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Can Fintechs Stabilize the Financial Sector?*

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Abstract

The growing popularity of fintechs has led the Financial Stability Board (FSB) to publish considerations about the effects of this emerging industry on stability and efficiency in the financial sector. Against this background, this paper compares the effects of competition and collaboration between banks and fintechs on stability and efficiency. Using a partial equilibrium model and a general equilibrium model with moral hazard between investors and the financial sector based on [Martinez-Miera and Repullo \(2017\)](#), this paper shows that cooperation between banks and fintechs increases stability and efficiency compared to the case of a competitive equilibrium. The findings are robust to changes in bargaining power within the financial sector but depend critically on contestable loan markets.

Keywords: fintech, bigtech, financial stability, general equilibrium

JEL classification: G21, G23, G28

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1. Introduction

The fintech market is a fast-growing segment of the financial sector.¹ Against this background, the Financial Stability Board (FSB) has published considerations on potential effects of the existence of fintechs on the market structure in financial services. According to the FSB, fintechs' potential influence on the market structure can be divided into three different channels. The first channel considers that fintechs, which provide bank-like services such as credit and payment more efficiently than do incumbent banks, could potentially affect risk-taking and efficiency in the financial sector. The second channel through which fintechs might affect the market structure, is size. Large technology firms, so-called bigtechs, entering the market in credit, insurance, and wealth management could have various effects on the financial sector. The third channel describes fintechs as third-party providers of services such as data provisioning and physical connectivity, potentially creating systemic operational and cyber security risks if banks fail to manage the risks of outsourcing.

The first channel builds on a body of literature analyzing the effects of competition on banks' risk-taking. The well-known models of [Allen and Gale \(2004\)](#) and [Repullo \(2004\)](#) show that an increase in market power in the banking sector affects efficiency ambiguously but decreases banks' incentives to take higher risk due to a higher intermediation margin (franchise-value effect). In contrast, [Boyd and De Nicolò \(2005\)](#) find that when banks give loans to entrepreneurs and entrepreneurs decide the level of risk depending on the banks' loan rates, higher market power of banks leads to an increase in the loan rates and therefore to a higher degree of risk-taking (risk-shifting effect). [Martinez-Miera and Repullo \(2010\)](#) in turn show that the effect of competition on banks' risk-taking can be ambiguous. In addition to the risk-shifting effect found by [Boyd and De Nicolò \(2005\)](#), they find that when loan default is not perfectly correlated,

¹As a legal definition of the term fintech does not yet exist, this paper follows the definition of the Financial Stability Board (FSB): [...] technology-enabled innovation in financial services that could result in new business models, applications, processes or products with an associated material effect on the provision of financial services. ([FSB \(2019\)](#))

more market power increases banks' margins from performing loans, thereby decreasing banks' risk-taking incentives (margin effect).² A more recent strand of literature uses a general equilibrium analysis to characterize the relationships among the market structure, interest rates, intermediation margin and risk-taking behavior of banks. [Martinez-Miera and Repullo \(2017\)](#) use a theoretical framework with moral hazard between banks and investors about banks' monitoring level of risky entrepreneurs. They find that monitoring banks tend to finance riskier entrepreneurs than do nonmonitoring banks. Furthermore, their model reveals that an increase in the supply of savings in the banking sector leads to lower loan rates in equilibrium. Thus, more savings decrease banks' intermediation spreads and therefore increase banks' risk-taking by means of a lower level of monitoring (margin effect). Finally, the model shows that the equilibrium in a competitive loan market is not efficient. Thus, although increasing market power comes at the cost of additional inefficiency, the resulting higher intermediation spreads would increase the level of monitoring in equilibrium and, thereby, overall efficiency.

First, this paper contributes to the literature on bank competition and risk-taking by extending a traditional credit banking sector in the framework of [Martinez-Miera and Repullo \(2017\)](#) to consider fintechs as providers of credit-bank-like services. Second, this paper discusses the effects of fintechs on stability when the fintechs' business model is a third-party monitoring service for credit banks. Finally, the paper examines whether the existence of bigtechs affects stability in the financial sector.

The main findings are that collaboration between banks and fintechs increases stability and efficiency in the financial sector compared to a competitive equilibrium. Collaboration enables banks to make use of fintechs' superior monitoring technology for the entire market, while competitive pressure by potential entrants decreases loan rates. The effects of bigtechs on stability and efficiency are ambiguous. Although the results are robust to changes in bargaining power within the financial sector, higher market power may lead to inefficiently high loan rates and decreasing stability.

²Empirical evidence on the effect of competition on financial stability is also mixed; see [Keeley \(1990\)](#), [Berger et al. \(2009\)](#), [Jiménez et al. \(2013\)](#).

The structure of this paper is as follows: Section 2 presents the structure of the model. Section 3 discusses a partial equilibrium with banks and fintechs competing and collaborating in the financial sector. Section 4 presents a general equilibrium to endogenize all interest rates. Section 5 discusses the results and limitations with regard to efficiency. Finally, Section 6 concludes.

2. Model

This paper models an economy based on the framework of [Martinez-Miera and Repullo \(2017\)](#) with two dates, t_0 and t_1 . Four types of agents exist: investors, a bank B , a fintech F and entrepreneurs. The large set of investors is assumed to be risk neutral and able to lend a limited amount of funding to the financial sector, comprising B and F . The large set of entrepreneurs requires external funding from the financial sector to invest in risky projects. This investment generates the following stochastic return \tilde{R} in t_1 per unit invested in t_0 :

$$\tilde{R} = \begin{cases} R > 0, & \text{with probability } 1 - p + m \\ 0, & \text{with probability } p - m \end{cases} \quad (1)$$

The probability of success $p \in (0, 1)$ is assumed to be a constant, capturing an entrepreneur's ability. The parameter $m_i \in (0, p)$ with $i = B, F$ captures the bank's or fintech's monitoring intensity of an entrepreneur and is assumed to be unobserved by the investors. Hence, the economy faces two moral hazard problems. Monitoring increases the probability of success but comes at the cost of a convex cost function $c(m_i)$ with $c'(m_i) > 0$ and $c''(m_i) > 0$. The fintech is assumed to have better monitoring technology and thus faces lower monitoring costs than the bank, implying $c(m_F) < c(m_B)$. However, fintechs are at most startup companies and have higher administrative costs than banks. Thus, the fintech's administrative costs (e.g., costs of a banking license) are assumed to reduce the intermediation margin by ϵ .³

³The assumption of fintechs being startup companies is relaxed later when discussing the effects of bigtechs on financial stability.

