

# Breaking Bagehot's Rules: Loan Contracting with Advantageous Central Bank Funding

*Christian Eufinger (IESE) and Zhiqiang Ye (Zhejiang University)*

Conference on Markets and Intermediaries - Frankfurt  
October 1-2, 2024

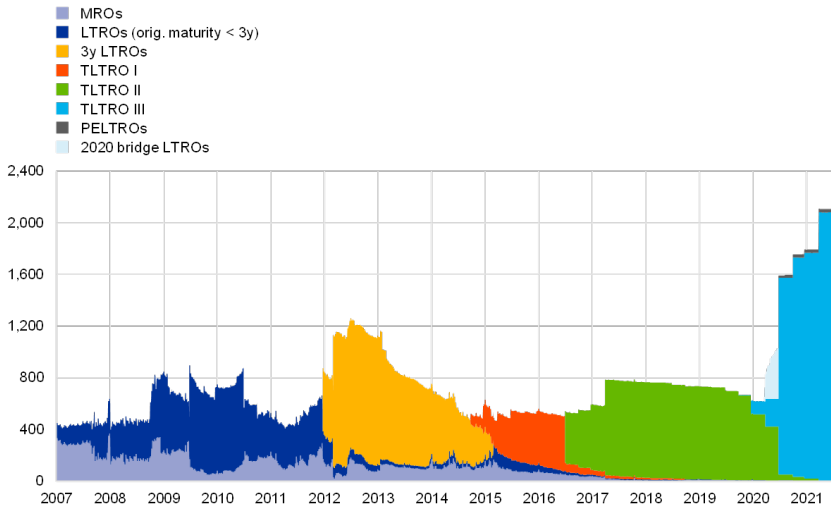
# Preferential central bank funding schemes

- Since global financial crisis, central banks have fundamentally redefined their role, extending beyond classical “lender of last resort” (LOLR)
- New tool: preferential funding schemes (e.g., ECB’s LTRO)
- Primary purposes (BIS, 2023; Carlson and Zarutskie, 2022; Goodhart et al., 2020):
  - Stimulate credit growth
  - Improve bank profitability and liquidity

# Examples

- Bank of Japan's "Loan Support Program"
- ECB's "Long-Term Refinancing Operations" (LTRO) and Targeted-LTRO (TLTRO)
- Bank of England's "Funding for Lending Scheme"
- Fed's Bank Term Funding Program

# LTRO volumes



## Preferential CB funding schemes usually contain:

- Preferential interest rates (below market rate):
  - Ex: ECB's TLTRO programs offered rates as low as -1%
- Preferential collateral requirements (compared to market requirements):
  - Ex (1): ECB's haircut on 5-year PT government bonds 4% in 2010, while market haircut 10%
  - Ex (2) Fed's Bank Term Funding Program values collateral at par

# Research questions

- Effects of preferential CB funding schemes studied empirically:
  - Andrade et al., 2019; Cahn et al., 2017; Carpinelli and Crosignani, 2021; Casiraghi et al., 2013; Darracq-Paries and De Santis, 2015; Garcia-Posada and Marchetti, 2016; Bednarek et al., 2021; Acharya and Steffen, 2015; Andreeva and Vlassopoulos, 2019; Crosignani et al., 2020; van der Kwaak 2022; and many others
- ...but (a) theoretical analyses scarce (b) unclear transmission mechanism from the CB schemes to firm behavior
- We address this gap by investigating how preferential CB funding schemes (interest rates and collateral requirements) affect ...
  - Loan contracting
  - Borrower investments (size and efficiency)

# Effects of preferential CB funding schemes

- Incentivize banks to encourage their borrowers to take on **excessive leverage and overinvest**
- If collateral requirements sufficiently lenient, banks lose monitoring incentives and steer borrowers toward inferior **high-risk projects**
- **Interaction** between preferential interest rates, collateral requirements, and market rates
  - Favorable rates and lower market rates can amplify negative effect of lenient collateral requirements on banks' loan contracting and borrowers' investment efficiency
- Although such funding programs may provide short-term benefits to banks' credit growth and profitability, they can plant seeds for financial instability and hinder economic growth in the long run

