Bridging the Gap?

FinTech Entry and Financial Inclusion *

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(`Preliminary & incomplete draft`)

Abstract

The rise of FinTech lenders offers an opportunity to promote financial access but may disrupt banks' banking efforts. This paper presents a banking model where an incumbent bank specializes in some niche markets. When FinTech enters, it intensifies competition for certain niches, reducing the bank's lending relationship gains. Although FinTech serves some unattended niches, the bank may abandon others, creating an ambiguous impact on financial inclusion. The overall effect depends on how the market is initially served and FinTech's efficiency and competitiveness.

Keywords: FinTech, financial inclusion, lending relationships, regulatory arbitrage, market efficiency.

JEL Codes: G21, G23, G28.

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1 Introduction

Increasing access to finance for small and medium enterprises (SMEs) can foster economic growth as they are a crucial engine for job creation in developing economies (Ayyagari et al., 2011). Nevertheless, SMEs face more difficulties gaining access to finance due to severe informational problems (Beck and Demirguc-Kunt, 2006). One way for traditional banks to overcome these problems is by establishing lending relationships, which enable lenders to gather information from more opaque borrowers (Sharpe, 1990; Petersen and Rajan, 1994; Berger et al., 2001). Moreover, the recent and rapid growth of FinTech offers a great chance to enhance access to credit through digital technological advancements. (Jagtiani and Lemieux, 2018; Abbasi et al., 2021; Hodula, 2023). However, by increasing competition, FinTech entry can affect banks' incentive to invest in lending relationships, potentially making access to finance less inclusive (Boot and Thakor, 2000).

This paper studies the impact of a FinTech's entry on financial inclusion through the lens of an illustrative banking model. In particular, we show that the impact on financial inclusion is uncertain and depends on 1) how traditional banks initially served the credit market and 2) the FinTech's features, such as its ability to attract borrowers away from banks and its efficiency in serving unattended borrowers.

In the paper's model, a screening cost is paid to serve a niche market due to an adverse selection problem. An incumbent bank has a cost advantage in serving opaque niches (Boot and Thakor, 2000; Degryse and Ongena, 2007), whereas a FinTech entrant is better at banking less opaque niches (Thakor and Merton, 2018; Balyuk et al., 2022). Due to these high screening costs, the credit market is only partially served in equilibrium. The entrant serves niches that the incumbent avoids due to prohibitive screening costs. Yet, it also competes with the incumbent for its niche markets. The incumbent anticipates more competition, discouraging it from initially serving some niches as lending relationship rents decrease and do not compensate it for screening costs. The overall effect on access to finance depends on which effect predominates.

The paper focuses on one crucial dimension for promoting economic growth: broadening access

to finance. In particular, the paper highlights the importance of the different market segment specializations of traditional banks and FinTechs. If they do not differentiate much, competition between these two types of intermediaries can harm financial inclusion. Furthermore, this effect depends on the inclusiveness of current credit access. For example, if traditional banks serve only a small portion of the credit market, FinTech entry can boost credit access by attracting new borrowers, even though traditional banks may become less inclusive after FinTech's entry.

The illustrative analysis in this paper provides policy insights to increase SMEs' financial inclusion. To prevent the reduction of the returns on information discovery, we recommend that information disclosure policies should focus on hard rather than soft information. Besides, given banks' comparatively higher regulatory burden, we recommend introducing a regulatory action that levels the field with FinTechs so that FinTech's regulatory-induced comparative advantage does not deter banks from serving bancarized niches. Finally, we propose that mechanisms of entry regulation consider, as key metrics, FinTechs' efficiency and competitiveness and the initial level of financial inclusion.