3. Partial Equilibrium

The sequence of events is as follows: At t_0 , bank B and fintech F attempt to raise funds from investors to lend to entrepreneurs. The financial sector can fund only a limited amount of one project (e.g., due to regulation). Consequently, B and F compete for the market with a total size of one. Parameter α denotes the (endogenous) bank's market share, and $1 - \alpha$ denotes the (endogenous) fintech's market share. The limited size of the financial sector results in a loan rate $R_B = R_F = R$, leaving the entrepreneur without any surplus. B and F decide the deposit rate D_i with $i = B, F$ for investors to raise funds. Given the loan rate R and the optimal deposit rate D_i^* , both choose their optimal level of monitoring m_i^* . In t_1 the entrepreneur's project return \tilde{R} is realized and all (re-)payments are made if $\tilde{R} = R$. The financial sector faces limited liability in the case of $\tilde{R} = 0$.

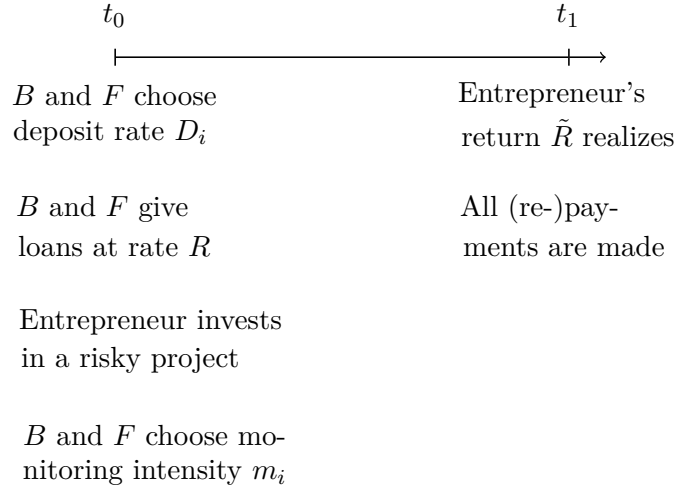


Figure 1: Sequence of events in a competitive equilibrium

Competitive Equilibrium

B and F choose their optimal deposit rates D_B^* and D_F^* and their optimal monitoring intensities m_B^* and m_F^* simultaneously at t_0 .

The two corresponding maximization problems of B and F are as follows:

$$\begin{aligned}
\max_{D_B, m_B} E(\pi_B) &= \alpha(D_B, D_F) [(1 - p + m_B)(R - D_B) - c(m_B)] \\
s.t. \quad (1 - p + m_B^*)D_B^* &\geq R_0 \\
s.t. \quad \alpha(D_B^*, D_F^*)[(1 - p + m_B^*)(R - D_B^*) - c(m_B^*)] &\geq 0 \\
s.t. \quad m_B^* &= \arg \max_{m_B} [\alpha(D_B^*, D_F^*) [(1 - p + m_B)(R - D_B^*) - c(m_B)]]
\end{aligned} \tag{2}$$

The parameter $\alpha(D_B, D_F)$ denotes the market share of the bank as a function of deposit rates D_B and D_F .⁴ The first constraint is the participation constraint of the investors, assuring that investors receive at least their outside option R_0 . The second constraint is the nonnegativity constraint of the bank. The third constraint is the incentive compatibility constraint of the bank, resulting from moral hazard. As the monitoring intensity m_i is unobservable to the investors, it cannot be contracted by B or F . Hence, a feasible contract between the investors and the bank must include a monitoring intensity that maximizes expected profits of the bank, given the optimal deposit rate D_B^* .⁵

$$\begin{aligned}
\max_{D_F, m_F} E(\pi_F) &= (1 - \alpha(D_B, D_F)) [(1 - p + m_F)(R - D_F - \epsilon) - c(m_F)] \\
s.t. \quad (1 - p + m_F^*)D_F^* &\geq R_0 \\
s.t. \quad (1 - \alpha(D_B^*, D_F^*))[(1 - p + m_F^*)(R - D_F^* - \epsilon) - c(m_F^*)] &\geq 0 \\
s.t. \quad m_F^* &= \arg \max_{m_F} [(1 - \alpha(D_B^*, D_F^*)) [(1 - p + m_F)(R - D_F^* - \epsilon) - c(m_F)]]
\end{aligned} \tag{3}$$

The parameter $(1 - \alpha(D_B, D_F))$ denotes the market share of the fintech as a function of deposit rates D_F and D_B . Again, the first constraint is the participation constraint of the investors, the second constraint is the nonnegativity constraint of the fintech and the third constraint denotes the incentive constraint of the fintech.

⁴The market share $\alpha(D_B, D_F)$ coincides with the demand of deposits attracted by bank B , as the total size of the financial sector is equal to one.

⁵Note that any other monitoring intensity than m_B^* is not credible. In such a case, B would have an incentive to adjust m_B unobserved by the investors to increase expected profits. In turn, the adjustment of the monitoring intensity would affect the participation constraint of the investors.

