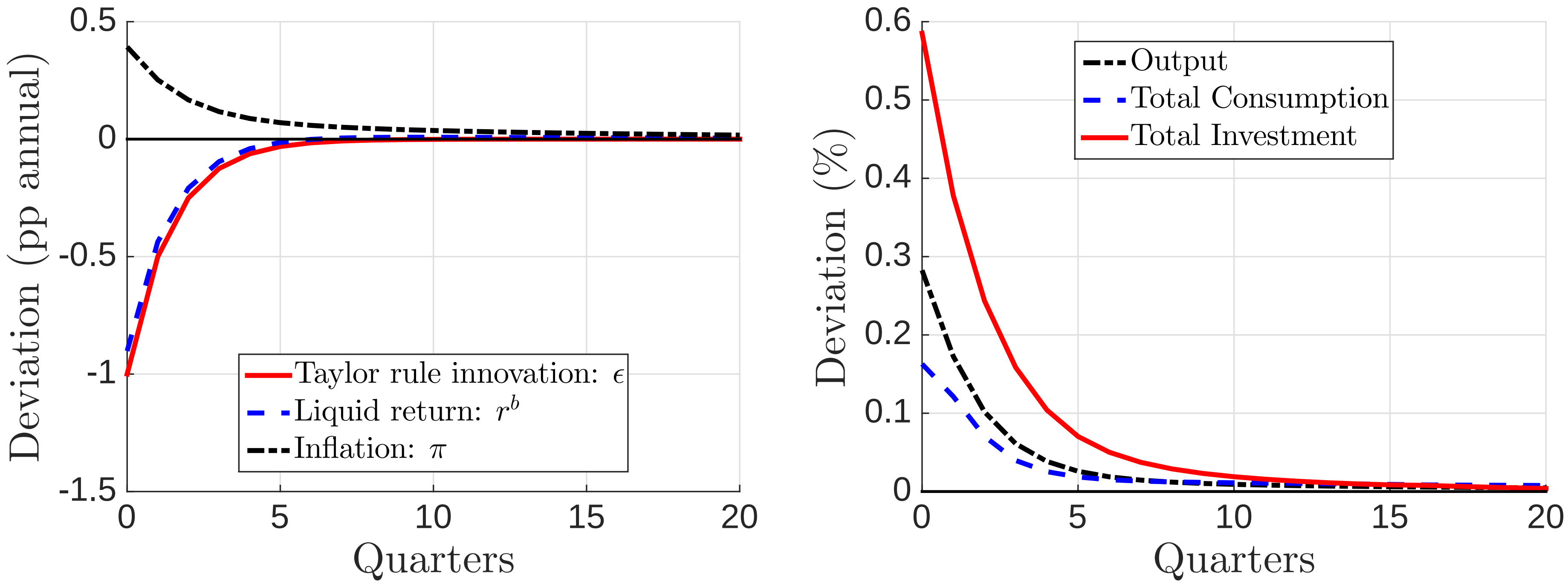

Transmission of monetary policy shock to C

$$dC = \underbrace{\frac{\partial C}{\partial r^b} dr^b}_{\text{direct}} + \underbrace{\frac{\partial C}{\partial w} dw + \frac{\partial C}{\partial r^a} dr^a}_{\text{indirect}}$$