The paper adds to the existing literature on the impact of FinTech lending on access to finance (Livshits et al., 2016; Jagtiani and Lemieux, 2018; Tang, 2019; Abbasi et al., 2021; Sheng, 2021; Erel and Liebersohn, 2022; Gopal and Schnabl, 2022). This literature primarily focuses on the direct impact of FinTechs on increasing lending to underserved borrowers, with limited attention to their effect on bank lending behavior. Moreover, the literature that examines general equilibrium effects on access to finance often focuses on loan volumes, which does not allow for the distinction between broader access to finance and more credit for the already banked population. This paper extends this research by examining, in a banking model, the impact of FinTech entry on traditional banks' incentives to promote access to finance and, consequently, its overall effect on financial inclusion. The illustrative theoretical framework developed in the paper can serve as a guide for future empirical work that aims to study the overall impact of FinTechs on financial inclusivity.

The paper also relates to the literature exploring the effects of competition on lending (Petersen

and Rajan, 1995; Boot and Thakor, 2000; Beck et al., 2004; Love and Pería, 2015). This literature shows that lenders are more likely to finance credit-constrained firms in concentrated markets because it is easier for them to keep the benefits of forming lending relationships. Consequently, competition may diminish the value of these relationships, decreasing lending. This paper examines how competition between traditional banks and FinTechs varies based on their differences and how this competition can impact access to finance.

2 Model

Consider an economy with two dates ($t = 1, 2$) and a credit market that can be divided into a continuum of niche markets according to an opaqueness index $m \in [0, 1]$. Lower values of m correspond to higher opaqueness.

2.1 Entrepreneurs

Each niche market m is populated by a mass $f(m)$ of penniless entrepreneurs that live for two dates, where $f(\cdot)$ is a pdf over the support $[0, 1]$. At any date, each entrepreneur has access to a project that requires a unit investment and matures at the end of the period. The project yields a stochastic payoff x, which is independent and identically distributed according to

$$x = \begin{cases} X, & \text{with probability } \tilde{p}, \\ 0, & \text{with probability } 1 - \tilde{p}, \end{cases}$$

The project's output cannot be stored, so it can not generate collateral for subsequent lending rounds.

Every market m has two unobservable types of entrepreneurs that differ in their ability to run their projects. A project managed by a high-ability entrepreneur has a probability of success p, which is higher than the probability $p - \delta$ of a project run by a low-ability entrepreneur. All

entrepreneurs have a reservation utility $\underline{u}$, and the fractions of high- and low-ability types in each niche market are γ and $1-\gamma$, respectively.

An adverse selection problem may deter the financing of projects belonging to high-ability entrepreneurs. In particular, projects managed by entrepreneurs with high ability have positive one-period NPV, that is,

$$pX - 1 > \underline{u}, \tag{1}$$

where the interest rate of fully insured deposits is normalized to zero, and their supply is perfectly elastic at such a rate. On the contrary, low-ability entrepreneurs' projects have negative one-period NPV, such that if types are unobservable, no niche market will be served. That is,

$$\hat{p}X - 1 < \underline{u}, \tag{2}$$

where $\hat{p} = p - (1-\gamma) \times \delta$ is the average probability of success.

Only financial intermediaries can finance entrepreneurs' projects. Moreover, they do it by offering one-period loan contracts.

2.2 Financial intermediaries

An incumbent specialized financial intermediary can help to overcome the adverse selection problem. In particular, the *incumbent* can observe the entrepreneur's type by paying a screening cost $m \times \phi_I$ when serving the entrepreneur for the first time. Thus, the incumbent is better at screening niche markets with a low value of m; i.e., more opaqueness. The incumbent can be seen as a traditional bank that is better at soft information processing. For instance, Liberti and Petersen (2019) point out that banks' private information primarily consists of soft information.

Rents from lending relationships help to compensate for the screening cost incurred by the incumbent. In particular, interacting with the borrower in more than one lending round allows the incumbent to extract more rents and cover the initial investment of banking a niche market. In

this way, second-round rents can turn into profitable niche markets in which the incumbent made a loss in the first lending round due to high screening costs. Furthermore, as in Padilla and Pagano (2000), it is assumed that default is forgiven: each investment project is run as a separate limited liability company, and the entrepreneur cannot be disqualified after bankruptcy.