The following first-order conditions for m_B^* and m_F^* result:

$$\alpha(D_B^*, D_F^*) [(R - D_B^*) - c'(m_B^*)] = 0 \quad (4)$$

$$(1 - \alpha(D_F^*, D_B^*)) [(R - D_F^* - \epsilon) - c'(m_F^*)] = 0 \quad (5)$$

Since deposits are costly for B and F , both decrease their deposit rates until the expected rates are equal to the outside option R_0 of the investors, making the first constraints of (2) and (3) binding:

$$D_B^* = \frac{R_0}{1 - p + m_B^*} \quad (6)$$

$$D_F^* = \frac{R_0}{1 - p + m_F^*} \quad (7)$$

Inserting (6) and (7) into equations (4) and (5) yields the following system of equations for the pair (m_B^*, m_F^*) :

$$\alpha \left(\frac{R_0}{1 - p + m_B^*}, \frac{R_0}{1 - p + m_F^*} \right) \left[\left(R - \frac{R_0}{1 - p + m_B^*} \right) - c'(m_B^*) \right] = 0 \quad (8)$$

$$\left(1 - \alpha \left(\frac{R_0}{1 - p + m_F^*}, \frac{R_0}{1 - p + m_B^*} \right) \right) \left[\left(R - \frac{R_0}{1 - p + m_F^*} - \epsilon \right) - c'(m_F^*) \right] = 0 \quad (9)$$

Whether the system of equations (8)-(9) characterizes an equilibrium depends on the ability of B and F to undercut their competitor to attract more deposits.

Proof B and F can undercut their competitor if an increase in the deposit rate D_i leads to a relatively small decrease in the unobserved optimal monitoring intensity m_i^* . In this case, B and F can coexist if the marginal costs of monitoring coincide.

If B offers a deposit rate $D_B^* = \frac{R_0}{1 - p + m_B^*}$, F can attract the entire market ($\alpha = 0$) by offering the investors a deposit rate D_F' that is slightly above $D_B^* = \frac{R_0}{1 - p + m_B^*}$. However, if fintech F offers a deposit rate $D_F^* = \frac{R_0}{1 - p + m_F^*}$, bank B may also attract the entire market ($\alpha = 1$) by offering the investors a deposit rate D_B' that is slightly above $D_F^* = \frac{R_0}{1 - p + m_F^*}$. Thus, neither D_B^* nor D_F^* can characterize an equilibrium.

Consequently, the only deposit rates that can characterize an equilibrium are the maximum values of D_B and D_F , which lead to the minimum values of the feasible range of monitoring by the fintech and the bank $m_i \in [0, p]$. This implies binding nonnegativity constraints in (2) and (3).

Notably, this result also implies that an interior solution with banks and fintechs competing can exist only when marginal costs coincide in equilibrium and depositors of B and F receive the same expected deposit rate above the amount of their outside option R_0 . Otherwise, the competitor with the lower costs could attract the entire market. Thus, the following condition for an interior solution must hold in equilibrium:

$$R = \min_{m_B \in [0, p]} \frac{R_0}{1 - p + m_B} + c'(m_B) = \min_{m_F \in [0, p]} \frac{R_0}{1 - p + m_F} + \epsilon + c'(m_F) \quad (10)$$

Identical marginal costs of B and F are a necessary but not sufficient condition for coexistence of a bank and a fintech. As investors are indifferent between the two types of funding, multiple equilibria in the range of $\alpha^* \in [0, 1]$ exist.

Another type of equilibrium results when B and F are not able to increase their market share by undercutting the competitor's price. In such a case, the system of equations (8)-(9) indeed characterizes an equilibrium since offering a deposit rate slightly above D_i^* leads to a relatively large decrease in unobserved optimal monitoring m_i^* . Therefore, B and F cannot promise the investors an expected return higher than R_0 . Consequently, competition between a bank and a fintech does not affect the monitoring intensity since B and F choose the same contracts they would choose without competition. Again, multiple equilibria in the range of $\alpha^* \in [0, 1]$ exist.⁶ ■

Proposition 1

Competition between fintechs and banks reduces the stability of the financial sector if and only if competitors face high monitoring costs in a partial equilibrium.

⁶Appendix A derives the exact threshold conditions for the two types of equilibrium.

This result is in line with the franchise-value effect discussed in the literature, arguing that more bank competition leads to a lower intermediation margin and thus increases risk-taking by banks. Note that although the previous section models competition between a bank and a fintech, the fintech company must also obtain a banking license to compete for depositors.

Cooperative Equilibrium

The previous section has shown that in a partial equilibrium framework, where a bank and a fintech with a banking license compete, risk-taking may increase with the degree of competition. However, the vast majority of banks cooperate with fintechs. Therefore, this section studies how such cooperation affects risk-taking in the financial sector by analyzing the following kind of collaboration: the fintech, with superior monitoring technology, can monitor the entrepreneur at lower costs than that of the bank, $c(m_F) < c(m_B)$, as an external service provider for the bank. Thus, the fintech avoids administrative costs ϵ of having its own banking license. The bank must compensate the fintech in return for the external service.⁷

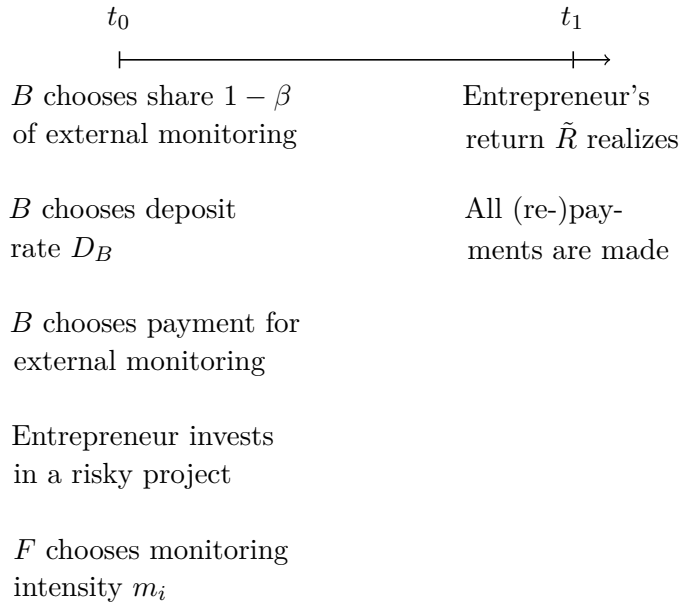


Figure 2: Sequence of events in a cooperative equilibrium

⁷Following from the fact that fintechs are mainly startup companies, this section assumes that the bank has the bargaining power vis-à-vis the fintech. This assumption will be relaxed in Appendix B.