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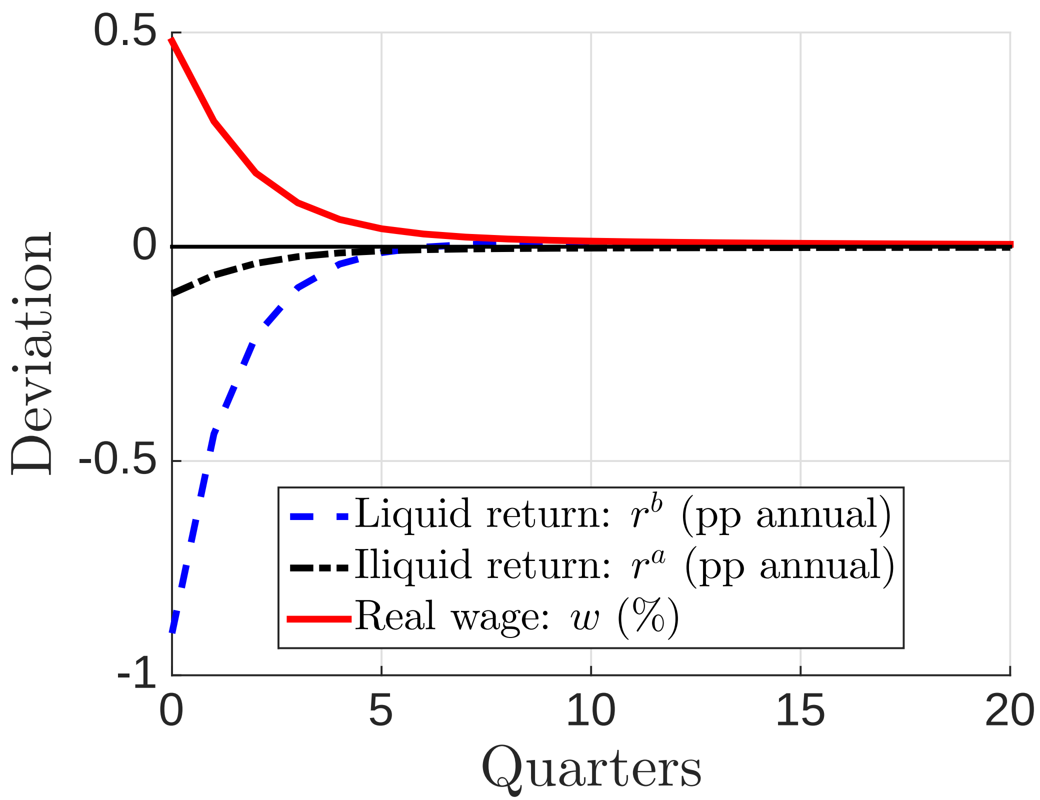

Transmission of monetary policy shock to C

$$dC = \left(\frac{\partial C}{\partial r^b} + \frac{\partial C}{\partial T}\frac{\partial T}{\partial r^b}\right) dr^b + \left(\frac{\partial C}{\partial w} + \frac{\partial C}{\partial T}\frac{\partial T}{\partial w}\right) dw + \frac{\partial C}{\partial r^a} dr^a$$

Transfers adjusts: direct effect from $r^b \downarrow$ on government debt
indirect effect of $w \uparrow$ on tax revenues

Transmission of monetary policy shock to C

$$dC = \underbrace{\left(\frac{\partial C}{\partial r^b} + \frac{\partial C}{\partial T}\frac{\partial T}{\partial r^b}\right) dr^b}_{24\%} + \underbrace{\left(\frac{\partial C}{\partial w} + \frac{\partial C}{\partial T}\frac{\partial T}{\partial w}\right) dw + \frac{\partial C}{\partial r^a} dr^a}_{76\%}$$