Before all lending decisions happen on date 1, a new financial intermediary's entry on date 2 is announced. Contrary to the incumbent, the *entrant* has an advantage in banking niche markets with high index m; i.e., less opaque. The entrant can be seen as a FinTech lender that relies on processing hard information by leveraging big data approaches (Balyuk et al., 2022). In particular, the entrant pays a screening cost $(1 - m) \times \phi_E$ from attending a niche market m. Thus, the parameter ϕ_E measures *the FinTech's efficiency at serving new niches.*

Moreover, the entrant observes the type of entrepreneurs with previous access to credit (i.e., screened at date 1 by the incumbent), and it can poach the incumbent's clients at a cost $(1-m)\times\kappa$. Thus, the incumbent will face competition at date 2 over the niche markets attended at date 1, reducing date 2 rents extracted from them. The parameter κ can be seen as *the FinTech's degree of competitiveness.* For instance, if the services offerred by the FinTech and the traditional bank are difficult to substitute, the bank will be in a better position to retain its customer base, in which case κ will be higher. On the contrary, lower regulatory costs for FinTechs relative to banks facilitate the poaching of clients from banks to FinTechs, i.e., a low value of κ.

2.3 Solving the model

The problem is solved by backward induction. First, competition outcomes at date 2 are determined. Next, the incumbent decides which niche markets to serve at date 1.

2.3.a Events at date 2

Let m_I^* be the marginal niche served by the incumbent at date 1, that is, niches with index $m \leq m_I^*$ received funding in the first lending round, leaving $1 - m_I^*$ markets unattended. Among

the unattended niches, the entrant decides which of them to serve on date 2. On the other hand, the incumbent and the entrant compete in prices for the bancarized clients in niches $m \leq m_I^*$.

The following proposition characterizes the equilibrium outcome at date 2.

Proposition 1. *The incumbent will serve niches $m \leq m_I^*$ at date 2; whereas the entrant will serve niches $m \geq m_E^*$, where $m_E^* = 1 - \frac{1}{\phi_E} \times (pX - 1 - \underline{u})$. The incumbent and the entrant will offer, respectively, date-2 interest rates*

$$R_{I,2}(m) = \frac{1 + \kappa \times (1-m)}{p}, \text{ for } m \leq m_I^* \quad \text{and} \quad R_{E,2}(m) = \begin{cases} \frac{1+\kappa\times(1-m)}{p}, & \text{for } m \leq m_I^*, \\ X - \underline{u}/p, & \text{for } m \geq m_E^*. \end{cases}$$

Proposition 1 states the new served niche markets after the entry of the new intermediary. As the entrant has an advantage in banking niches with high index m, it will serve unattended niches in which the one-period revenue covers for the funding and screening costs. Moreover, as such niches are far from the incumbent's expertise, the entrant will not face competition, allowing to charge an interest rate that makes indifferent the entrepreneur between taking the contract or not. Note that the bank's incentives for investing in unattended niche markets are even lower at date 2, as no potential rents from engaging in a second lending round can be extracted.

The incumbent will retain its customers; i.e., no switching happens on equilibrium. However, competition decreases the interest rate that the incumbent can charge to its clients at date 2. For instance, a very high rate can cause the entrant to poach the incumbent's clients by offering a lower interest rate. Consequently, the incumbent will charge the lowest interest rate the entrant can provide without incurring a loss. Because the entrant cannot poach a client at a zero cost, $\kappa > 0$, the incumbent can price the loan at a price higher than its fair value $\frac{1}{p}$; see Proposition 1. Hence, the incumbent's date-2 profit in a niche m is equal to

$$\pi_{I,2}(m) \equiv p \times R_{I,2}(m) - 1 = \kappa \times (1-m). \tag{3}$$

Note that the rents captured by the incumbent depend on its advantage at serving a niche m. If such an advantage dissipates (i.e., $\kappa = 0$), competition will eliminate rents at date 2.