At t_0 , only bank B raises funds from investors to lend to one entrepreneur. B chooses the share of external monitoring $1 - \beta$, the compensation μ the fintech receives for its external monitoring service, the deposit rate D_B and the monitoring intensity of internal monitoring m_B . Given the loan rate R and the array of optimal decisions of bank B ($\beta^*, \mu^*, D_B^*, m_B^*$), fintech F chooses the optimal level of monitoring m_F^* . Again, at t_1 , the entrepreneur's project return \tilde{R} realizes and all (re-)payments are made. The maximization problem of B at t_0 is as follows:

$$\begin{aligned}
\max_{\beta, \mu, D_B, m_B} \quad & E(\pi_B) = \beta [(1 - p + m_B)(R - D_B) - c(m_B)] \\
& + (1 - \beta)(1 - \mu)[(1 - p + m_F)(R - D_B) - c(m_F)] \\
s.t. \quad & (1 - p + m_F^*)D_B^* \geq R_0 \\
s.t. \quad & E(\pi_B^*) \geq 0 \\
s.t. \quad & m_B^* = \arg \max_{m_B} [\beta^* [(1 - p + m_B)(R - D_B^*) - c(m_B)] \\
& + (1 - \beta^*)(1 - \mu^*)[(1 - p + m_F^*)(R - D_B^*) - c(m_F^*)]] \\
s.t. \quad & m_F^* = \arg \max_{m_F} [(1 - \beta^*)\mu^*[(1 - p + m_F)(R - D_B^*) - c(m_F)]] \\
s.t. \quad & E(\pi_F^*) = E(\pi_F^*)^c
\end{aligned} \tag{11}$$

The first constraint denotes the participation constraint of the investors. The second constraint is the nonnegativity constraint of B . The third constraint is the incentive constraint of the bank, resulting from moral hazard between B and the investors with respect to B 's monitoring intensity. The fourth constraint results from additional moral hazard arising from the collaboration between B and F since the fintech provides an unobservable monitoring service for the bank. As the bank pays for the service, a fixed-payment contract would incentivize the fintech to choose the maximum amount of monitoring possible, exceeding the bank-preferred monitoring intensity. Thus, the only way to solve this asymmetric information problem is via a performance-based contract between B and F . The fifth constraint is the participation constraint of the fintech, requiring the bank to promise the fintech payment in the amount of its outside option, namely, F 's expected profit $E(\pi_F^*)^c$ in the competitive equilibrium.

Bank B will always cooperate with fintech F and choose to rely completely on the less expensive external monitoring service by the fintech to maximize its expected profits $E(\pi_B)$. As the bank always chooses $\beta^* = 0$ in equilibrium, the maximization problem in (11) simplifies to:

$$\begin{aligned}
\max_{\mu, D_B} E(\pi_B) &= (1 - \mu)[(1 - p + m_F)(R - D_B) - c(m_F)] \\
s.t. \quad (1 - p + m_F^*)D_B^* &\geq R_0 \\
s.t. \quad E(\pi_B^*) &\geq 0 \\
s.t. \quad m_F^* &= \arg \max_{m_F} [\mu^*[(1 - p + m_F)(R - D_B^*) - c(m_F)]] \\
s.t. \quad E(\pi_F^*) &= E(\pi_F^c)
\end{aligned} \tag{12}$$

The following first-order condition for m_F^* results for a given pair (μ^*, D_B^*) :

$$R - D_B^* - c'(m_F^*) = 0 \tag{13}$$

Since deposits are costly, B decreases the deposit rates until the expected rates are equal to the outside option R_0 of the investors:

$$D_B^* = \frac{R_0}{1 - p + m_F^*} \tag{14}$$

Inserting (14) into (13) leads to the following first-order condition for m_F^* :

$$R = \frac{R_0}{(1 - p + m_F^*)} + c'(m_F^*) \tag{15}$$

These findings appear to coincide with the results of [Martinez-Miera and Repullo \(2017\)](#), who discuss a single-bank equilibrium. However, I state and prove that stability in the cooperative equilibrium exceeds the stability of their single-bank equilibrium and that of the competitive equilibrium from the previous discussion.

Proof By choosing $\beta^* = 0$, the bank maximizes the profitability of the entire financial sector by implementing the most efficient monitoring technology available. However, the bank must ensure participation of the fintech by offering remuneration in the amount of the fintech's expected profit $E(\pi_F^*)^c$ in the competitive equilibrium. Specifically, the fintech's compensation for monitoring depends on the pair (D_B^*, m_F^*) from equations (14) and (15) and the array $(\alpha^{c*}, D_F^{c*}, m_F^{c*})$ characterizing the competitive equilibrium in the previous section:

$$\mu^* = \frac{(1 - \alpha^{c*}) [(1 - p + m_F^{c*})(R - D_F^{c*} - \epsilon) - c(m_F^{c*})]}{(1 - p + m_F^*)(R - D_B^*) - c(m_F^*)} \quad (16)$$

Fintech F increases its monitoring intensity up to m_F^* because the optimal contract that regulates performance-based compensation μ^* , chosen by the bank, implies a payment for F in the amount of the expected profit of the competitive equilibrium $E(\pi_F^*)^c$, if and only if F chooses a monitoring intensity m_F^* , thereby maximizing the expected profits of B .