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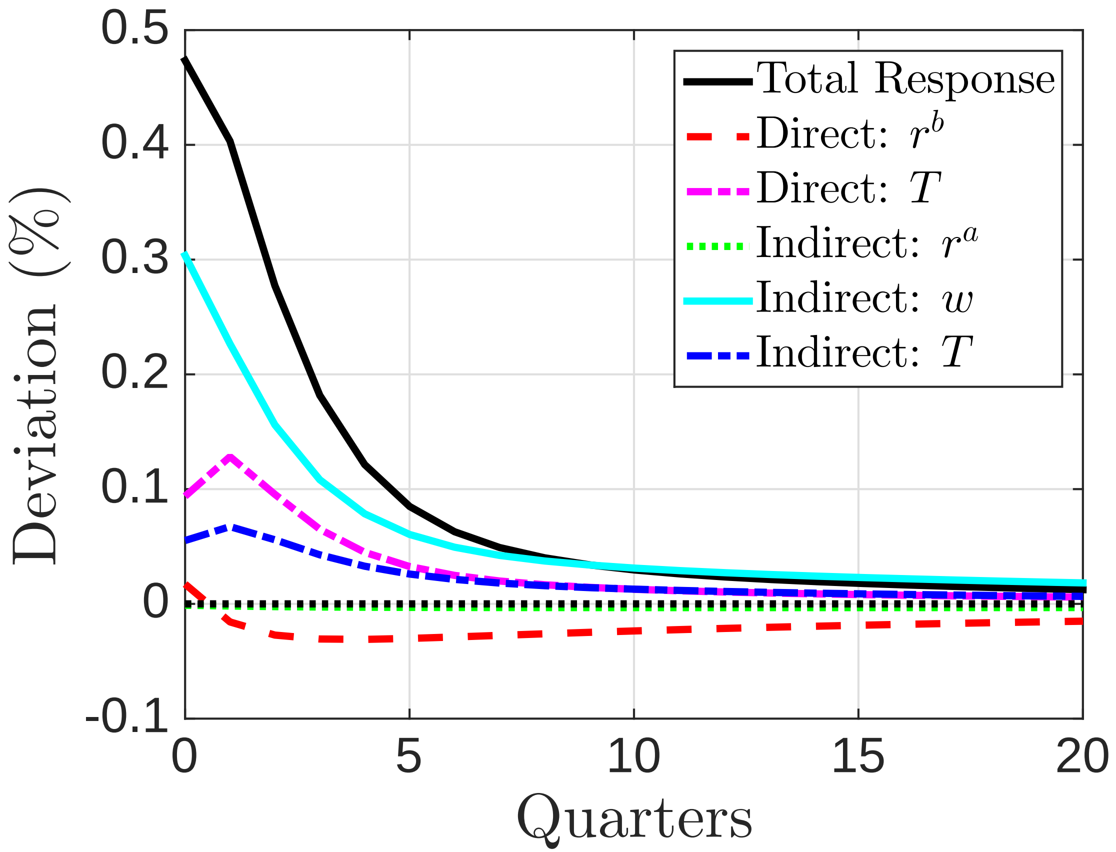
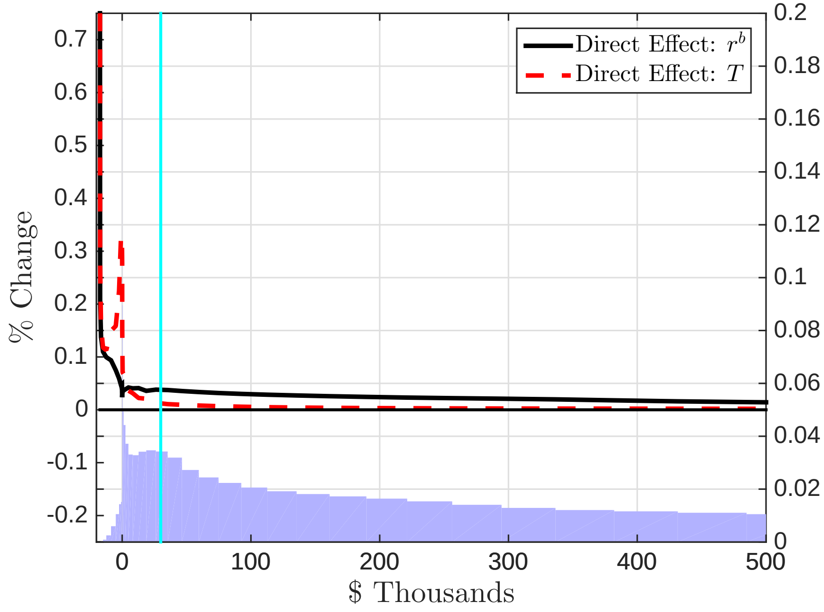
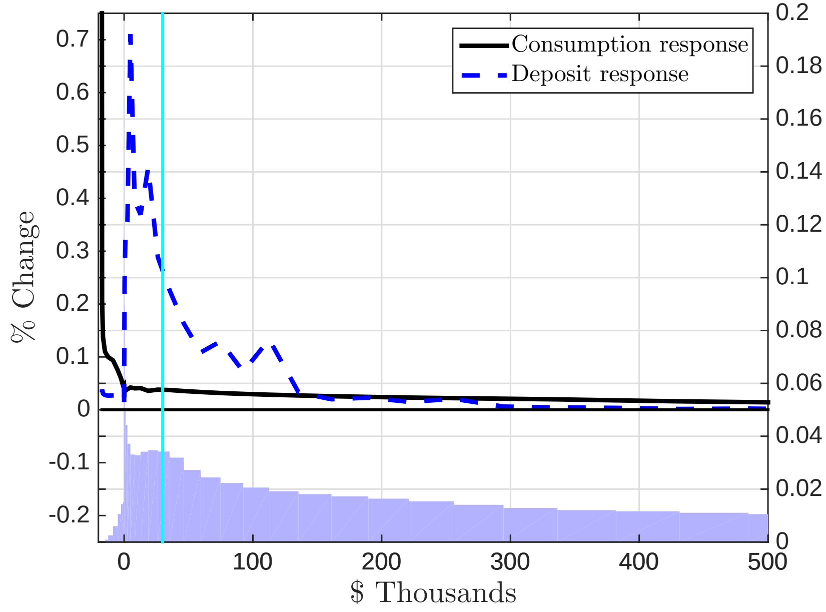