2.3.b Events at date 1

At date 1, the incumbent decides on the niche markets that it will serve. When doing that, it considers whether the rents extracted from entrepreneurs over the life of the lending relationship compensate for the screening cost $\phi_I \times m$ incurred to overcome the adverse selection problem. Recall that if no screening is done, banking a niche market m is unprofitable due to the presence of low-ability entrepreneurs; see condition (2).

The following proposition states the niche markets served by the incumbent.

Proposition 2. *If $\phi_I > \underline{\phi}$, the incumbent will serve niche markets with index $m \leq m_I^* < 1$, where $m_I^* = \frac{1}{\phi_I + \kappa} \times (pX - 1 - \underline{u} + \kappa)$. Moreover, it will charge a gross interest rate to niche m equal to*

$$R_{I,1}(m) = X - \frac{\underline{u}}{p}, \text{ for } m \leq m^*.$$

Proposition 2 indicates that some niches of the credit market will not have access to finance due to prohibitive screening costs at date 1; i.e., $\phi_I > \underline{\phi}$. In particular, the rents the incumbent can extract from the lending relationship are insufficient to compensate for the screening cost in niches far from the incumbent's expertise. Moreover, as competition intensifies with the entry of the new intermediary, the incumbent will extract fewer rents at date 2, resulting in serving fewer niches; i.e., m_I^* decays. Finally, because there is no competition at date 1, the incumbent charges a gross interest rate that captures entrepreneurs' surplus at date 1.

3 Analysis on access to finance

In this section, we analyze the effect of the FinTech's entry on financial inclusion. On the one hand, the entrant can help financial inclusion by banking unattended niches (*efficiency effect*).

On the other hand, the entrant increases competition, which may discourage the incumbent from serving some niches (*competition effect*). The net effect on financial inclusion will depend on which of these effects predominate.

The effect of the FinTech on financial inclusion is illustrated in Figure 1. First, the FinTech helps the bancarization of high m-index niches; i.e., niches m_E^* to 1 in panel (b). The positive efficiency effect is larger if the FinTech is more efficient at serving these niches (i.e., a low value of ϕ_E); see panel (c). On the contrary, if ϕ_E is higher, the FinTech is less efficient, serving fewer new niches. Second, after the FinTech's entry, the incumbent stops serving some previously attended niches due to more competition from the FinTech. The negative competition effect is represented by the niches m_I^* to m_I^0 that the bank abandons after the FinTech's entry. The magnitude of the competition effect will depend on the degree of competitiveness of the FinTech. In panel (e), the effect is small, as the FinTech is less capable of poaching clients from the bank (i.e., a high value of κ), whereas, in panel (f), the effect is larger, due to more aggressive competition (i.e., a low value of κ).

Thus, the total effect on financial inclusion will depend on whether the competition or the efficiency effect predominates. Let Δ be the change in access to finance after the FinTech's entry, which is defined as

$$\Delta = \gamma \times \Big(\int_0^{m_I^*} f(m)\mathrm{d}(m) + \int_{m_E^*}^1 f(m)\mathrm{d}(m) - \int_0^{m_I^0} f(m)\mathrm{d}(m) \Big), \tag{4}$$

where the first and second terms represent the mass of high-ability entrepreneurs attended by the incumbent and the entrant after the latter's entry, respectively. The last term is the mass of high-ability entrepreneurs served by the incumbent in the absence of any entry, where m_I^0 is defined as $\frac{2}{\phi_I} \times (pX - 1 - \underline{u})$, that is, the project's surplus over the lending relationship's life over the incumbent's screening cost; see panel (a) in Figure 1.

