

# Corporate Finance and Monetary Policy

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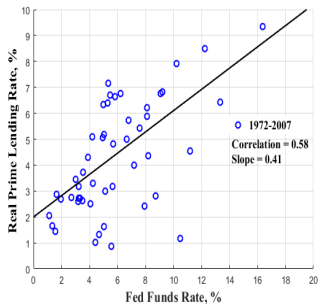
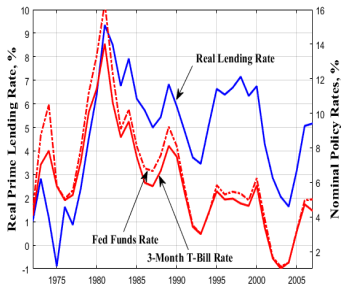
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## What we do

- A model of corporate finance and monetary policy
- How policy (with different instruments) affects:
  - firms' financing choices (money and credit)
  - interest rates
  - investment
- Implications for pass through and transmission mechanism
  - ① Pass through and microstructure
  - ② Transmission and firm heterogeneity

# Pass through



# Key ingredients

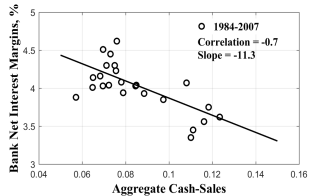
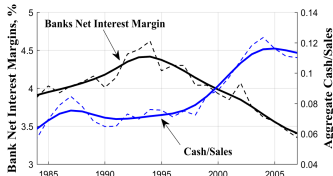
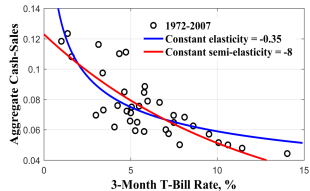
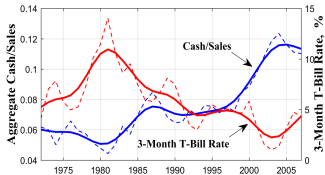
## ① Competing financing means: cash and credit

- relevant empirically  
e.g., for small businesses (SSBF, 2003)
  - Liquid assets: 95%
  - Credit line or bank loan: 45%
  - Owner loans: 30%

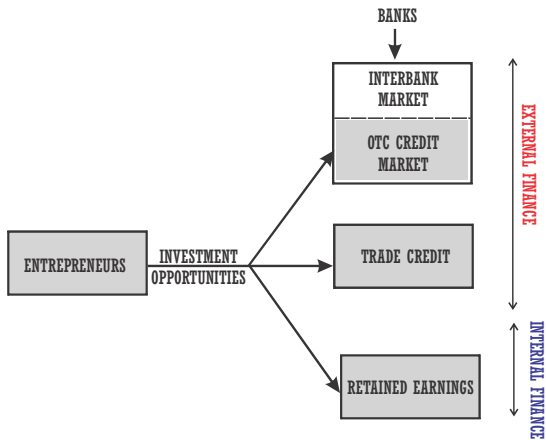
## ② Market for bank loans as an OTC market

- bilateral contracts, search and bargaining
- intensive and extensive margins of credit

# Firms' money demand, banks' profitability



# Our model



# Insights

- ① **Pass through** from nominal policy rate to real lending rate
  - without nominal rigidities, segmentation, regulation
  - depends on credit frictions, policy instruments, etc.
- ② **Transmission mechanism**
  - disconnect between pass through and transmission
  - depends on firms' characteristics, credit frictions
  - policy implementation, e.g., OMOs
- ③ By-products: topical phenomena (negative rates, liquidity traps)

