Fintech and Bank competition: The impact of lending technology on market segmentation

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Introduction

FinTech lending (Berg, Fuster, Puri (NBER, 2021))

- Use of technology to provide lending products.

- The use of technology has two main flavors:
  1. To improve the customer-lender interaction (for example, with a fully online application process), giving rise to a better user experience, faster processing times and lower operational costs.
  2. Technology can be used to improve screening or monitoring, for example, by using alternative data sources or machine learning methods.
• Fintech lending has experienced a tremendous growth in the last decade

  ▶ Business lending grew a 43.1% per annum in 2016-2020

• Nevertheless, fintech lenders compete with traditional lenders (banks) for borrowers
• Fintech lenders:
  ▶ More focus on short-term lending
  ▶ Usually, no collateral requirements
• **Traditional lenders (banks):**
  
  - Usually demand a collateral
  
  - Longer-term loans

  - Longer processing time

  - Use more traditional data and methods to screen borrowers
This paper

- Competition in the credit market between a traditional lender and a fintech
- Borrowers with different financing needs: short-term vs. long-term
- Fintech has a superior screening ability, but the gap decreases for long-term predictions
- Competition: First-price sealed-bid common value auction with differentially informed bidders
- Main focus: How technology affects the “landscape” of competition between traditional lenders and fintechs
Main theoretical findings

- **Segmentation:**
  - **Fintech:** More likely to offer short-term unsecured loans
  - **Bank:** More likely to offer long-term, secured (by some asset) loans

- **Interest rates:**
  - **Short-term:** Fintech offers higher (FOSD) interest rates than the traditional lender
  - **Long-term:** Traditional lender offers rates with a higher “spread” than the fintech rates

- Screening ability and collateral requirements are substitutes

- **Market segmentation:** As the screening ability gap between the two lenders increases, segmentation decreases in the long-term segment, while in the short-term it can increase or decrease (depending on the level of collateral)

- Federal Reserve’s Small Business Credit Survey (2019): These findings explain some of the empirical observations from the survey
Literature review

- **Closest paper** is: He, Huang and Zhou (NBER, 2020):
  - Competition between a fintech and a traditional lender
  - Effect of credit information sharing between the lenders
  - **No collateral requirements**
  - **No loans of different maturities**

- Thakor (JFI, 2020), Berg, Fuster and Puri (NBER, 2021): Fintech survey papers

- Manove, Padilla and Pagano (Rand, 2001), Inderst and Mueller (JFE, 2007), Stroebel (JF, 2016): Collateral determination

- Donaldson, Piacentino, and Thakor (JF, 2021): Bank and non-bank finance
Borrowers

- Continuum of risk neutral entrepreneurs (borrowers) of measure one

- Each entrepreneur can have either a short-term (S) or a long-term project (L), and needs one unit of capital

- Each S (L) entrepreneur has an investment project that generates a return that is either \( r^S \) (\( r^L \)) or 0, in case of a default

- A fraction \( \mu_i \) has good projects (G) and a fraction \( 1 - \mu_i \) has bad (B) projects for \( i \in \{S, L\} \)

- The probabilities of no default are given by \( 1 \geq p_G > p_B \geq 0 \) and they are the same for S and L borrowers.
Lenders, screening ability and collateral

• Two risk neutral lenders: a fintech (F) and a traditional lender (T)

• Let $S^i_j \in \{g, b\}$ denote lender $j$’s signal about borrower of type $i \in \{S, L\}$, which can be either good ($g$) or bad ($b$)

• The signal conditional probabilities are given by

$$q^{i,g}_j = (S^i_j = g|G) \geq \frac{1}{2} \text{ and } q^{i,b}_j = (S^i_j = b|B) \geq \frac{1}{2},$$

• where $q^{i,g}_j$ and $q^{i,b}_j$ capture the accuracy of lender $j$’s signals for borrower of type $i$

• We set $q^{S,g}_F = q^{S,g}_T = 1$ and $q^{L,g}_F = q^{L,g}_T = 1$

• Furthermore, we let

$$q^{S,b}_F \equiv q^{S}_F, q^{S,b}_T \equiv q^{S}_T, q^{L,b}_F \equiv q^{L}_F \text{ and } q^{L,b}_T \equiv q^{L}_T.$$
Let $\Delta q^i \equiv q^i_F - q^i_T$ denote the difference in the signal accuracy between the two lenders.