Bank B will always cooperate with fintech F because B is the residual claimant in the financial sector, maximizing expected profits by maximizing profitability of the entire financial sector. As a result, monitoring in the cooperative equilibrium exceeds monitoring in the competitive equilibrium. A cooperating bank, serving the entire market, faces lower costs and avoids competition. This scenario implies lower deposit rates D_B^* to meet the investors' participation constraint because the probability of default $p - m_F^*$ is lower than $p - m_F^{c*}$ in the competitive equilibrium. Note that the monitoring intensity in the cooperative equilibrium exceeds the monitoring intensity in the single-bank equilibrium because the collaboration between the bank and a fintech without a banking license also implies a single bank serving the entire market. However, this bank faces lower monitoring costs due to the collaboration with the fintech; thus, the stability in a cooperative equilibrium exceeds the stability in a single-bank equilibrium. ■

Proposition 2

In a partial equilibrium, collaboration between a bank and a fintech decreases deposit rates and increases monitoring compared to a competitive equilibrium or single-bank equilibrium.

This result is also in line with the discussed franchise-value effect from the literature, arguing that less bank competition leads to a higher intermediation margin and thus decreases the risk-taking of banks. However, the result is also driven by another effect: the bank, which is able to buy superior external monitoring service from a fintech by paying the fintech its outside option, faces lower monitoring costs and thus increases the monitoring intensity in the financial sector. A necessary condition for this result is the option to implement performance-based compensation for the external monitoring service of the fintech.

4. General Equilibrium

This section extends the partial equilibrium from section 3 to a general equilibrium framework based on [Martinez-Miera and Repullo \(2017\)](#) by endogenizing all interest rates.

Again, consider an economy with two dates and four types of agents: investors, banks, fintechs and entrepreneurs. The large set of investors is assumed to be risk neutral and endowed with a fixed aggregate supply of savings ω at t_0 . The large set of heterogeneous entrepreneurs, differing in their observable risk type $p \in (0, 1)$, requires external funding from the financial sector. The financial sector raises funds from investors to lend to entrepreneurs.

Each entrepreneur p may invest funds into a project with a stochastic return \tilde{R}_p as defined in (1). The aggregate investment of entrepreneurs of type p is denoted by x_p . Following the literature,⁸ the project return \tilde{R}_p is assumed to be a decreasing function of x_p . This assumption is based on entrepreneurs being producers of an intermediate

⁸e.g., [Melitz \(2003\)](#), [Martinez-Miera and Repullo \(2017\)](#) and [Martinez-Miera and Repullo \(2019\)](#)

good sold at price R_p in the case of success to a large set of heterogeneous final good producers, differing in productivity θ_p with density $g(\theta_p) = \sigma(\theta_p)^{(1-\sigma)}$ and $\sigma > 1$. The final good producers' productivity parameter θ_p denotes how many units of a final good can be produced per unit of the intermediate good. Thus, final good producers demand the intermediate good if and only if θ_p equals at least their input price R_p .

For the market to clear, the aggregate demand for the intermediate good of type p must be equal to aggregate supply:

$$\int_{R_p}^{\infty} g(\theta_p) dp = (R_p)^{-\sigma} = x_p \quad (17)$$

Solving (17) for R_p leads to:

$$R_p = (x_p)^{-1/\sigma} \quad (18)$$

The intuition for this negative relationship between x_p and R_p is that if the aggregate investment x_p increases, demand for the intermediate good must increase as well for the market to clear. This implies that market price R_p decreases to widen the interval of profitable final good producers.

By assumption, banks and fintechs are specialized; thus, each type p of entrepreneur can raise funds from only one type of bank B_p or fintech F_p . Unlike in the model of [Martinez-Miera and Repullo \(2017\)](#), the loan market is not only implicitly contestable by potential entrants but also explicitly contestable since every bank faces explicit competition from a fintech.

As before, entrepreneurs cannot make any surplus because when banks and fintechs charge a certain loan rate, entrepreneurs enter the market until the loan rate equals their project return R_p .

Competitive Equilibrium

The assumptions on different monitoring technologies of B_p and F_p do not differ from those in the previous section 3. Hence, when banks and fintechs with a banking license compete with each other, an interior solution with banks and fintechs requires that equilibrium loan rates formally do not differ from those in equation (10). The reason is that implicit competitive pressure by potential entrants and explicit pressure due to competition between the fintechs and banks force the financial sector to choose the lowest feasible loan rate R_p for every risk class p :

$$R_p = \min_{m_B \in [0, p]} \frac{R_0}{(1 - p + m_B)} + c'(m_B) = \min_{m_F \in [0, p]} \frac{R_0}{(1 - p + m_F)} + \epsilon + c'(m_F) \quad (19)$$

However, the exogenous outside option R_0 from the previous section is endogenized in the general equilibrium framework. The first part of this section deducts the equilibrium loan rate R_p for any given safe rate R_0 . The second part endogenizes R_0 by introducing a market clearing condition for the aggregate demand of entrepreneurs' investment and aggregate supply of investors' savings.

The parameter R_0 defines the return of a riskless entrepreneur ($p = 0$) and, thus, the loan rate a bank would choose when lending to a riskless entrepreneur. Note that a fintech could not compete in such a riskless market because it would have to set a loan rate $R_0 + \epsilon > R_0$ to cover its additional administrative costs. Although fintechs are endowed with superior monitoring technology, an interior competitive equilibrium with fintechs and banks is feasible if and only if fintechs face the same total marginal costs. However, the optimal monitoring intensities of banks and fintechs differ because banks' marginal costs of monitoring $c'(m_B)$ exceed the marginal monitoring costs of fintechs $c'(m_F)$ due to the fintechs' superior technology. Furthermore, the safest entrepreneurs are financed by nonmonitoring banks.

Proof The monitoring intensities m_B^* and m_F^* in equilibrium must satisfy the following first-order conditions to be the minimum values of the feasible contracts implied by competition in the financial sector:

$$-\frac{R_0}{(1-p+m_B^*)^2} + c''(m_B^*) = 0 \quad (20)$$

$$-\frac{R_0}{(1-p+m_F^*)^2} + c''(m_F^*) = 0 \quad (21)$$

Consequently, m_F^* exceeds m_B^* in an interior solution since fintechs have better monitoring technology than that of banks ($c''(m_F) < c''(m_B)$). However, an interior solution with banks and fintechs coexisting requires the same loan rate R_p of banks and fintechs for a given risk class p .