Figure 2 shows how financial inclusion varies following the entry of the FinTech across three dimensions. Panel (a) illustrates a credit market with a high initial financial inclusion, where most

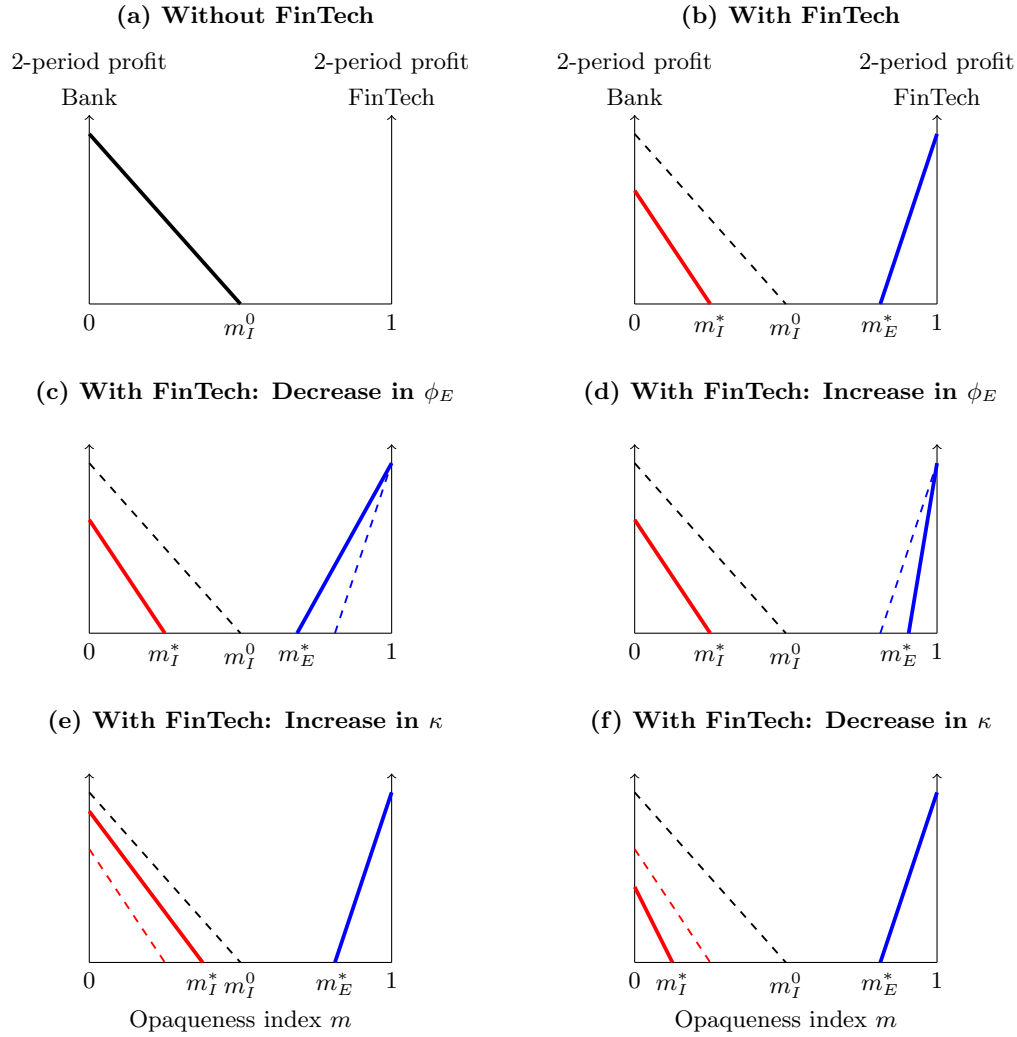

Figure 1: Effect on financial inclusion of ϕ_E and κ

The figure illustrates the effect of a FinTech's entry on financial inclusion. The lines represent the incumbent's and FinTech's profit from attending a niche market m. Panel (a) depicts a situation in which no entry occurs. In such a case, the incumbent serves niches from 0 to m_I^0 (when profits become zero). As a reference, the black dashed line represents this case in panels (b) to (f). Panel (b) illustrates a situation where a FinTech enters the market. In such a case, the bank serves niches from 0 to m_I^* (when profits become zero), and the FinTech serves niches from m_E^* (when profits become zero) to 1. The effect on financial inclusion depends on the niches the bank abandons (from m_I^0 to m_I^*) and the unattended niches the FinTech starts serving (from m_E^* to 1). For comparison, the blue (red) dashed line in panel (c) and (d) (panel (e) and (f)) coincides with the solid blue (red) line in panel (b). Panel (c) (panel (d)) describes a situation in which the FinTech is more (less) efficient at serving niches with high m-index but equally competitive relative to panel (b). In such a case, financial inclusion increases (decreases). Panel (e) (panel (f)) shows a situation in which the FinTech is less (more) competitive but equally efficient relative to panel (b). In such a situation, financial inclusion increases (decreases).

