

Open Banking: Lending Market Competition and Resource Allocation Efficiency

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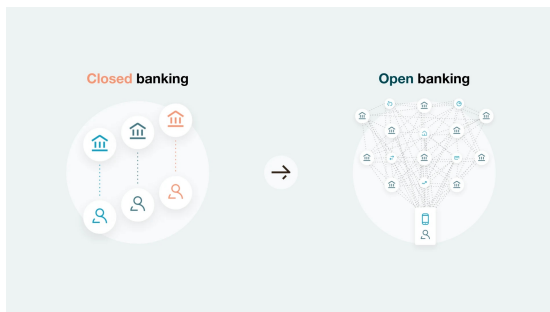
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Open Banking: Data Control and Data Sharing



Closed banking model

- The customers' banks have sole control and possession of customer data.

Open banking model

- A large number of traditional banks, new providers and fintech companies will have access to customer data.

Is Open Banking Desirable?

Open banking aims at increasing lending market competition.

- 1 How does open banking reshape lending market competition?
 - Effectiveness in competition
 - How does maturity transformation play a role?
- 2 What are the consequences of regime shift from closed banking to open banking?
 - **Resource allocation**
 - Funding efficiency and screening efficiency
 - Can open banking improve resource allocation efficiency?
 - **Bank financing**
 - How does open banking affect bank borrowing cost?
 - **Financial inclusion**
 - Will ex-ante underbanked borrowers benefit from open banking?

Preview of Model

- Bank i 's **signal** = $f(\text{Borrower data}; \text{Algorithm}_i)$
 - Closed banking: no data sharing
 - Open banking: share data but not signals
- Lending market competition: common-value auctions
 - Winner's curse: a bank winning the competition suggests that the other bank's signal is likely bad.
- Maturity transformation
 - Shadow banks and fintech lenders finance mainly by uninsured short-term debt.
 - Feedback loop between bank short-term debt and bank investment
- Financial inclusion
 - It is inefficient to issue loans without new positive information.

Preview of Results

Lending market competition (talk)

- Closed banking: **informational monopoly**
- Open banking: **banks refrain from participation with positive probability.**
- Open banking may **reduce** expected number of banks serving borrowers.

Resource Allocation (talk)

- Open banking **underperforms** closed banking in inefficient borrower market.

Bank Financing (paper)

- Fixed an equilibrium loan rate, open banking **increases bank financing cost** and **narrows bank spread.**

Financial inclusion (paper)

- High-quality borrowers are **less likely to obtain loans** in some cases.
- Ex-ante underbanked borrowers are **better off.**

Open banking

- [He et al. \(2022\)](#): borrower endogenous sign-up
- [Babina et al. \(2022\)](#): fintech entry and data production

Lending market competition with asymmetric information

- [Broeker \(1990\)](#), [Hauswald and Marquez \(2003\)](#): unlimited liability, positive ex-ante NPV
- [He et al. \(2022\)](#): unlimited liability, bad signal information structure

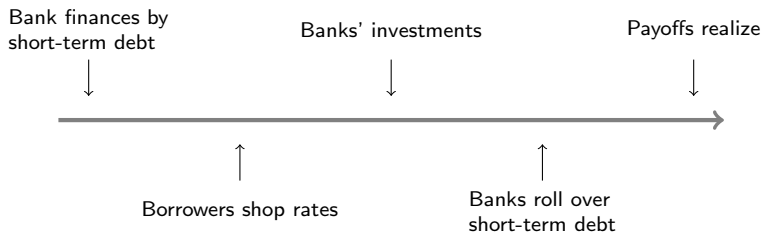
Bank investment and maturity transformation

- [Diamond and Dybvig \(1983\)](#): exogenous bank loan, no competition

Bank financing

- [Cordella and Yeyati \(2002\)](#), [Dell'Ariccia and Marquez \(2006\)](#), [Allen et al. \(2011\)](#), [Dell'Ariccia et al. \(2014\)](#), and [Cordella et al. \(2018\)](#): Banks are protected by limited liability, but there is no banking competition.

Model: Timeline



Model: Borrower

A continuum of homogeneous borrowers are trying to borrow \$1 each.

- A common shock $\theta \in \{L, H\}$, where $L = 0$ and $H = 1$.
- Equal prior: $\Pr(\theta = H) = 1/2$

Each borrower's cash flow

$$\begin{cases} R, & \text{with probability } \theta; \\ 0, & \text{with probability } 1 - \theta. \end{cases}$$

- R is the *conditional cash flow*.
- Borrowers do not know θ and have limited liability.

Model: Banks

Two banks: Bank 1 is borrowers' home bank, while bank 2 is an alternative.

- Shadow banks and fintech lenders
- Banks are risk neutral and have **limited liability**.
- Banks compete in a first-price sealed-bid *common-value* auction.
 - For tractability and Fair Lending laws: Each bank either does not lend or makes one bid to all borrowers.
- Status-quo investment: Risk-free with a gross return R_a
 - R_a is exogenous.
 - $R \in (R_a/\pi, 2R_a)$
 - $R > R_a/\pi$: Efficient to issue loans with a good signal
 - $R < 2R_a$: Inefficient to issue loans based on prior

Model: Data, Information, and Rate Shopping

Information = $f(\text{data}, \text{algorithm})$

- More data, more precise signal \Rightarrow No data, no signal
- Different banks have different algorithms \Rightarrow Same data, different signals

Closed banking: Borrowers can shop rates but cannot provide data.