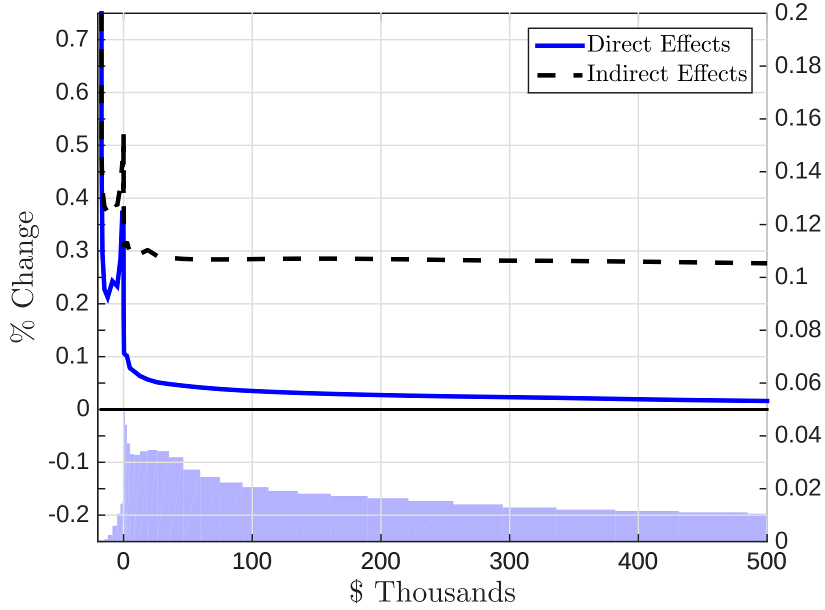
Transmission across the distribution: direct effects





- Intertemporal substitution: (+) for non-HtM
- Income effect: (-) for rich savers and (+) for borrowers
- Portfolio reallocation: (-) for those with near-zero income effect

Transmission across the distribution: indirect effects



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

Role of fiscal response in monetary transmission

	T adjusts (1)	G adjusts (2)	B^g adjusts (3)
Change in r^b (pp)	-0.23%	-0.21%	-0.25%
Change in C_0 (%)	0.47%	0.63%	0.09%
Elasticity of C_0 to r^b	-2.10	-3.01	-0.36