We make the following assumption regarding the screening ability of lenders as a function of the lending horizon.

$$\Delta q^S > \Delta q^L \geq 0 \text{ and } q^S_j \geq q^L_j$$
Collateral

- In addition to the interest rate, lender $j$ can ask borrowers to post a collateral $c_j < 1$.

- The collateral is used to mitigate the losses in case of default.

- That is, if borrower defaults the lender liquidates the collateral.
Timing

- Lenders receive their private signals, update their beliefs about the borrower’s type and simultaneously make their interest rate offers to the S borrowers, $r_j^S$, and to the L borrowers, $r_j^L$.

- Lender $j$ also asks borrowers to post a collateral $c_j$.

- Competition is on a borrower-by-borrower basis. Borrowers then choose the offer with the higher expected payoff.

- For simplicity we assume the lenders have the same cost of funds, which we normalize to one.
Borrower signals

- Probability both lenders observe good signals

\[ p_{gg}^i \equiv (S_F^i = g, S_T^i = g) = \mu_i + (1 - \mu_i)(1 - q_T^i)(1 - q_F^i) \]

- Let

\[ \nu_{gg}^i = \frac{\mu_i}{p_{gg}^i} \]

be the probability of repayment of an \( i \) borrower, conditional on two good signals

- F lender observes a good signal, while a T lender observes a bad signal

\[ p_{gb}^i \equiv (S_F^i = g, S_T^i = b) = (1 - \mu_i)q_T^i(1 - q_F^i) \]

- F lender observes a bad signal, while a T lender observes a good signal

\[ p_{bg}^i \equiv (S_F^i = b, S_T^i = g) = (1 - \mu_i)(1 - q_T^i)q_F^i \]
Borrower choices

- Suppose a borrower of type $i$ has received two interest rate offers, $r^i_F$ and $r^i_T$ from the fintech and the traditional lender, respectively.

- Then, the borrower knows that both lenders have received good signals.

- The borrower will borrow from lender F if and only if

$$r^i_F < r^i_T + z^i_{gg} c,$$

where $z^i_{gg} = \frac{1-\nu^i}{\nu^i} = \frac{(1-q^i_T)(1-q^i_F)}{\tau^i}$, is the likelihood ratio of no repayment over repayment, conditional on two good signals.
Mixed strategy equilibrium

- Competition in the credit market has a flavor of a first-price sealed-bid common value auction with differentially informed bidders

- Winning an entrepreneur entails a winner’s curse

- Due to the winner’s curse, an equilibrium in pure strategies does not exist
• We will construct the mixed strategy equilibrium

• Let $m^i_j$ be the probability that lender $j$ makes an offer to an $i$ borrower upon drawing a good signal

• Let $Z^i_F(r) \equiv (r_F^i - z_{gg}^i c \leq r)$ be the probability distribution of lender F’s interest rate offers, conditional on making an offer to an $i$ borrower

• Similarly, let $Z^i_T(r) \equiv (r_T^i + z_{gg}^i c \leq r)$ be the probability distribution of lender T’s interest rate offers, conditional on making an offer to an $i$ borrower
Indifference conditions

\[ p_{gg}^i \left( 1 - m_T^i + m_T^i (1 - Z_T^i(r)) \right) \left( (1 + r)\nu_{gg}^i - 1 \right) - p_{gb}^i = \pi_F^i \]

\[ p_{gg}^i \left( 1 - m_F^i + m_F^i (1 - Z_F^i(r)) \right) \left( (1 + r)\nu_{gg}^i - 1 \right) - p_{bg}^i (1 - c) = \pi_T^i \]
• We make the following assumptions that determine the magnitude of the winner’s curse.