Since monitoring is costly, the financial sector does not monitor every risk type. The higher the risk p of an entrepreneur is, the more useful monitoring becomes for a fintech or bank. Consequently, two lower limits for a positive amount of monitoring result:

$$\hat{p}_B = 1 - \sqrt{\frac{R_0}{c''(0)}} \quad (22)$$

$$\hat{p}_F = 1 - \sqrt{\frac{R_0}{c''(0)}} \quad (23)$$

It follows from (22) and (23) that $\hat{p}_B > \hat{p}_F$, implying that fintechs choose to monitor safer types of entrepreneurs than do banks. Thus, the equilibrium loan rates R_p can be defined for all p for a given safe rate R_0 :

$$R_p = \begin{cases} \frac{R_0}{1-p} & \text{for } 0 \leq p < \hat{p}_F \\ \min \left(\frac{R_0}{1-p}, \min_{m_F \in [0,p]} \frac{R_0}{(1-p+m_F)} + \epsilon + c'(m_F) \right) & \text{for } \hat{p}_F \leq p < \hat{p}_B \\ \min \left(\min_{m_B \in [0,p]} \frac{R_0}{(1-p+m_B)} + c'(m_B), \min_{m_F \in [0,p]} \frac{R_0}{(1-p+m_F)} + \epsilon + c'(m_F) \right) & \text{for } \hat{p}_B \leq p \leq 1 \end{cases} \quad (24)$$

In the interval $0 \leq p < \hat{p}_F$, fintechs cannot compete with banks, as fintechs would have to set a loan rate $\frac{R_0}{(1-p)} + \epsilon > \frac{R_0}{(1-p)}$ to avoid losses due to administrative costs ϵ . Therefore, an interior solution with banks and fintechs competing is feasible for risk types of at least \hat{p}_F . Thus, a competitive equilibrium with an interior solution requires $p \in [\hat{p}_F, 1]$.

In the interval $\hat{p}_F \leq p < \hat{p}_B$, fintechs can compete with nonmonitoring banks if fintechs face low administrative costs ϵ or have substantially better monitoring technology than do banks, resulting in $\frac{R_0}{1-p} = \min_{m \in [0,p]} \frac{R_0}{(1-p+m_F)} + \epsilon + c'(m_F)$. Otherwise, the competitor with the lower marginal costs attracts the entire market.

In the interval $\hat{p}_B \leq p \leq 1$, banks and fintechs can coexist when the marginal costs coincide, as defined in (19). Again, if one of the competitors can undercut the other due to lower marginal costs, the entire market is served by this competitor.

Finally, the model endogenizes the safe rate R_0 by introducing a market clearing condition. The market clears if the fixed aggregate supply of savings from investors ω equals the aggregate demand for investment x_p of all risk types p of entrepreneurs:

$$\int_0^1 x_p dp = \omega \quad (25)$$

Thus, the aggregate supply of investors ω affects the demand for investment in the riskless project x_0 , which in turn leads to the equilibrium safe rate R_0 , as discussed at the beginning of this section. As the participation constraint of the investors requires all investors to have the same expected safe rate R_0 , the equilibrium loan rates R_p for all p depend on R_0 . ■

Proposition 3

In a general competitive equilibrium, banks do not face explicit competition from fintechs in the interval $p \in [0, \hat{p}_F[$. A competitive equilibrium with an interior solution requires $p \in [\hat{p}_F, 1]$.

According to these results, the effect of fintechs on stability in the financial sector is twofold: first, competitive and profitable fintechs increase stability by introducing monitoring in risk classes of entrepreneurs in the interval $p \in [\hat{p}_F, \hat{p}_B[$ where banks do not monitor; second, monitoring intensity may increase in the segment $p \in [\hat{p}_B, 1]$ if fintechs are sufficiently profitable to operate in the market.

Cooperative Equilibrium

The previous section has discussed a general equilibrium framework in which banks and fintechs with a banking license compete. In perfect analogy to the partial equilibrium framework, this section analyzes how cooperation between banks and fintechs, being external monitoring service providers without the need for their own banking license, affects stability in the financial sector.

Again, fintechs provide monitoring of entrepreneurs for banks at low costs. Thereby, fintechs avoid the administrative costs of having their own banking license and receive performance-based compensation from the banks. At t_0 , banks raise funds from investors to lend to one entrepreneur per risk type $p \in [0, 1]$. Banks decide the array (β, μ, D_B, m_B) , while fintechs decide the monitoring intensity m_F . At t_1 , the entrepreneurs' project returns \tilde{R}_p realize for each risk type p and all (re-)payments are made.

The introduction of implicit competition by contestable loan markets in a general cooperative equilibrium framework changes the requirements on the equilibrium loan rate as follows:

$$R_p = \min_{m_F \in [0, p]} \frac{R_0}{(1 - p + m_F)} + c'(m_F) \quad (26)$$

Unlike in equation (15), which characterizes the optimal monitoring intensity in a cooperative partial equilibrium, competitive pressure by potential market entrants forces the fintechs in contestable loan markets to choose m_F such that the minimum feasible loan rate R_p for a given safe rate R_0 results.

The loan rates R_p for monitored risk classes must be lower than the loan rates in the competitive equilibrium, as fintechs face lower marginal costs $c'(m_F)$ by avoiding administrative banking license costs ϵ .

Furthermore, I state and prove that the stability in cooperative equilibrium exceeds the stability in the competitive equilibrium.

Proof Competitive and cooperative equilibria require fintechs to meet first-order condition (21) in a general equilibrium framework. However, competitive equilibrium requires first-order condition (20) to hold for banks. Comparison of these two necessary conditions reveals $m_F^* > m_B^*$ due to the lower marginal monitoring costs of fintechs. Consequently, it is not the intensity of monitoring within one risk class p that increases due to cooperation between banks and fintechs but the range of monitored entrepreneurs across different risk types p .

