Open Banking under Maturity Transformation

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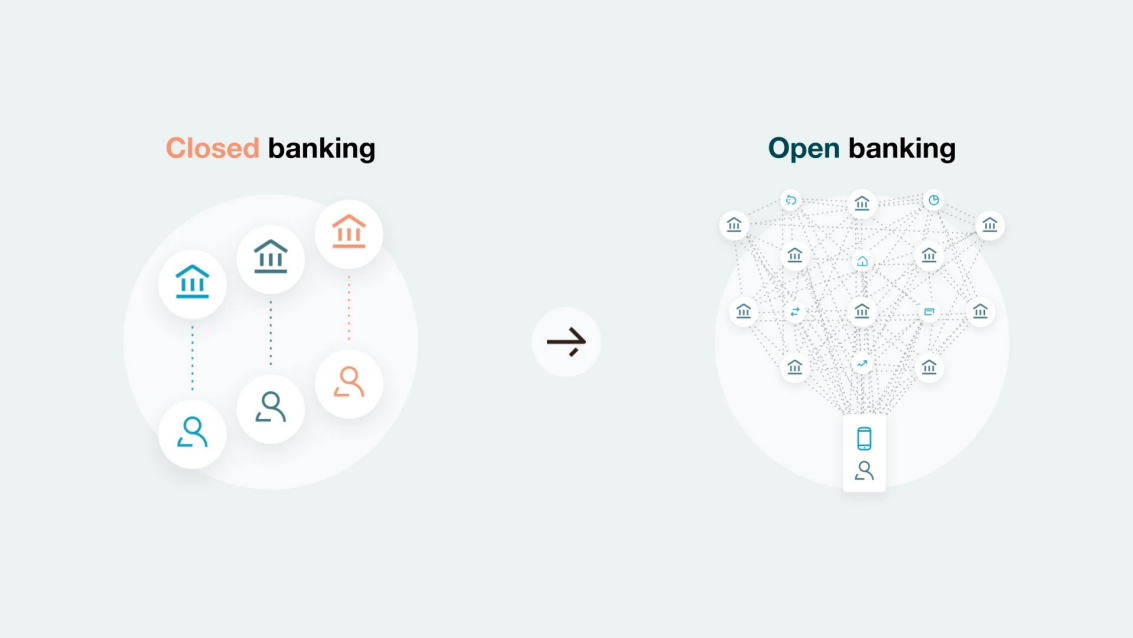
Open Banking: Data Control and Data Sharing



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.

Open Banking: Resource Allocation

Open banking aims at increasing lending market competition. However, is more competition desirable?

- Are borrowers better off?
  - He, Huang, and Zhou (2022)
- More efficient resource allocation?
  - This paper
  - Also call it "economic efficiency"

