Internet Appendix

How FinTech Enters China's Credit Market

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Competitive Benchmark. Banks face local refinancing costs r^L and charge a competitive local interest rate r^C so as to break even. By assumption, a share $1-p^{S|+}$ of borrowers are incorrectly identfied as safe borrowers (while they are risky) and their default risk $e^{-\gamma i}$ is decreasing in borrower type $i \in [0,1]$. The expected loan loss for a unit of credit follows as $(1+r_i^C) \times e^{-\gamma i}(1-p^{S|+})$ under a zero recover rate. The equilibrium condition for zero expected profits in the loan market for borrower type i becomes

$$\text{(A1)} \qquad \underbrace{(1+r_i^C) \times [1-e^{-\gamma i}(1-p^{S|+})]}_{expected\ return} = \underbrace{1+r^L}_{cost\ of\ capital} .$$

This directly implies Equation (2). Figure 1 draws the competitive bank credit yield r_i^C (red line) as a function of the borrower type $i \in [0,1]$. As safe borrowers leave the credit market for credit yields above $\overline{r}^S$, only credit yields below this thresholds are optimal to avoid adverse selection on risky borrowers only. Hence, borrower types $i \in [i^C, 1]$ obtain credit, whereas the riskier types with $i \in [0, i^C)$ are excluded from the credit market. The extensive margin of credit supply to borrower type i^C is characterized by the condition

$$\text{(A2)} \qquad \overline{r}^S = r^L + e^{-\gamma i^C}(1-p^{S|+})(1+\overline{r}^S),$$

which implies Equation (3).

Market Entry of a New Credit Technology. The FinTech firm disposes of a better credit technology which reduced the type II error of providing credit to risky borrower types. Only a share $1-p^{S|+}-\Delta$ of borrowers (with $\Delta > 0$) are incorrectly identified as safe borrowers. The zero profit condition of the FinTech firm is fulfilled for a credit yield r_i^Δ given by

$$\text{(A3)} \qquad \underbrace{(1+r_i^\Delta) \times [1-e^{-\gamma i}(1-p^{S|+}-\Delta)]}_{expected\ return} = \underbrace{1+r^N}_{cost\ of\ capital} ,$$

where r^N denote the (national) refinancing cost of the FinTech firm. Figure 1 graphs the break even yield r_i^Δ (blue line) as a function of the borrower type $i \in [0,1]$. The FinTech firm is able to extend the extensive margin of credit provision to additional borrower types $i \in [i^{FT}, i^C]$ as stated in Proposition 1. For the latter borrower types it can charge the maximal yield $\overline{r}^S$ which precludes adverse selection. For the segment $i \in [i^C, 1]$ of the borrower type distribution, the FinTech firm charges a slight discount ϵ relative to the competitive yield r_i^C to attract all of the potential customers it can reach. We ignore in this derivation the repercussion of FinTech credit provision on the equilibrium rate r_i^C by assuming that only a small share $\delta > 0$ of borrowers of type i, namely e-commerce firms, can qualify for FinTech credit. To a first order approximation, this leaves the break even condition in Equation A1 for traditional banks unchanged.

Limited Creditor Substitutability. Next we distinguish borrows of type $i \in [0,1]$ in a second dimension $s \in [0,1]$ according to their switching costs to FinTech credit. For a uniform distribution over s for all i we assume linear switching costs $c(i,s) = \theta s$, with $\theta > 0$. This implies that the FinTech firm is now facing a downward sloping demand curve for each point $i \in [i^C, 1]$. Borrowers with characteristics (i,s) will switch to the FinTech credit offer if and only if $r_i^C - r_i^{FT} > \theta s$, which implies for $r_i^C \geq r_i^{FT}$ a demand function $s(r_i^{FT}) = \min[\frac{1}{\theta}(r_i^C - r_i^{FT}), 1]$. To simplify notation, we define the (FinTech) credit score of borrower type i as one minus the probability of default, hence $CS_i^{FT} = 1-e^{-\gamma i}(1-p^{S|+}-\Delta)$. The profit maximizing credit yield $r_i^{FT} \in (r^C - \theta, r^C]$ charged by the FinTech firm to borrower type $i \in [i^C, 1]$ is characterized by

$$\max_{r_i^{FT}} \Pi_i(r_i^{FT}) = \delta s(r_i^{FT}) \times [CS_i^{FT}(1 + r_i^{FT}) - (1 + r^N)]. \tag{A4}$$

The first order condition (for an interior solution) follows as

$$0 = \frac{1}{\theta}(r_i^C - r_i^{FT*})CS_i^{FT} - [CS_i^{FT}(1 + r_i^{FT*}) - (1 + r^N)]\frac{1}{\theta} \ , \tag{A5}$$

and the optimal yield r_i^{FT*} charged to borrower i by the FinTech firm is

$$r_i^{FT*} = \begin{cases} \frac{1}{2}\left[r_i^{\Delta} + r_i^C\right] & \text{if} \quad \theta \geq \overline{\theta} \\ r_i^C - \theta & \text{if} \quad \theta < \overline{\theta} \end{cases} \ , \tag{A6}$$

where we define a threshold value $\overline{\theta} = r_i^C - \frac{1}{2}\left[r_i^{\Delta} + r_i^C\right]$ and $r_i^{\Delta} = \frac{1+r^N}{CS_i^{FT}} - 1$ denotes the break even yield of the FinTech firm for borrower i. The market demand or market share of the Fintech entrant follows as

$$s_i^{FT*} = \begin{cases} \frac{1}{2\theta}\left(r_i^{\Delta} + r_i^C\right) & \text{if} \quad \theta \geq \overline{\theta} \\ 1 & \text{if} \quad \theta < \overline{\theta} \end{cases} \ . \tag{A7}$$

The solution of interest is $\theta \geq \overline{\theta}$ as it represents an optimal trade-off between revenue loss through lower yields and a larger customer base, whereas $\theta < \overline{\theta}$ corresponds to the corner solution when the FinTech firm captures the entire market.