- Bank 1 possesses data so generates a private signal s_1 where

$$\Pr(s_1 = H|\theta = H) = \Pr(s_1 = L|\theta = L) = \pi \in (1/2, 1)$$

- Bank 2 has no information.

Open banking: Borrowers shop rate and share their data with Bank 2.

- Bank 2 generates a private signal s_2 :

$$\Pr(s_2 = H|\theta = H) = \Pr(s_2 = L|\theta = L) = \pi.$$

- s_1 and s_2 are mutually independent conditional on θ .

Model: Bank Short-term Creditor

After a bank's investment, it needs to roll over its short-term debt.

- Each bank needs to roll over \$1 short-term debt by promising to pay back r .
 - r measures bank financial cost.
- Bank investments are disclosed to their short-term creditors.
- Whether the losing bank bids is not disclosed.
- Competitive bank short-term debt market
 - Risk-free investment: $r_a \in (1, R_a)$
 - r_a is exogenous.
 - Lend to borrowers: $r = r_a / \zeta$, where ζ is the winning bank's short-term creditor's posterior about θ .

Closed Banking: Information Monopoly

A unique equilibrium, which is in pure strategy and satisfies intuitive criterion.

$$\beta_1 = \begin{cases} R, & \text{if } s_1 = H; \\ \text{no bid}, & \text{if } s_1 = L. \end{cases}$$
$$\beta_2 = \text{no bid.}$$

In equilibrium, bank 1 is an **informational monopolist**.

Bank 2 does not participate because

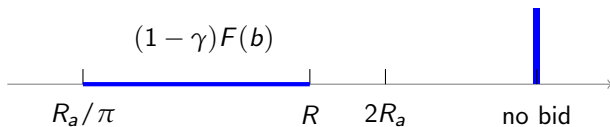
- Inefficient borrowers \Rightarrow a bank bids only if it has good new information.
 - Bank 2 does not have private information.
 - Bank 2 is facing winner's curse.
- Maturity transformation prevents banks from shifting risks.
 - Bank 2 cannot issue loans and finance at a low interest rate.

Open Banking

There is a unique symmetric equilibrium.

- $\beta_i(L) = \text{no bid}$
- $\beta_i(H)$:

$$\gamma = \frac{(1-\pi)\pi\left(2-\frac{R}{R_a}\right)}{\left(\frac{R}{R_a}-1\right)\pi^2-(1-\pi)^2}$$

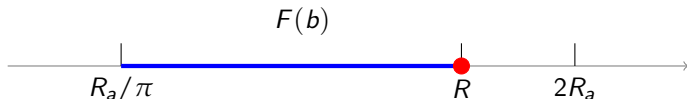


In equilibrium, $\gamma > 0$ for all $R \in (R_a/\pi, 2R_a)$.

- Banks may refrain from bidding even if they observe good signals.

Refrain from Bidding when $s = H$

Suppose that $\gamma = 0$.



$b_2 = R$ is in the bidding support.

- Win only if $s_1 = L$
- If win, $\zeta_2 = 1/2$, and so $r_2 = 2r_a$
- Bank 2 payoff by bidding R (conditional on winning)

$$\Pr(\theta = H | s_2 = H, s_1 = L) (R - r_2) < \frac{1}{2} (2R_a - 2r_a) < R_a - r_a$$

- Deviating to **no bid** is profitable.

Inefficient borrowers

- A bank issues loans only if it observes a good private signal.
- The potential winner's curse may offset the good private signal.
- A bank issues loans only when winner's curse is weaker (than a good signal), which requires the other bank to refrain from bidding with positive probability.

Maturity transformation **prevents banks from shifting risks.**

- Otherwise, banks finance at low interest rates so that they can issue loans.

Lending Market Competition

Under open banking, no bid probability

$$\gamma = \frac{(1 - \pi)\pi \left(2 - \frac{R}{R_a}\right)}{\left(\frac{R}{R_a} - 1\right) \pi^2 - (1 - \pi)^2}$$

- Decreasing in R
- $\gamma \rightarrow 1$ as $R \rightarrow R_a/\pi$.

Does open banking necessarily increase lending market competition?

- For small R , under open banking, average number of banks is **almost zero**.
- For any R , under closed banking, the number of banks is **one**.

Maturity Transformation

Consider a benchmark where banks' short-term debt interest rates are fixed.

- Finance by insured deposits
- No maturity transformation \Rightarrow banks can shift risks.

Lending market competition

- Closed banking: Bank 2 bids **blindly** with positive probability.
- Open banking: Both banks bid if they observe good signals.

Without maturity transformation

- Open banking **surely increases** lending market competition.