# Literature

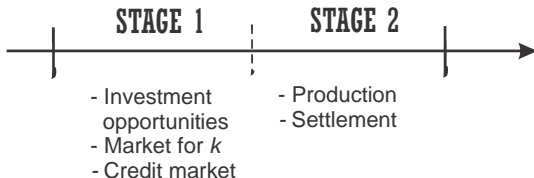
- ① New Monetarist approach to money, credit, and banking
  - Money and credit: e.g. Sanches and Williamson (2010)
  - Banking: e.g. Cavalcanti and Wallace (1999)
- ② Frictions in credit market
  - Limited pledgeability: e.g. Kiyotaki and Moore (1997)
  - Search frictions: e.g. Wasmer and Weil (2004)
  - Intermediation spreads: e.g. Duffie et al. (2005)
- ③ Corporate finance and policy: e.g. Bolton and Freixas (2006)
- ④ Monetary policy and transmission: e.g. Bernanke et al. (1999)



# ENVIRONMENT

# Time, goods

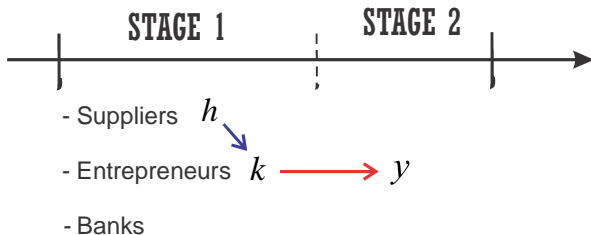
- Time:  $t = 0, 1, 2, \dots, \infty$
- Each period has two stages:
  - ① Competitive market for capital ( $k$ )  
OTC market for bank loans
  - ② Production ( $y$ ) and settlement of debts



- Capital is durable across stages but not across periods

# Agents

- 3 types of agents
  - ① Suppliers: produce  $k$
  - ② Entrepreneurs: transform  $k$  into  $y$
  - ③ Banks



# Preferences

$$U(c, h) = \underbrace{c}_{\text{consumption}} - \underbrace{h}_{\text{labor}}$$

- Discount factor:  $\beta = 1/(1 + \rho)$

# Technologies

- **Entrepreneur's technology:**

$$y = \varepsilon f(k) \quad \text{where } \varepsilon \in \{0, 1\}$$

where  $\{\varepsilon_t\}$  iid with  $\Pr(\varepsilon_t = 1) = \lambda$

- **Supplier's technology:**

$$k = h$$

## Limited enforcement/commitment

- $k$  in stage 1  $\longrightarrow$   $y$  in stage 2
- Entrepreneurs cannot commit to repay in stage 2
- Suppliers have no recourse (no trade credit)  
(in paper:  $\chi_s f(k)$  is pledgeable to suppliers)

# Banks

- 1 issue short-term liabilities
  - can serve as means of payment because banks can commit to repay
- 2 supply loans
  - can enforce repayment up to  $\chi_b f(k)$  where  $\chi_b \in (0, 1]$

## Frictions in credit market

- $\alpha \in (0, 1]$  pairwise meetings between entrepreneurs and banks
  - delays to get loan application accepted
- Short-lived relationships: destroyed at end of period
- Terms of loan contract determined through bargaining



# EXTERNAL FINANCE

## Bank credit

- Loan contract: loan size,  $k$ , and interest payment,  $\phi$

$$\text{Entrepreneur's surplus} \quad : \quad S^e = f(k) - k - \phi$$

$$\text{Bank's surplus} \quad : \quad S^b = \phi$$

- Nash bargaining s.t. **pledgeability constraint**:

$$\max (S^e)^{1-\theta} (S^b)^\theta \quad \text{s.t.} \quad \overbrace{k + \phi}^{\text{principal+interest}} \leq \overbrace{\chi_b f(k)}^{\text{pledgeable output}}$$

## Terms of the loan contract

- ① If  $\chi_b \geq \chi_b^*$ , then  $k = k^*$  and

$$\phi = \theta [f(k^*) - k^*].$$

Lending rate

$$r \equiv \frac{\phi}{k} = \overbrace{\theta \frac{[f(k^*) - k^*]}{k^*}}^{\text{intermediation premium}}$$