\[ p_{bg}^S (1 - c) \geq p_{gb}^S \iff c \leq \frac{\Delta q^S}{q_F^S (1 - q_T^S)} \]

\[ p_{bg}^L (1 - c) \leq p_{gb}^L \iff c \geq \frac{\Delta q^L}{q_F^L (1 - q_T^L)} \]

• F lender dominates the S segment; T lender dominates the L segment
Lemma

- **S segment**: The F lender makes a strictly positive profit $\pi_F^S > 0$, while T lender makes a zero profit $\pi_T^S = 0$

- **L segment**: The T lender makes a strictly positive profit $\pi_T^L > 0$, while F lender makes a zero profit $\pi_F^L = 0$
Equilibrium for S borrowers

- The F lender always makes an offer upon drawing a good signal and its interest rate distribution has a mass point at the upper bound of the support.

- The T lender makes an offer with a probability.

- The F lender’s rate distribution FOSD the distribution of T.

- The support of T lender’s distribution is shifted to the left by the amount of the collateral times the likelihood ratio of no repayment over repayment.
• T lender, given its high winner’s curse, does not always make an offer

• F is a monopoly lender with some probability

• This allows the F lender to raise its interest rates
Effect of screening capacity on market segmentation and credit supply in the short-term segment

- Level of collateral determines the effect of better screening ability on supply of credit

- Suppose the screening capacity of lender F increases

- If the collateral is low, the T lender lowers the probability with which it makes loan offers

- If the collateral is high, the T lender increases the probability with which it makes loan offers
Equilibrium for L borrowers

- The T lender always makes an offer upon drawing a good signal and its interest rate distribution has a mass point at the upper bound of the support.

- The F lender makes an offer with a probability.

- The T lender’s rate distribution “spread” is higher than that of the distribution of F.

- The lower winner’s curse for the T lender allows it to offer high interest rates more frequently.
Mass point = 19.4%
Effect of screening capacity on market segmentation and credit supply in the long-term segment

- Suppose the screening capacity of lender F increases
- Then, F lender increases the probability with which it makes an offer
- Market segmentation decreases
Collateral competition

- Add a stage in the game where lenders choose $c_j$

- Cost: $\frac{c_j^2}{2\gamma_j}$

- Equilibrium collaterals

$$c_F^* = \theta(1 - \mu_S)\gamma_F q_F^S(1 - q_F^S) \text{ and } c_T^* = (1 - \theta)(1 - \mu_L)\gamma_T q_T^F(1 - q_T^F)$$

- The collateral requirement of lender $j$ depends on:

  1. the cost of lender $j$ of underwriting the collateral, as captured by the parameter $\gamma_j$ and

  2. the likelihood of lender $j$'s winner's curse, $(1 - \mu_i)q_{-j}q^i(1 - q^i)$, in the segment in which it earns its rents
• Own screening ability and collateral requirements are substitutes

• Rival screening ability and collateral requirements are complements

• F lender’s superior screening ability affords a lower collateral requirement than the T lender, $c_T^* > c_F^*$
Conclusion

- **Fintech**: Short-term, unsecured loans; higher interest rates and higher likelihood of loan offers relative to traditional lenders, in the short-term segment.

- **Bank**: Long-term, asset-backed loans; more dispersed rates and higher likelihood of loan offers relative to fintech lenders, in the long-term segment.

- Collateral mitigates the winner’s curse, but is also a function of the winner’s curse.

- Fintech chooses lower collateral than the traditional lender due to its superior screening ability.

- As screening ability gap between the two lenders increases, segmentation in the short-term segment can increase or decrease depending on the level of collateral, but in the long-term segment it will decrease.
Thank you!

Q&A