

# Firm Heterogeneity, Capital Misallocation and Optimal Monetary Policy

Discussion at Itam

by Saki Bigio (UCLA)  
on September 23, 2022

## » Point of the paper

- \* Investigates Role of Firm Heterogeneity in NK transmission
- \* Marries NK and Moll models

## » Point of the paper

- \* Investigates Role of Firm Heterogeneity in NK transmission
- \* Marries NK and Moll models
- \* Discussion:
  - \* how does MP impact capital misallocation?
  - \* how does misallocation impact monetary policy?

## » Point of the paper

- \* Investigates Role of Firm Heterogeneity in NK transmission
- \* Marries NK and Moll models
- \* Discussion:
  - \* how does MP impact capital misallocation?
  - \* how does misallocation impact monetary policy?
- \* Comments:
  - \* test mechanism directly

## » Preconception before reading paper

Misallocation:

- ★ not important at high frequency

## » Preconception before reading paper

### Misallocation:

- ★ not important at high frequency
- ★ capital reallocation about 25% GDP
- ★ capital-labor substitution very low at high frequency
- ★ distribution of net-worth: slow moving - speed needs excess returns

## » Preconception before reading paper

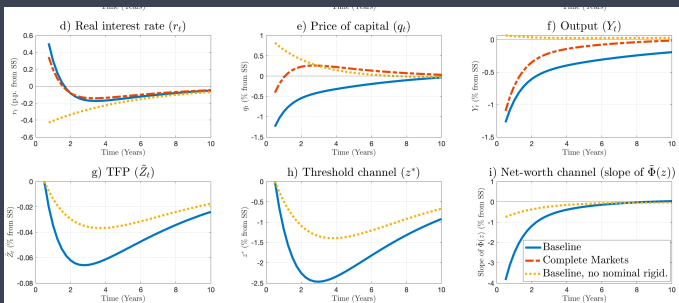
Misallocation:

- ★ not important at high frequency
- ★ capital reallocation about 25% GDP
- ★ capital-labor substitution very low at high frequency
- ★ distribution of net-worth: slow moving - speed needs excess returns

In exercises:

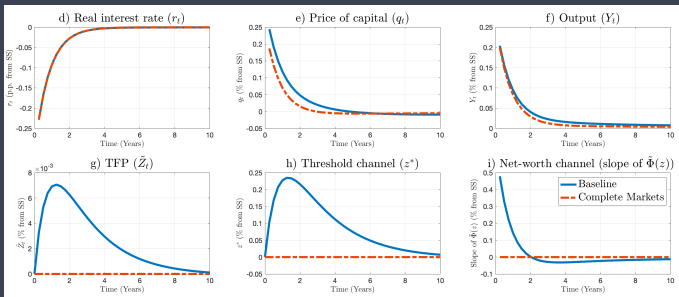
- \* has bite! but why?

# » Amplification - Patience Shock





# » Key Figures - Rate Shock



## » Preconception before reading paper

Does heterogeneity operate only through capital misallocation?

- ★ maybe amplifies labor wedge?
- ★ maybe impacts capital accumulation?
- ★ maybe impacts expectations?

Could additional channels matter more?

## » New-Keynesian Model

- \* Autonomous Euler Equation+Phillips Curve:

$$\frac{\dot{C}}{C} = \frac{i_t - \pi_t - \rho}{\sigma}$$

$$\dot{\pi}_t = \kappa \cdot \text{outputgap} + \rho\pi_t$$

## » New-Keynesian Model

- \* Autonomous Euler Equation+Phillips Curve:

$$\frac{\dot{C}}{C} = \frac{i_t - \pi_t - \rho}{\sigma}$$

$$\dot{\pi}_t = \kappa \cdot \text{outputgap} + \rho\pi_t$$

- \* Background Equations:

$$C_t = L_t$$

- \* Key (labor wedge)

$$\left( \rho - \frac{\dot{C}_t}{C_t} \right) \pi_t = \frac{\epsilon}{\Theta} \underbrace{\left( w_t - \frac{\epsilon - 1}{\epsilon} \right)}_{\text{final markup}} + \dot{\pi}_t$$