- ② If  $\chi_b < \chi_b^*$ , pledgeability binds

	$\theta$	$\chi_b$
$k$	-	+
$\phi$	+	+
$r$	+	0

# INTERNAL FINANCE

## Adding money

- Investment can be financed with earnings retained in cash
- Supply of money:  $M_{t+1} = (1 + \pi)M_t$
- Unbanked entrepreneur with  $a_m^e$  real balances:

$$\Delta^m(a_m^e) = \max \{f(k^m) - k^m\} \text{ s.t. } k^m \leq a_m^e$$

## Terms of loan contract

$$\begin{aligned}
 (k, d, \phi) \in \arg \max & \left[ \overbrace{f(k) - k - \phi}^{\text{profits}} - \overbrace{\Delta^m(a_m^e)}^{\text{disagreement}} \right]^{1-\theta} \phi^\theta \\
 \text{s.t.} & \quad \overbrace{k - d}^{\text{loan size}} + \phi \leq \chi_b f(k) \\
 & \quad \underbrace{d}_{\text{down payment}} \leq \underbrace{a_m^e}_{\text{real balances}}
 \end{aligned}$$

- ① Money raises financing capacity,  $\chi_b f(k) + a_m^e$
- ② And affects bargaining position,  $\Delta^m(a_m^e)$

## Terms of loan contract

- If liquidity constraint does not bind:  $k^c = k^*$
- Lending rate decreases with  $a_m^e$

$$r = \frac{\theta [f(k^*) - k^* - \Delta^m(a_m^e)]}{k^* - a_m^e}$$

# Coexistence of money and credit

- Entrepreneurs retain earnings in cash to maximize:

$$-ia_m^e + \underbrace{\lambda(1-\alpha)\Delta^m(a_m^e)}_{\text{internally financed}} + \underbrace{\lambda\alpha\Delta^c(a_m^e)}_{\text{banked financed}}$$

where  $1+i = (1+\rho)(1+\pi)$

- **RESULT #1:** For all  $i > 0$  and  $\chi_b > 0$ , **money and credit coexist** if  $\lambda(1-\alpha) > 0$  or  $\lambda\alpha\theta > 0$



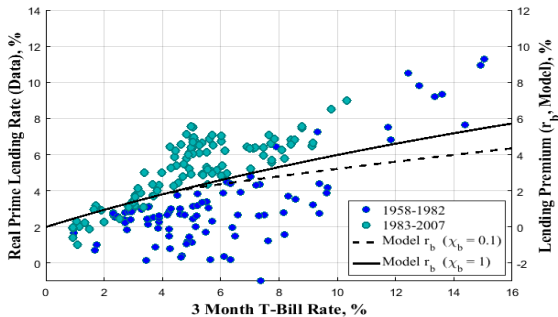
## Pass through

- **RESULT #2: Nominal rate affects real lending rate**
  - No regulation
  - No nominal rigidity
  - No market segmentation
- For small  $i$ :

$$r \approx \frac{\theta}{2\lambda [1 - \alpha(1 - \theta)]} i$$

# Pass through

- $f(k) = k^{1/3}$ ,  $\theta = 0.16$ ,  $\alpha = 0.9$ ,  $\lambda = 2/3$



## Transmission

- **RESULT #3: Disconnect between pass through and transmission**
- For small  $i$ , aggregate investment is

$$K \approx \underbrace{\lambda \alpha k^*}_{\text{bank financed}} + \underbrace{\lambda(1-\alpha)k^* + \frac{(1-\alpha)i}{f''(k^*)[1-\alpha(1-\theta)]}}_{\text{internally financed}}$$

- $\partial r / \partial i$  (pass through)  $\uparrow$  with  $\alpha$  and  $\theta$   
but  $|\partial K / \partial i|$  (transmission)  $\downarrow$  with  $\alpha$  and  $\theta$