borrowers are found in niche markets with a low index m, closer to the incumbent's expertise. In contrast, panel (b) depicts a scenario with a low initial financial inclusion, characterized by thicker tails in niches further from the incumbent's expertise. The FinTech's entry can have a different impact on financial inclusion depending on the initial level of financial inclusion.

Furthermore, within each panel, the effect on financial inclusion is computed for various FinTech efficiency and competitiveness levels. FinTech efficiency in the model is denoted by ϕ_E, with a lower value indicating higher efficiency in serving niches with a high value of m. Additionally, the degree of competitiveness is measured by κ in the model. A low κ reflects the FinTech's ability to attract clients away from the incumbent, which is more likely when intermediaries provide similar services to these borrowers or the FinTech benefits from a looser regulation (vis-à-vis the traditional bank). Consequently, when financial inclusion is initially high, the FinTech's entry can disrupt the bank's incentive to engage in lending relationships, making access to finance less inclusive. As shown in panel (a) of Figure 2, this is especially severe when κ is low, and ϕ_E is high, as competition leads the bank to withdraw from specific niches, and the FinTech's ability to broad access to finance does not compensate for the loss. In contrast, if traditional banks serve only a small portion of the credit market, the gains in financial inclusion can be significant; see panel (b) of Figure 2. This is because the niches served by the entrant significantly outweigh those that the bank stops serving.

In sum, the overall effect on financial inclusion will depend on the efficiency of the FinTech at serving unattended niches, the degree of competitiveness of the FinTech, and how the credit market was initially attended.