$$\frac{1}{C} w_t = L_t^\nu$$

## » New-Keynesian Model

- \* (rest of discussion) fixed price
- \* Euler Equation (solved backwards from ss)

$$\frac{\dot{C}}{C} = \frac{i_t - \rho + \epsilon_t}{\sigma}$$

- \* Adjustment through labor wedge:

$$\underbrace{w_t}_{\text{labor wedge}} = C_t^{1+1/\nu}$$

## » w/ Capital + Inelastic Labor Supply

- \* Euler Equation+
- \* Investment rate and price:

$$\frac{\dot{K}}{K} = \iota, \quad \Xi'(\iota) = q$$

- \* Consumption:

$$C = \underbrace{MPL(K) \cdot L}_Y - \underbrace{\iota K}_{I_t}$$

- \* Non-arbitrage:

$$i_t = \frac{MPK(k) - \delta q + \dot{q}}{q}$$

- \* adjustment: via  $\iota$

## » Polar Cases

- \* Inelastic Labor:
  - \* adjustment through investment
- \* Inelastic Capital:
  - \* adjustment through labor

## » Polar Cases

- \* Inelastic Labor:
  - \* adjustment through investment
- \* Inelastic Capital:
  - \* adjustment through labor
- \* NK model with capital
  - \* adjustment through labor and capital



## » Heterogeneity

- \* Firm return on capital

$$\underbrace{\left[ \max_{l|k} m_t z_t^\alpha (l|k)^{1-\alpha} - w_t l|k \right]}_{z\varphi(w,m)} k_t^o$$

## » Heterogeneity

- \* Firm return on capital

$$\underbrace{\left[ \max_{\ell/k} m_t z_t^\alpha (\ell/k)^{1-\alpha} - w_t \ell/k \right]}_{z\varphi(w,m)} k_t^o$$

- \* Key:

$$\ell/k = z_t (m_t, w_t)^{1/\alpha} (1 - \alpha)^{1/\alpha}$$

- \* Operational Revenue:

$$\varphi(w, m) = \Gamma(\alpha) \cdot m_t^{1/\alpha} w_t^{-(1-\alpha)/\alpha}$$

## » Capital Market

- \* Firms have allocated assets  $k$ :

$$\pi_t(z) k = \max_{k^o \in [0, \gamma k]} [z\varphi(w, m) - R_t] k^o + R_t k$$

- \* Threshold operating firm:

$$z^* \varphi(w, m) = R_t$$

- \* Clearing for capital input:

$$\int_0^\infty k F(k, z^*) dk = \int_0^\infty \gamma k (1 - F(k, z^*)) dk$$

- \* Complication: joint  $k$  and  $z$  distribution

## » My variation...

- \* Household owns capital stock
- \* Household distributes capital
  - \* equal amount of capital to every firm
  - \* firms trade
  - \* distribute profits back

## » My variation...

- \* Household owns capital stock
- \* Household distributes capital
  - \* equal amount of capital to every firm
  - \* firms trade
  - \* distribute profits back
- \* Market Clearing

$$KF(z^*) = K\gamma(1 - F(z^*))$$

- \*  $z^*$  fixed!

## » Rep Firm

\* Aggregation:

$$C_t = \bar{Z}_t L_t^{1-\alpha}$$

## » Rep Firm

- \* Aggregation:

$$C_t = \bar{Z}_t L_t^{1-\alpha}$$

- \* Result:

$$\bar{Z}_t \equiv \mathbb{E} [z_t | z_t > z_t^*]$$

$$L_t/K_t = \bar{Z}_t (m_t/w_t)^{1/\alpha} (1 - \alpha)^{1/\alpha}$$

- \* Rental rate of capital

$$z^* \varphi(w, m) = R_t$$

## » Aggregate Model

- \* Euler Equation (as in NK model)



## » Aggregate Model

- \* Euler Equation (as in NK model)
- \* Adjustment through labor wedge:

$$\underbrace{w_t}_{\text{labor wedge}} = \frac{1}{\bar{z}_t^{1/\nu}} C_t^{1+1/\nu}$$