Funding Efficiency

Conditional on $\theta = H$:

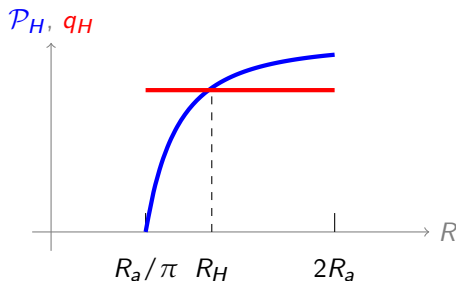
- Funding probability under open banking:

$$\mathcal{P}_H = \pi^2(1 - \gamma^2) + 2\pi(1 - \pi)(1 - \gamma)$$

- Funding probability under current banking:

$$q_H = \pi$$

There is a $R_H \in (R_a/\pi, 2R_a)$, such that $\mathcal{P}_H \geq q_H$ if and only if $R \in [R_H, 2R_a)$.



Screening Efficiency

Conditional on $\theta = L$:

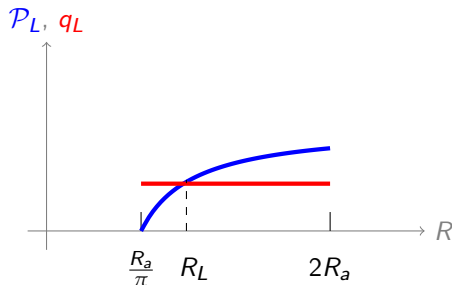
- Funding probability under open banking:

$$\mathcal{P}_L = (1 - \pi)^2(1 - \gamma^2) + 2\pi(1 - \pi)(1 - \gamma)$$

- Funding probability under current banking:

$$q_L = 1 - \pi$$

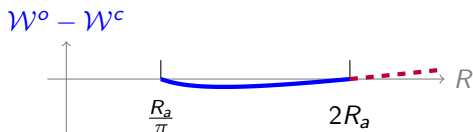
There is a $R_L \in (R_a/\pi, 2R_a)$, such that $\mathcal{P}_L \leq q_L$ if and only if $R \in [R_a/\pi, R_L]$.



Economic Efficiency

W^o (W^c): ex-ante economic efficiency under open (closed) banking.

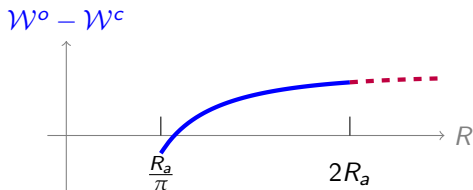
For any $R \in (R_a/\pi, 2R_a)$, under short-term debt rollover, open banking underperforms closed banking in terms of ex-ante economic efficiency.



- For large R , borrowers are funded with higher probability ex ante.
 - Ex-ante inefficiency implies that open banking underperforms.
- For small R , open banking system is not working.
 - Good signals are ignored.

Economic Efficiency

With fixed short-term debt interest rate at r_a



- Under closed banking, uninformed bank is too aggressive.
 - Many loan decisions are uninformative.
- Under open banking, banks make loan decisions based on private signals.

Bank Financing

Consider an equilibrium loan interest R

- Only possible equilibrium loan interest rate under closed banking
- Eliminating effects of loan interest rate

Open banking increases bank financing cost and narrows bank spread.

	Closed banking	Open banking
Borrowing cost	r_a/π	$r_a/\zeta(R)$

where

$$\zeta(R) = \frac{\gamma}{1+\gamma} [\pi^2 + (1-\pi)^2] + \frac{1}{1+\gamma} [2\pi(1-\pi)] < \pi.$$

- Bank 1's creditors are not facing winner's curse under closed banking.
- Winning bank's creditors are facing winner's curse under open banking.

Closed banking

- Monopoly pricing leads to zero ex-post payoff to borrowers.
- Borrowers' ex-ante payoffs are zero.

Open banking

- Competition drives down interest rates charged, so borrowers' ex-ante payoffs are strictly positive.

Therefore, for any $R \in (R_a/\pi, 2R_a)$, open banking increases borrower welfare.

- Ex-ante underbanked borrowers are better off

Conclusion

This paper proposes a model to compare open banking with closed banking.

- Maturity transformation, negative ex-ante NPV

Banking competition

- Closed banking: Informational monopoly
- Open banking: Banks may refrain from bidding.

Resource allocation

- Open banking underperforms closed banking.
- How to manage risks related to resource allocation efficiency is an important issue when adopting open banking.

Bank financing

- Open banking narrows bank spread.

Borrower welfare

- Open banking outperforms closed banking.

Appendix: Ex-ante Efficient Project

When $R > 2R_a$, it is efficient to fund the project ex ante.

Banking competition

- Closed banking: bank 1 bids if and only if $s_1 = H$, and bank 2 bids with positive probability.
- Open banking: both banks bid if and only if observing good signals.

Resource allocation

- Open banking outperforms closed banking
 - More informative decisions

Borrower Welfare

- When R is large, open banking leads to **lower** borrower welfare.
 - No winner's curse to bank 1 under closed banking, so it is easier for bank 1 with $s_1 = L$ to mimic.
 - Winner's curse under open banking makes it harder for bank i with $s_i = L$ to mimic and thus leads to higher rate charged.