(a) High initial financial inclusion **(b) Low initial financial inclusion**

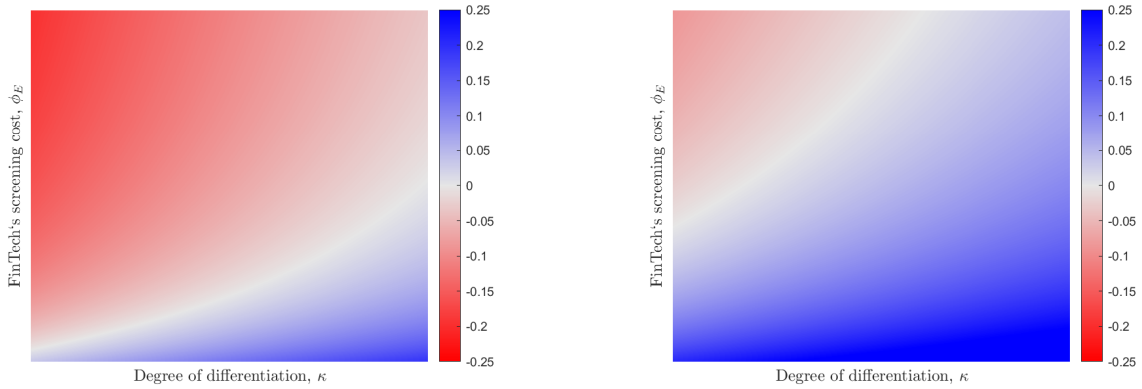

Figure 2: Effect on Financial Inclusion of the FinTech Intermediary's Entry

For the sole illustration of the solution, the following parametrization was chosen: $X = 1.2$, $p = 1$, $\underline{u} = 0$, $\phi_I = 1$, $f \sim \text{Beta}(a, b)$. Panel (a) considers a case where the incumbent bank initially serves a large portion of the credit market. In particular, the parameters of the beta function are equal to $a = 1$ and $b = 1.35$. Thus, most borrowers will be in niche markets where the incumbent bank has larger expertise (low values of m). Panel (b) considers a case where the incumbent bank initially serves a few niche markets. By choosing $a = 1$ and $b = 0.95$, fewer borrowers will be located in niche markets where the monopoly bank has a comparative advantage (low values of m). For each case, the figure depicts how access to finance changes after the entry of a FinTech (Δ in equation 4) for different values of the FinTech's screening cost ϕ_E and degree of competitiveness κ. A red point indicates less financial inclusivity ($\Delta < 0$), and a blue point indicates more financial inclusivity ($\Delta > 0$).

4 Conclusions and policy implications

4.1 Main results

The paper presents an illustrative model in which a bank specializes in serving opaque borrowers by establishing lending relationships. The announcement of the entry of a FinTech decreases the rents that the bank can extract from its lending relationships, turning some lending relationships unprofitable. Even though the FinTech intermediary serves some previously unattended borrowers by the bank, the effect on financial inclusivity is uncertain, as the bank stops lending to certain of its previously attended borrowers. The net impact on financial inclusion will depend on how the traditional bank initially served the credit market, FinTech's ability to serve new borrowers, and FinTech's degree of competitiveness. In particular, the entry of the FinTech will be more disruptive to financial inclusion when financial inclusion is already high, the FinTech's ability to serve new borrowers is low, and the FinTech is better able to compete with the bank for its customer base, increasing the chance of more aggressive competition for the bank's borrowers.

4.2 Policy implications

Our findings have the following policy implications for a regulator that wishes to maximize SMEs' financial inclusion. First, information-sharing policies should focus on hard information and thus avoid the mandatory disclosure of soft information. Measures that reduce the return of information discovery must be avoided as soft information-intensive SMEs can be financially excluded as a result (Petersen and Rajan, 1994; DeYoung et al., 2008; Uchida et al., 2012; Liberti and Petersen, 2019). Regulators should also be cautious when regulating the disclosure of hard information as its effects on the provision of SMEs are mixed (Sutherland, 2018)

Second, given the regulation advantage that FinTechs gained in the aftermath of the Great Financial Crisis (Dou et al., 2018; Buchak et al., 2018; Anagnostopoulos, 2018; Irani et al., 2020; de Roure et al., 2021), we recommend a regulatory action that levels the field between banks and

FinTechs in line of the recommendations by Vives (2017). Here, we stress that the design of the new regulation should prevent banks' anticipation of competition from stopping their lending to previously banked niches.

Third, given that FinTechs do not necessarily increase the overall financial inclusion in credit markets (Buchak et al., 2018; Cornaggia et al., 2018; Fuster et al., 2019; Tang, 2019; de Roure et al., 2021) and may even be detrimental for this purpose (Barocas and Selbst, 2016; Fuster et al., 2022), entry regulation should consider FinTechs' efficiency and competitiveness and the initial level of financial inclusion. This recommendation is in line...