Proof of Proposition 2. Substituting Equation (2) and $CS_i^{FT} = 1 - e^{-\gamma i}\left(1 - p^{S|+} - \Delta\right)$ into Equation (6) yields

$$s_i = \frac{1}{2\theta}\left\{ \frac{r^L + 1}{1 - \frac{(1-p^{S|+})(1-CS_i^{FT})}{1-p^{S|+}-\Delta}} - \frac{1+r^N}{CS_i^{FT}} \right\}. \tag{A8}$$

The first derivative of the market share with respect to the borrower credit score CS_i^{FT} follows as

$$\frac{ds_i}{dCS_i^{FT}} = -\frac{1}{2\theta}\left\{ \frac{(CS_i^{FT})^2 \times \left[\frac{1-p^{S|+}-\Delta}{1-p^{S|+}} \times (1+r^L) - (1+r^N)\right] - \left[\frac{\Delta}{1-p^{S|+}}\right]^2 (1+r^N) + \frac{2\Delta(1+r^N)}{1-p^{S|+}} \times CS_i^{FT}}{(CS_i^{FT})^2\left[CS_i^{FT} - \frac{\Delta}{1-p^{S|+}}\right]^2} \right\}. \tag{A9}$$

Assuming $r^L \geq r^N$, we have

$$\frac{ds_i}{dCS_i^{FT}} < \frac{1}{2\theta}\left\{ \frac{-(CS_i^{FT})^2 \times \left[\frac{1-p^{S|+}-\Delta}{1-p^{S|+}} \times (1+r^N) - (1+r^N)\right] + \left[\frac{\Delta}{1-p^{S|+}}\right]^2 (1+r^N) - \frac{2\Delta(1+r^N)}{1-p^{S|+}} \times CS_i^{FT}}{(CS_i^{FT})^2\left[CS_i^{FT} - \frac{\Delta}{1-p^{S|+}}\right]^2} \right\}, \tag{A10}$$

which simplifies to

$$\frac{ds_i}{dCS_i^{FT}} < \frac{1}{2\theta}\left\{ \frac{\frac{\Delta(1+r^N)}{1-p^{S|+}}\left[(1-CS_i^{FT})^2 - \frac{1-p^{S|+}-\Delta}{1-p^{S|+}}\right]}{(CS_i^{FT})^2\left[CS_i^{FT} - \frac{\Delta}{1-p^{S|+}}\right]^2} \right\}. \tag{A11}$$

It follows that $\frac{ds_i}{dCS_i^{FT}} < 0$ if and only if $(1-CS_i^{FT})^2 - \frac{1-p^{S|+}-\Delta}{1-p^{S|+}} < 0$. Substituting $CS_i^{FT} = 1 - e^{-\gamma i}\left(1 - p^{S|+} - \Delta\right)$ into Equation (2) yields

$$r_i^C = \frac{r^L + (1-CS_i^{FT}) \times \frac{1-p^{S|+}}{1-p^{S|+}-\Delta}}{1-(1-CS_i^{FT}) \times \frac{1-p^{S|+}}{1-p^{S|+}-\Delta}} \leq \overline{r^S}, \tag{A12}$$

where we use $r_i^C \leq \overline{r^S}$. The latter condition can be rewritten as

$$1 - CS_i^{FT} \leq \frac{\overline{r^s} - r^L}{1+\overline{r^s}} \times \frac{1-p^{S|+}-\Delta}{1-p^{S|+}} \quad , \tag{A13}$$

or

$$\begin{aligned} (1-CS_i^{FT})^2 &\leq \left[\frac{\overline{r^s}-r^L}{1+\overline{r^s}} \times \frac{1-p^{S|+}-\Delta}{1-p^{S|+}}\right]^2 < \frac{1-p^{S|+}-\Delta}{1-p^{S|+}} \\ 0 &> (1-CS_i^{FT})^2 - \frac{1-p^{S|+}-\Delta}{1-p^{S|+}}. \end{aligned}$$

Proof of Proposition 3. We take the first derivative of Equation (A1) to obtain

$$\frac{ds_i}{dr^L} = \frac{1}{2\theta}\left[\frac{1}{1-\frac{(1-p^{S|+})(1-CS_i^{FT})}{1-p^{S|+}-\Delta}}\right]. \tag{A15}$$

Using $1 - \frac{(1-p^{S|+})(1-CS_i^{FT})}{1-p^{S|+}-\Delta} > 0$ directly implies

$$\frac{ds_i}{dr^L} > 0. \tag{A16}$$