# Model

## Model setup



# Model overview

- Risk-neutral players: firm, bank, central bank, and numerous competitive household investors (“investors”)
- Firm (with equity endowment  $E$ ) has real investment projects: good & bad
- Bank offers loan contract to firm and can monitor it
  - Bank monitoring: force firm to choose good project
- Investors provide funds to both, firm and bank
- Central bank (CB) provides preferential funding scheme to bank

# Firm projects

- Firm's projects are represented by  $\{F(I), P\}$ 
  - $I$ : investment scale
  - $F(I)$ : project return when successful
  - $P$ : success probability
- Good project:  $F(I) = f(I)$  and  $P = p_H$ .
- Bad project:  $F(I) = \delta f(I)$  (with  $\delta > 1$ ) and  $P = p_L$  (with  $p_L < p_H$ ).
  - $f'(I) > 0$ ,  $f''(I) < 0$ , and  $f(0) = f'(\infty) = 0$ .
- Good project is “good” and bad project “bad” from efficiency perspective:

$$p_H f'(E) > 1 + r > p_L f'(0).$$

- $1 + r$ : Market interest rate / investors' cost of capital

# Firm moral hazard

- Without monitoring, firm will choose good project only if:

$$p_H [f(I) - R_{out}] \geq p_L [\delta f(I) - R_{out}], \text{ [Firm IC]}$$

- $R_{out}$ : nominal return promised to outside funding providers
- IC holds when  $I$  is not too large
- Without monitoring,  $I$  cannot exceed upper bound  $\bar{I}$

# Bank lending and monitoring

- Bank can monitor firm (force firm to implement good project; moral hazard disappears)
- Banks can offers loan contract  $\{R_b, q\}$  to firm
  - $q$ : loan volume
  - $R_b$ : promised loan repayment
- Bank incurs private participation costs  $\gamma$  when lending (e.g., debt overhang or giving up risk-shifting opportunity)
- Bank's funding sources:  $\alpha q$  from CB funding scheme with nominal interest rate  $1 + r_c$  and  $(1 - \alpha)q$  from investors (fairly priced)

# Preferential CB funding

CB funding is “preferential”:

- Rate  $1 + r_c <$  market-based interest rate
- Favorable collateral requirements:
  - Collateral covers proportion  $\lambda \in [0, 1]$  of CB interest rate  $1 + r_c$
  - If bank defaults it incurs per-unit value loss of  $\lambda(1 + r_c)$ , which is CB's collateral seizure
  - Lower  $\lambda \Rightarrow$  more favorable collateral requirements

# Bank profit

- Bank's expected per-unit payment to central bank is

$$\iota(P) \equiv P(1 + r_c) + (1 - P) \lambda(1 + r_c),$$

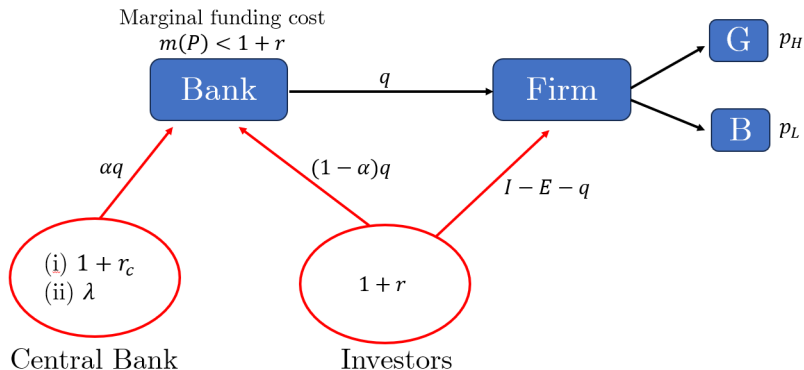
- $P = p_H$  or  $p_L$ , depending on firm's project choice
  - $\iota(P) < 1 + r$ : CB funding less costly than market-based funding
- Bank's marginal funding costs:

$$m(P) \equiv (1 - \alpha)(1 + r) + \alpha\iota(P) < 1 + r$$

- Bank profit:

$$\pi_b(R_b, q, P) = PR_b - qm(P) - \gamma$$

# Setup overview



# Optimal bank contract

## Optimal bank contract - with compulsory monitoring



# Optimal contract with *compulsory monitoring*

## Proposition 1

With compulsory monitoring, the bank's optimal contract,  $\{R_b^h, q^h\}$ , is given by solution of the following system of equations

$$p_H f'(q^h + E) = m(p_H),$$

$$p_H R_b^h = p_H f(q^h + E) - E(1 + r) - (p_H f(\bar{I}) - \bar{I}(1 + r))$$

**If bank lends to firm, the firm's investment level is  $\underline{I^h} \equiv q^h + E > I^*$  and thus higher than the efficient level.**

# Optimal contract with *compulsory monitoring* (cont.)

## Corollary 1

*Extent of investment inefficiency and firm's leverage increase with extent of CB funding cost advantage (i.e., increase with  $\alpha$  and decrease with  $\iota(p_H)$ )*

As  $m(p_H)$  decreases (i.e.,  $\alpha$  becomes higher or  $\iota(p_H)$  becomes lower):

- Lending spread  $1 + r - m(p_H)$  becomes more profitable;
- Bank increases  $q^h$  to extract more profit from lending spread, worsening firm's overinvestment

# Optimal bank contract

## Optimal bank contract - without compulsory monitoring

# Without compulsory monitoring

## Proposition 2

If following inequality holds:

$$\underbrace{\alpha (1 - \lambda) (1 + r_c) \Delta p}_{=m(p_H) - m(p_L)} > (p_H - p_L \delta) f'(0),$$

*it is optimal for the bank to offer the bad project loan contract  $\{R_b^l, q^l\}$  when the bank's liabilities are sufficiently large. The firm implements the bad project after accepting the contract.*

# Why does bank potentially waive monitoring?

With  $\lambda < 1$ , inducing firm to implement bad project has two effects:

- Cost-saving:  $m(p_L) < m(p_H)$ .
  - Lowers likelihood that bank has to honor its debt repayment obligations
- Income-reducing:
  - Bad project's expected return  $<$  good project's expected return

When cost-saving effect  $>$  income-reducing effect (if  $\lambda$  sufficiently small), bank waives monitoring

# Why does bank potentially waive monitoring?

## Proposition 3

*If there exists a  $\lambda$  for which bank prefers bad project, then there exists a  $\hat{\lambda}$  with  $\hat{\lambda} \in [0, 1)$  for which bank prefers bad (resp. good) project whenever  $\lambda \leq \hat{\lambda}$  (resp.  $\lambda > \hat{\lambda}$ )*

- Corollary: more severe borrower overinvestment when bad project is implemented ( $q^l > q^h$ )

# Interaction preferential rate and collateral requirement

Depending on bank's debt level, lowering CB funding scheme (lowering  $r_c$ ) can either amplify or weaken negative effect of preferential collateral requirements on bank's loan contract design.

## Proposition 4

$r_c \downarrow$  will shift bank's preference toward bad project if:

$$\frac{D^l}{D^h} > \frac{p_H + (1 - p_H)\lambda}{p_L + (1 - p_L)\lambda}.$$

# Interaction preferential rate and collateral requirement

$r_c \downarrow$  has two opposing effects on bank's project preference:

- Spread effect:

- Bank's success likelihood (and thus having to repay its debt obligations) higher if bank implements good instead of bad project loan contract
- Decreasing  $r_c$  decreases bank's marginal funding costs more for good project loan contract (i.e.,  $\Delta m(p_H) > \Delta m(p_L)$ )

- Level effect:

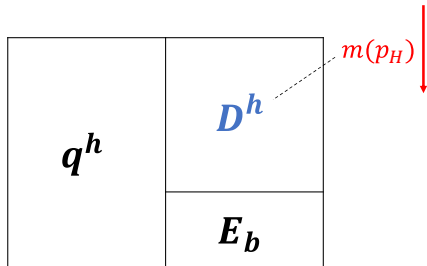
- If  $D^l > D^h$ , reduction in bank's marginal funding costs by some  $\tau$  decreases bank's funding costs by more for bad than for good project loan contract (as  $\tau D^l > \tau D^h$ )

⇒ If  $D^l \gg D^h$ , level effect  $>$  spread effect, shifting bank's preference toward firm's bad project (i.e., waiving monitoring).

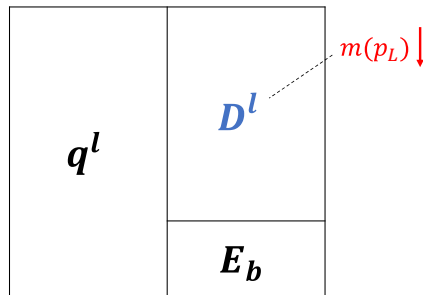


Effect of  $r_c \downarrow$ 

Panel A: Good project case



Panel B: Bad project case



■ Level effect    ■ Spread effect

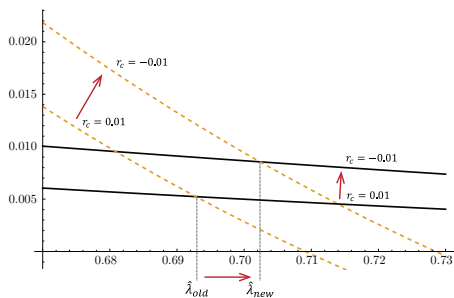
# Interaction preferential rate and collateral requirement

- Whether  $r_c \downarrow$  has amplification or dampening on risk-taking is determined by favorability of collateral requirement
- $D^l > D^h$  holds if collateral requirement sufficiently lenient:

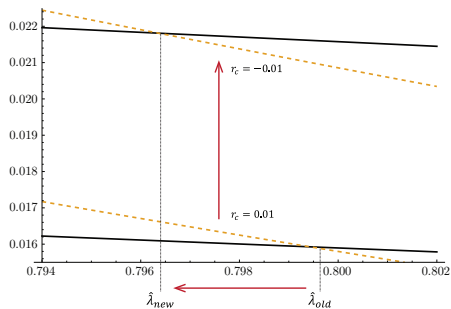
$$\lambda < \bar{\lambda} \equiv \frac{1 - \frac{1}{\delta}}{1 - \frac{1}{\delta} + \frac{1}{p_L \delta} - \frac{1}{p_H}} - \frac{(1 - \alpha)}{\alpha} \frac{(1 + r) \left( \frac{1}{p_L \delta} - \frac{1}{p_H} \right)}{(1 + r_c) \left( \frac{1 - p_L}{p_L \delta} - \frac{1 - p_H}{p_H} \right)}.$$

# Potential amplification through preferential rate

Panel A: Level effect dominates



Panel B: Spread effect dominates



--- Bad Project    — Good Project

# Further Results

- Similar finding for decrease in market rate as for decrease in preferential CB funding rate
- Optimal central bank funding scheme involves
  - 1 bid limit for banks
  - 2 sufficiently strict collateral requirements
- Results robust to endogenous firm equity decision
- Results robust to economy with infinite number of nonidentical firms

# Conclusion

- We examine impact of preferential central bank funding on (i) banks' loan contract design, (ii) their monitoring incentives, and (iii) borrowers' investment behavior
- Preferential funding schemes can incentivize banks to encourage their borrowers to
  - take on excessive leverage
  - overinvest
  - invest in inferior high-risk projects
- Dangerous to have both, preferential interest rates and favorable collateral requirements, due to interaction effects