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A Proofs

Proof of Proposition 1

First, consider the entrant's decision to serve an unattended niche. For a niche $m > m_I^*$, the entrant will serve it if it can make profits after paying the screening cost, that is,

$$\max_{R_{2,E}(m)} p \times R_{2,E}(m) - 1 - \phi_E \times (1-m) \geq 0, \quad \text{subject to } p \times (X - R_{2,E}(m)) \geq \underline{u}.$$

Moreover, the entrant does not face competition for niches $m > m_I^*$. Note that if the incumbent does not initially serve a niche, it will not serve it at date 2 as no rents from a second lending round will be available, making it even less attractive to attend such a niche. Thus, the entrant can charge an interest rate that allows it to keep the project's surplus, leaving the borrower with her outside option $\underline{u}$; i.e., $R_{2,E}(m) = X - \frac{\underline{u}}{p}$. As a consequence, the entrant serves a niche m if

$$p \times X - 1 - \underline{u} - \phi_E \times (1-m) \geq 0,$$

which delivers threshold $m_E^* = 1 - \frac{1}{\phi_E} \times (pX - 1 - \underline{u})$. Hence, new niches $m \geq m_E^*$ are being served by the entrant at date 2 and charged an interest rate $R_{2,E}^*(m) = X - \frac{\underline{u}}{p}$.

On the other hand, the incumbent competes with the entrant for its clients in niches $m \leq m_I^*$. In this scenario, the incumbent does not need to pay the screening cost, but it faces the possibility that the entrant poaches its client by offering better interest rates. Thus, for every niche $m \leq m_I^*$, both lenders compete in prices, decreasing interest rates until equilibrium interest rates make the entrant break even due to its cost disadvantage. That is, $R_{2,I}^*(m) = R_{2,E}^*(m)$, such that

$$p \times R_{2,E}^*(m) - 1 - \kappa \times (1-m) = 0 \quad \Rightarrow R_{2,E}^*(m) = \frac{1 + \kappa \times (1-m)}{p} \text{ for } m \leq m_I^*.$$

Note that if the poaching cost is sufficiently low, that is,

$$\kappa < p \times X - \underline{u} - 1,$$

the borrower's participation constraint will be satisfied at the equilibrium interest rates. Thus, part of the project's surplus is kept by bancarized borrowers at date 2, even in niches with less competition at date 2 (low values of m).

Proof of Proposition 2

Note that the date-2 profit of banking a niche m at date 1 is

$$p \times R^*_{2,I} - 1 = \kappa \times (1 - m) > 0.$$

Hence, when considering to serve a niche m at date 1, the incumbent considers rents over the entire life of the lending relationship.

In particular, the lender will serve a niche m if

$$\max_{R_{1,I}(m)} (p \times R_{1,I}(m) - 1) + \kappa \times (1 - m) - \phi_I \times m \geq 0, \quad \text{subject to } p \times (X - R_{1,I}(m)) \geq \underline{u},$$

that is, if the profit over the two periods of the lending relationship compensates for the screening cost $\phi_I \times m$. Because the incumbent enjoys monopoly power at date 1, it sets $R_{1,I}(m)$ so the borrower is left with her outside option. Hence, the marginal niche m^*_I served by the incumbent is determined by

$$p \times X - 1 - \underline{u} + \kappa \times (1 - m^*_I) - \phi_I \times m^*_I = 0 \quad \Rightarrow m^*_I = \frac{p \times X - 1 - \underline{u} + \kappa}{\phi_I + \kappa},$$

such that niches $m \leq m^*_I$ are served from date 1 and charged $R^*_{1,I}(m) = X - \frac{\underline{u}}{p}$ at date 1. Moreover, if the screening cost is sufficiently large, not all niches are served at date 1; that is,

$$\underline{\phi} \equiv p \times X - 1 - \underline{u} < \phi_I.$$

Furthermore, if the screening cost of the entrant is sufficiently large, there will still be unserved niches after its entry, that is,

$$m^*_I < m^*_E \iff \frac{(\phi_I + \kappa)(p \times X - 1 - \underline{u})}{\phi_I - (p \times X - 1 - \underline{u})} < \phi_E.$$