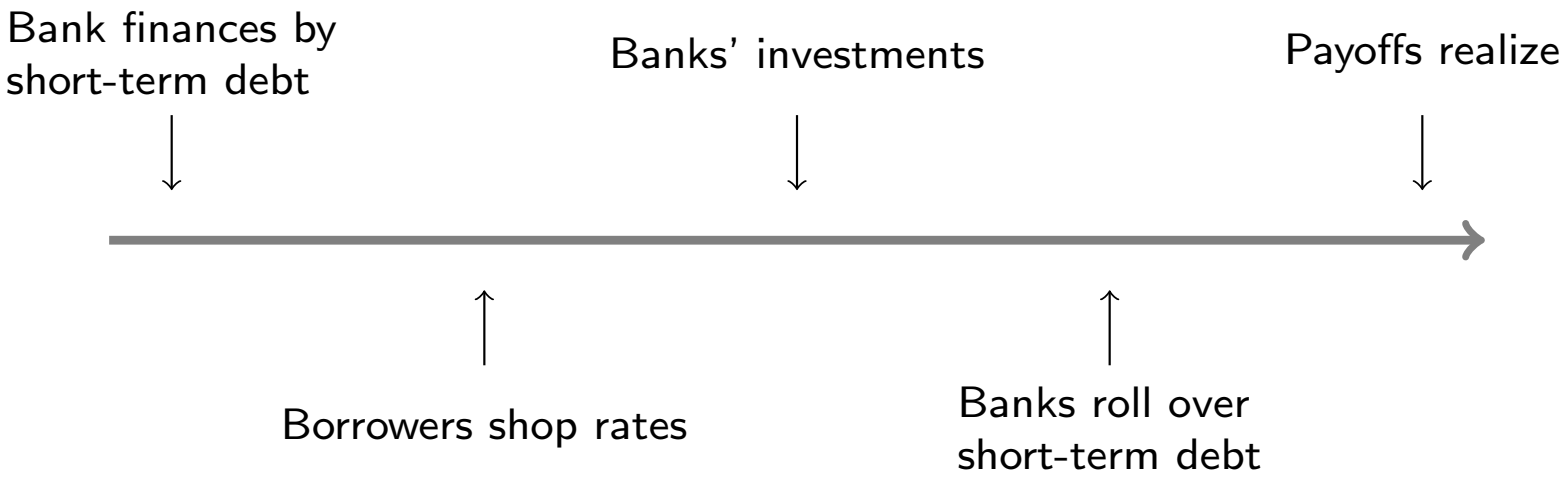
Preview of Model and Results

In our model

- Bank i's Signal $= f(\text{Borrower data}; \text{Algorithm}_i)$
  - Credit bureau is different: bank reports, signal rather than data
- Feedback loop between bank short-term debt and bank investment
  - Small traditional banks, shadow banks, and fintech lenders

Policy		Closed Banking	Open Banking	Evaluation
Lending market in literature	Model	Common-value auction with one informed bank and one uninformed bank (Hauswald and Marquez, 2003)	Common-value auction with two symmetric banks (Broeker, 1990)	Open banking leads to more efficient resource allocation when investment return is high
	Equilibrium	* Mixed-strategy equilibrium * Both banks bid	* Mixed-strategy equilibrium * Each bank bids with probability one	
Our modeling innnovation: short-term debt interest responds to bank investment				
Lending market in our paper	Equilibrium	* Pure-strategy equilibrium * Uninformed bank does not bid * Informed bank is an informational monopolist	* Mixed-strategy equilibrium * Banks may not bid with positive probability	Open banking is less efficient in resource allocation.

Model: Timeline



Model: Borrower

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

- Borrowers encounter a common shock, θ.

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*.
- $\theta \in \{L, H\}$, where $L = 0$ and $H = 1$.
- Borrowers do not know θ and have limited liability.
- Equal prior: $\Pr(\theta = H) = 1/2$

Model: Banks

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

- Small traditional banks, shadow banks, and fintech lenders
- Banks are risk neutral and have limited liability.
- Banks compete for the borrowers 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.
  - $R \in (R_a/\pi, 2R_a)$: small business with negative ex-ante NPV

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.
- The losing bank's quote 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.

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

In equilibrium, bank 1 is an informational monopolist.

- Monopoly pricing
  - $\beta_1(s_1 = H) = R$
- Short-term debt rollover prevents bank 2 from participating in competition.
  - Winner's curse to bank 2's short-term creditor $\Rightarrow$ higher financial cost

With fixed short-term credit interest rate, bank 2 bids even if it is uninformed.

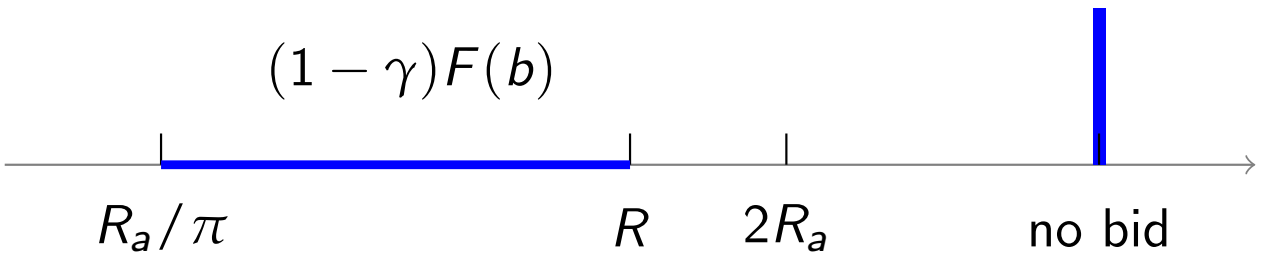
- As in other common-value auctions
- Relatively low financial cost