Specifically, as fintechs do not face administrative banking license costs ϵ , entrepreneurs of type $p \geq \hat{p}_L$ will always be monitored by fintechs, not just in the cases of fintechs being sufficiently profitable to operate in the market. Consequently, the following equilibrium loan rates result for a given safe rate R_0 :

$$R_p = \begin{cases} \frac{R_0}{1-p} & \text{for } 0 \leq p < \hat{p}_F \\ \min_{m_F \in [0, p]} \frac{R_0}{(1-p+m_F)} + c'(m_F) & \text{for } \hat{p}_F \leq p \leq 1 \end{cases} \quad (27)$$

In the last step, to close the model to endogenize R_0 and thus R_p and x_p , the market clearing condition $\int_0^1 x_p dp = \omega$ is introduced once again. ■

Proposition 4

In a general cooperative equilibrium, the loan rate R_p is lower than that in the competitive equilibrium for $\hat{p}_F \leq p \leq 1$, and the monitoring intensity in the financial sector increases.

This result appears to contradict the franchise-value effect from the literature at first glance. According to the results of this model, cooperation, and thus less competition between banks and fintechs, leads to a lower intermediation margin but nevertheless increases stability in the financial sector. However, these findings are obtained since the degree of implicit competition for banks and fintechs does not change as loan markets stay contestable in the general equilibrium framework, even though banks decide to collaborate with fintechs. A lower intermediation margin $R_p^* - R_0^*$ results because of contestable loan markets. Competitive pressure forces collaborating banks with lower marginal costs to decrease their loan rates. Notably, a fintechs' technology and thus their monitoring intensity does not depend on whether banks and fintechs compete or cooperate. Consequently, cooperation decreases risk-taking in the financial sector by increasing the market share subjected to high monitoring intensity $m_F^* > m_B^*$ and not by increasing monitoring intensity m_F^* itself.

5. Efficiency

The previous section has shown that in a general equilibrium based on [Martinez-Miera and Repullo \(2017\)](#), there is no contradiction between stability and efficiency in the financial sector when banks and fintechs collaborate. The increase in efficiency in cooperative equilibrium is based on two factors: first, banks can use superior monitoring technology for all their customers; second, fintechs avoid inefficient administrative costs of having their own banking license. Consequently, the collaboration of banks and fintechs increases efficiency by decreasing costs in the financial sector.

Without loss of generality, the model assumes that the incumbent banks have the bargaining power vis-à-vis the fintechs. Note that the distribution of profits in the financial sector would change if fintechs had the bargaining power in the cooperative equilibrium. The degree of efficiency, however, remains unchanged, as banks would receive performance-related compensation in the amount of their outside option while fintechs would be the residual claimants.⁹

⁹A detailed discussion of such a modification can be found in [Appendix B](#).

Limitations

Due to the simplicity of the model, some limitations in the results concerning efficiency and stability must be mentioned.

First, the results depend critically on the fact that loan markets are assumed to be contestable. If cooperation somehow leads to noncontestable loan markets, efficiency may decrease when banks and fintechs cooperate instead of compete. The reason is that without implicit competition by potential entrants, banks are not forced to set the lowest feasible loan rates in the cooperative equilibrium, resulting in a higher loan rate. This in turn may decrease social surplus because an increase in R_p decreases the demand for investment x_p for all p . A competitive equilibrium can deter banks from increasing loan rates above the lowest feasible rate without implicit competition from contestable markets if and only if explicit competition in the financial sector puts downward pressure on the loan rates.

Second, cooperation between banks and fintechs may lead to an increase in the supply of savings ω (e.g., because new investors may be attracted by this new business model). In such a case, the financial sector would face an opposing effect on monitoring as all loan rates decrease, making monitoring less attractive. When this effect exceeds the cooperative effect of lower marginal costs, stability in the financial sector in the competitive equilibrium exceeds stability in the cooperative equilibrium.

6. Conclusion

The growing popularity of fintechs has led to consideration by regulatory institutions concerning the effects of fintechs on stability and efficiency in the financial sector. This paper used a partial equilibrium model and a general equilibrium framework based on [Martinez-Miera and Repullo \(2017\)](#) to examine how the existence of fintechs affects stability and efficiency in the financial sector if banks compete with fintechs. Furthermore, this paper discussed how collaboration between fintechs and banks, which appears to be the most popular business model for fintechs, affects stability and efficiency in the financial sector.

In a partial equilibrium model with moral hazard, competition between a bank and a fintech leads to a decrease in monitoring if the monitoring costs are not excessive. The reason for this negative effect of competition on stability is that more bank competition leads to higher deposit rates and thus to a lower intermediation margin.

In a cooperative equilibrium between a bank and a fintech, where the fintech provides external monitoring service for the bank to avoid the administrative costs of having its own banking license, performance-based payment for the fintech is the only feasible contract. In such an equilibrium, the bank decreases deposit rates and increases monitoring intensity compared to those in the competitive partial equilibrium for two reasons. The first reason is the franchise-value effect from the literature, which states that less bank competition leads to a higher intermediation margin and thus decreases the risk-taking of banks. The second reason is that a bank, being able to buy superior external monitoring service from a fintech, faces lower monitoring costs and thus increases monitoring.

The introduction of a general equilibrium framework with endogenous interest rates reveals that the negative effect of competition on stability depends critically on the assumption of exogenous loan rates in the partial equilibrium. In a general competitive equilibrium, banks do not face competition by fintechs in the low-risk segment because fintechs cannot offset their administrative costs by means of their superior monitoring technology when monitoring is not profitable. Consequently, competition can increase stability in the financial sector if and only if fintechs are sufficiently profitable to compete in the high-risk segment. In such a case, fintechs choose a higher monitoring intensity than that chose by banks since their marginal costs of monitoring are lower.