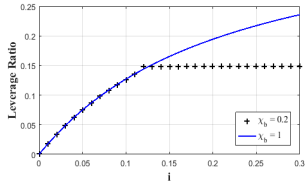
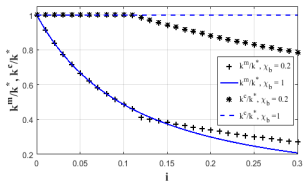
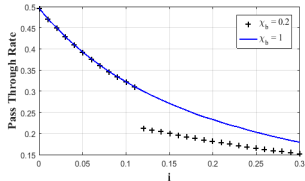
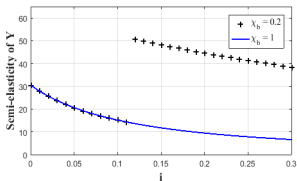
## Transmission with 2 channels

- **RESULT #4:** Transmission changes qualitatively when liquidity constraint binds,  $i \geq \bar{i}$

$$\underbrace{k^c - k^*}_{\text{bank lending channel}} \approx \underbrace{\frac{1}{1 - \chi_b}}_{\text{financing multiplier}} \underbrace{\frac{k^m - \bar{k}}{(i - \bar{i})}}_{D}$$

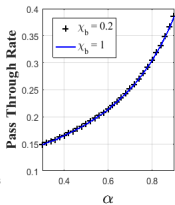
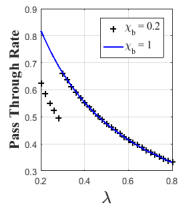
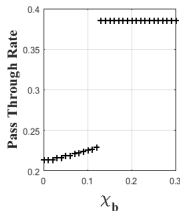
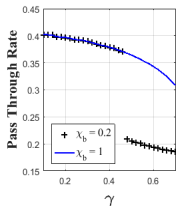
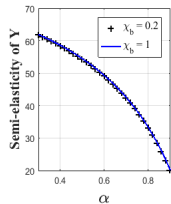
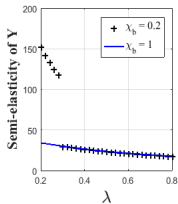
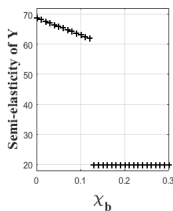
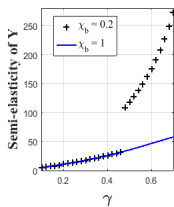
# Transmission and pass through

- $f(k) = k^{1/3}$ ,  $\theta = 0.16$ ,  $\alpha = 0.9$ ,  $\lambda = 2/3$



# Firm heterogeneity

- firms' characteristics:  $f(k) = k^\gamma$ ,  $\chi_b$ ,  $\lambda$ ,  $\alpha$



# INTERBANK MARKET

Policy with different interest rates

# Interbank market

- Reserve requirement:

$$\text{Reserves} = v \times \overbrace{l}^{\text{bank's liabilities}}$$

- A competitive interbank market in stage 1
- Banks can commit to repay intra-period loans to other banks
- Interbank rate:  $i_f$



## Pass through

- **RESULT #5:**  $i$  and  $i_f$  have distinct pass through rates
- For small  $i > \lambda v i_f$ ,

$$r \approx v i_f + \frac{\theta (i - \lambda v i_f)}{2\lambda [1 - \alpha(1 - \theta)]}$$

- Transmission:

	$i$	$i_f$
$k^m$	-	+
$k^c$	0	-
$K$	-	-

## OMO in interbank market

- $M$  increases by  $\mu M > 0$  to purchase bonds
- Asset purchases in stage 2 are neutral
- Purchases in the interbank market are non-neutral
- Redistribution of liquidity
  - ① Entrepreneur's real balances fall
  - ② Bank-financed investment increases
- Interbank rate decreases

## Conclusion: Follow-up projects

- ① Lending relationships and optimal policy  
(Rocheteau, Wong, and Zhang 2016)  
Policy trade-off: lending relationship creation vs self-insurance
- ② Life cycle of firms, money demand, and financing choices  
Dynamics of money accumulation and access to banking
- ③ Alternative market and information structures  
Adverse selection in loan market under competitive search