Open Banking

There is a unique symmetric equilibrium.

- $\beta_i(L) =$ 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.
- γ is decreasing in R.

Maturity Transformation in Open Banking

Bank short-term debt rollover

- Winner's curse to bank i's short-term creditor increases its financial cost.
- Exacerbates winner's curse to bank i
- In equilibrium, bank j refrains from bidding with a sufficient high probability to reduce the winner's curse to bank i to keep it indifferent.

With fixed short-term debt interest rate,

- Less winner's curse because of lower financial cost
- In equilibrium, a bank bids if and only if seeing a good signal.

Funding Efficiency

Conditional on $\theta = H$:

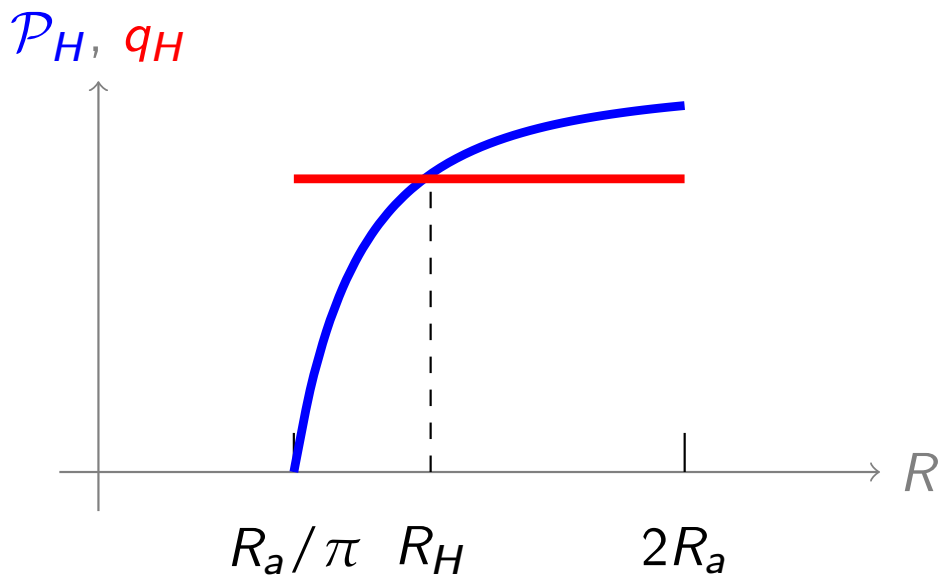
- Funding probability under open banking:

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

- 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 $R \in [R_H, 2R_a)$.



Screening Efficiency

Conditional on $\theta = L$:

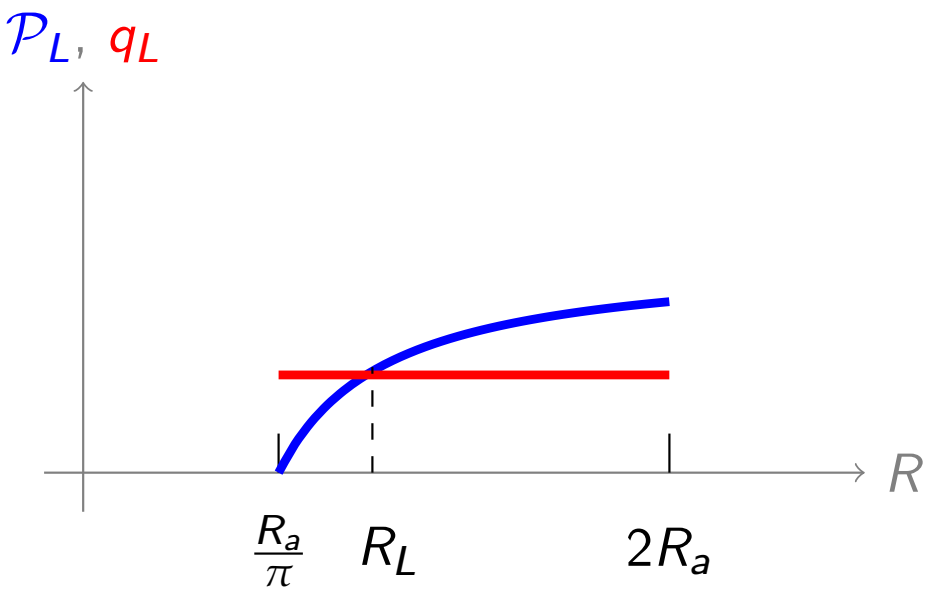
- Funding probability under open banking:

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

- Funding probability under current banking:

$$q_L = 1 - \pi$$

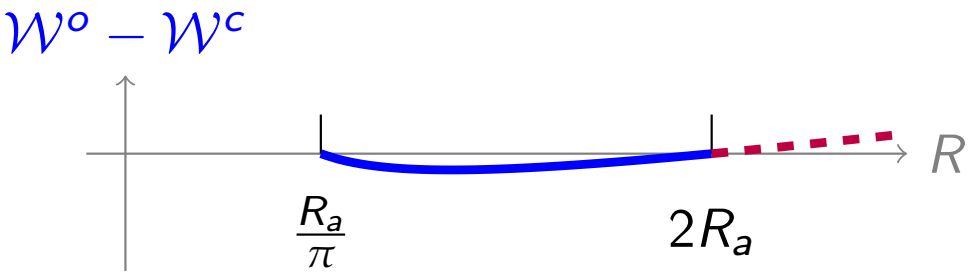
There is a $R_L \in (R_a/\pi, 2R_a)$, such that $\mathcal{P}_L \leq q_L$ if and only $R \in [R_a/\pi, R_L]$.



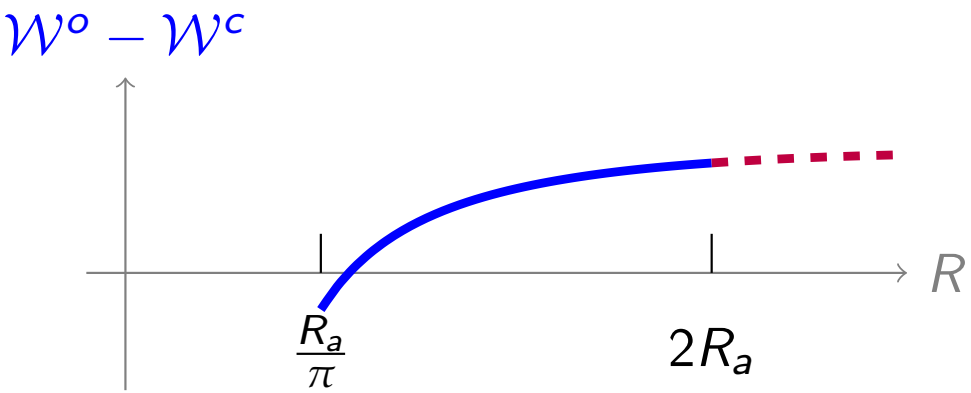
Economic Efficiency

$\mathcal{W}^o$ ($\mathcal{W}^c$): 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 current banking in terms of ex-ante economic efficiency.



With fixed short-term debt interest rate at r_a



Borrower Welfare

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.

Conclusion

This paper proposes a model to compare open banking with closed banking in banking competition, resource allocation, and borrower welfare.

- Maturity transformation

Banking competition

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

Resource allocation

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

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.