## » Aggregate Model

- \* Euler Equation (as in NK model)
- \* Adjustment through labor wedge:

$$\underbrace{w_t}_{\text{labor wedge}} = \frac{1}{\bar{Z}_t^{1/\nu}} C_t^{1+1/\nu}$$

- \*  $m$  determined by:

$$L_t/K_t = \bar{Z}_t (m_t/w_t)^{1/\alpha} (1 - \alpha)^{1/\alpha}$$

- \* Non-arbitrage  $q$

$$i_t = \mathbb{E}[\pi_t(z)] / q + \frac{\dot{q}}{q} - \delta$$

## » Benchmark in Discussion

- \* Equivalent representative agent NK model
- \* Actual model:
  - \* investment
  - \* but nothing in production block is altered
- \* Hence: key object
  - \* evolution of firm capital stock:

$$F(k, z)$$

- \* Key question: how does monetary policy affect this object?
- \* my version, no effect!

## » What my version differ?

- \* In my version:
  - \* firm distributes profits
  - \* households allocate capital
  - \* no force to alter  $F$
- \* Distribution of capital moves in paper
  - \* households and firms save independently,  $F(k, z) = K^F$  and  $K^H$

## » Key Mechanism in Paper

- \* Akin to standard NK model:
  - \* MP works by impacting real wages (movement along labor supply)
  - \* Firm profits similar pattern:

$$\pi(z) = \text{cons} \cdot \frac{z_t}{\bar{z}_t} \frac{L_t}{K_t} \cdot w_t$$

- \* Monetary policy shock compresses real profits
  - \* firms and household exposed differently
    - \* MP compresses distribution of wealth
    - \*  $\downarrow z^*$

## » Channels: effect of $\downarrow z^*$

- \* First channel: static

- \* efficiency:  $\downarrow z^* \rightarrow \downarrow \bar{Z}$  + labor wedge amplification

- \* Second channel: investment dynamics

- \* rental rate of capital

$$\downarrow z^* \varphi(w, m) = R$$

- \* but  $q$  determined by:

$$i_t = \mathbb{E}[R] / q + \frac{\dot{q}}{q} - \delta$$

- \* forward looking effects in NK model

## » Comments

- \* Isolate static and dynamic mechanisms
  - \* static: source compression of firm profit distribution (test this!)
  - \* dynamic: linked to lower  $R$
  - \* regressions in paper:
    - \* Investment can differ → adjustment costs at individual level

## » Comments

- \* Isolate static and dynamic mechanisms
  - \* static: source compression of firm profit distribution (test this!)
  - \* dynamic: linked to lower  $R$
  - \* regressions in paper:
    - \* Investment can differ → adjustment costs at individual level
- \* Quantitatively: investment seems driver, not TFP!
- \* Verify claim:
  - \* static mechanism: amplified by Frisch elasticity+labor share
  - \* dynamics: impact on investment (study fixed K benchmark)



## » Comment - Firm Flows

- \* Still feel the model needs to reconcile:
  - \* between firms: capital flows
  - \* within firms: across time
  - \* out of firm: household reallocation of profits
  - \* quantitatively realistic?

## » Comment - Firm Flows

- \* Still feel the model needs to reconcile:
  - \* between firms: capital flows
  - \* within firms: across time
  - \* out of firm: household reallocation of profits
  - \* quantitatively realistic?
- \* Labor market
  - \* mobile across firms (J2J transitions)?
  - \* but business cycle mechanism is outflow from labor market
  - \* labor allocated to zero productivity

## » Comment - Firm Flows

- \* Still feel the model needs to reconcile:
  - \* between firms: capital flows
  - \* within firms: across time
  - \* out of firm: household reallocation of profits
  - \* quantitatively realistic?
- \* Labor market
  - \* mobile across firms (J2J transitions)?
  - \* but business cycle mechanism is outflow from labor market
  - \* labor allocated to zero productivity
- \* Quant channel distortion of investment:
  - \* is  $R$  or  $i$  what matters
  - \* is mechanism feasible