- G adjusts: G translates 1-1 into aggregate demand
- B^g adjusts: no direct stimulus to aggregate demand

Concluding remarks

- Main finding
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- Implications for conduct of monetary policy
  - Key: fiscal response and functioning of markets

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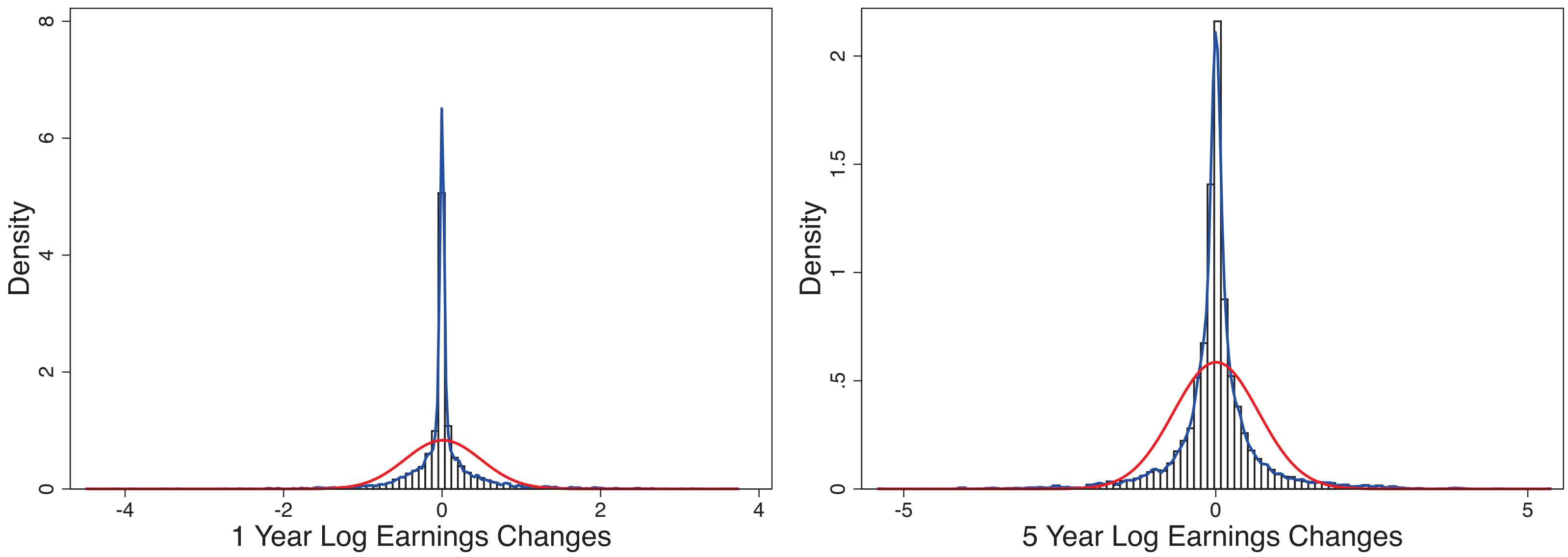
- Implications for conduct of monetary policy
  - Key: fiscal response and functioning of markets
- Road ahead
  - Forward guidance and unconventional monetary policy
  - Fiscal stimulus according to HANK

THANKS!

Earnings dynamics

Parameter		Component $j = 1$	Component $j = 2$
Arrival rate	λ_j	0.080	0.007
Mean reversion	β_j	0.761	0.009
St. Deviation of innovations	σ_j	1.74	1.53

- A career shock perturbed by periodic temporary shocks



Summary of market clearing conditions

- Liquid asset market

$$B^h = B^g$$

- Illiquid asset/capital market $\to r^a$

$$K = (1-\omega)A$$

- Labor market $\to w$

$$N = \int z\ell(a,b,z)d\mu$$

- Goods market $\to \pi$

$$Y = C + H + I + G + \chi + \text{borrowing costs} + \Theta$$