Open Banking under Maturity Transformation

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September 23, 2022
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 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”
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

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<td>* Mixed-strategy equilibrium</td>
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<td>* Both banks bid</td>
<td>* Each bank bids with probability one</td>
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**Our modeling innovation: short-term debt interest responds to bank investment**

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<td>* Uninformed bank does not bid</td>
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Model: Timeline

Bank finances by short-term debt

Borrowers shop rates

Banks roll over short-term debt

Banks' investments

Payoffs realize
Model: Borrower

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

- Borrowers encounter a common shock, $\theta$.

Each borrower’s cash flow

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

- $R$ is the \textit{conditional cash flow}.
- $\theta \in \{L, H\}$, where $L = 0$ and $H = 1$.
- Borrowers do not know $\theta$ and have limited liability.
- Equal prior: $\Pr(\theta = H) = 1/2$
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(data, 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 \(\theta\).
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 $\zeta$ is the winning bank’s short-term creditor’s posterior about $\theta$. 

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.

- 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
There is a unique symmetric equilibrium.

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

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

$$(1 - \gamma) F(b)$$

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

- Banks may refrain from bidding even if they observe good signals.
- $\gamma$ is decreasing in $R$. 
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.
Conditional on $\theta = H$:

- Funding probability under open banking:
  \[
  P_H = \pi^2 (1 - \gamma^2) + 2\pi (1 - \pi) (1 - \gamma)
  \]

- Funding probability under current banking:
  \[
  q_H = \pi
  \]

There is a $R_H \in (R_a/\pi, 2R_a)$, such that $P_H \geq q_H$ if and only $R \in [R_H, 2R_a)$. 
Screening Efficiency

Conditional on $\theta = L$:

- Funding probability under open banking:
  \[ P_L = (1 - \pi)^2(1 - \gamma^2) + 2\pi(1 - \pi)(1 - \gamma) \]

- Funding probability under current banking:
  \[ q_L = 1 - \pi \]

There is a $R_L \in (R_a / \pi, 2R_a)$, such that $P_L \leq q_L$ if and only $R \in [R_a / \pi, R_L]$. 
\( \mathcal{W}^o (\mathcal{W}^c) \): ex-ante economic efficiency under open (closed) banking.

For any \( R \in \left(\frac{R_a}{\pi}, 2R_a\right) \), 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 \( r_a \)
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.
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.