In a general cooperative equilibrium, stability and efficiency increase as fintechs use the superior monitoring technology for the entire market whenever it is profitable. Since fintechs' technology, and thus their monitoring intensity, does not depend on

whether banks and fintechs compete or cooperate, the stabilizing effect results from the increase in the fintechs' market share rather than the monitoring intensity itself. Furthermore, efficiency increases because the financial sector avoids inefficiently high monitoring costs and additional administrative costs.

Returning to the considerations of the FSB, the findings of this paper support the view that there is no need for regulation when banks collaborate with small fintechs. However, the FSB is concerned about the consequences of bigtechs on stability and efficiency in the financial sector.¹⁰ The conclusion about these concerns is ambiguous: on the one hand, the stability and efficiency results are robust to changes in bargaining power within the financial sector; on the other hand, an increase in market power may lead to noncontestable loan markets and thus to inefficiently high loan rates, implying a decrease in stability in the financial sector.

¹⁰see [FSB \(2019\)](#)

Appendix A

Competition between fintechs and banks reduces the stability of the financial sector if and only if competitors face high monitoring costs in the partial equilibrium. Appendix A derives the specific thresholds that determine the different types of equilibrium.

Threshold conditions

B and F can undercut their competitor if an increase in D_i leads to a relatively small decrease in the unobserved optimal monitoring intensity m_i^* . Specifically, if D_i increases, B and F are still able to meet the participation constraint of the investors, although the financial sector's incentive to monitor decreases.

In a first step, Appendix A analyzes the effect of an increase in the deposit rate D_i on the optimal monitoring intensity m_i^* :

$$\frac{dm_B}{dD_B} = -\frac{\frac{\partial f_B}{\partial D_B}}{\frac{\partial f_B}{\partial m_B}} = -\frac{1}{c''(m_B^*)} \quad (28)$$

$$\frac{dm_F}{dD_F} = -\frac{\frac{\partial f_F}{\partial D_F}}{\frac{\partial f_F}{\partial m_F}} = -\frac{1}{c''(m_F^*)} \quad (29)$$

with f_B and f_L being the first-order conditions of B and L for $0 < \alpha < 1$:

$$f_B = \alpha(D_B^*, D_F^*) [(R - D_B^*) - c'(m_B^*)] = 0 \quad (30)$$

$$f_F = (1 - \alpha(D_F^*, D_B^*)) [(R - D_F^* - \epsilon) - c'(m_F^*)] = 0 \quad (31)$$

In a second step, Appendix A examines whether the investors' participation constraint is violated when B or F increase D_i to undercut their competitor. When i increases D_i by δ , i can meet the participation constraint if

$$\left(1 - p + m_i^* - \frac{\delta}{c''(m_i^*)}\right) (D_i^* + \delta) \geq R_0 \quad \forall \delta \quad (32)$$

When i increases D_i by δ , i violates the participation constraint if

$$\left(1 - p + m_i^* - \frac{\delta}{c''(m_i^*)}\right) (D_i^* + \delta) < R_0 \quad \forall \delta \quad (33)$$

It follows from the two conditions (32) and (33) that higher values of $c''(m_i^*)$ decrease the probability of violating the participation constraint. This result in turn defines the thresholds for the two different types of competitive equilibrium in section 3.

Given the participation constraint is not violated in (32), B and F can undercut their competitor because an increase in D_i leads to a relatively small decrease in the unobserved optimal monitoring intensity m_i^* . Given the participation constraint is violated in (33), B and F cannot undercut their competitor because an increase in D_i leads to a relatively large decrease in m_i^* .

Appendix B

The effect of bigtechs on stability

To consider large and well-established fintechs in the model, Appendix B assumes that the fintech has the bargaining power vis-à-vis the bank to check whether the results are robust to such a modification.

If the fintech has the bargaining power, F will be the residual claimant, maximizing expected profits of the entire financial sector. F will always cooperate with bank B and choose complete external monitoring ($1 - \beta^* = 1$) to make full use of its superior monitoring technology:

$$\begin{aligned} \max_{\mu, D_B, m_F} \quad & E(\pi_F) = \mu[(1 - p + m_F)(R - D_B) - c(m_F)] \\ \text{s.t.} \quad & (1 - p + m_F^*)D_B^* \geq R_0 \\ \text{s.t.} \quad & E(\pi_F^*) \geq 0 \\ \text{s.t.} \quad & m_F^* = \arg \max_{m_F} [\mu^*[(1 - p + m_F)(R - D_B^*) - c(m_F)]] \\ \text{s.t.} \quad & E(\pi_B^*) = E(\pi_B^*)^c \end{aligned} \quad (34)$$

Unlike in section 3, bigtech F now maximizes expected profits $E(\pi_F)$ subject to a participation constraint of bank B , requiring the bank to receive remuneration for collaboration in the amount of the bank's outside option $E(\pi_B^*)^c$. Hence, bank B receives the following $1 - \mu^*$ share of total expected profits in the financial sector in the cooperative equilibrium:

$$1 - \mu^* = \frac{\alpha^{c*} [(1 - p + m_B^{c*})(R - D_B^{c*}) - c(m_B^{c*})]}{(1 - p + m_F^*)(R - D_B^*) - c(m_F^*)} \quad (35)$$

Since deposits are expensive, F forces B to decrease the deposit rates until the expected rates are equal to the outside option R_0 of the investors:

$$D_B^* = \frac{R_0}{1 - p + m_F^*} \quad (36)$$

The following first-order condition for m_F^* results for a given pair (μ^*, D_B^*) :

$$R - D_B^* - c'(m_F^*) = 0 \quad (37)$$

Inserting (36) into (37) leads to:

$$R = \frac{R_0}{(1 - p + m_F^*)} + c'(m_F^*) \quad (38)$$

Following from the equality of the bigtech's first-order condition (38) and the fintech's first-order condition (15), the distribution of the bargaining power within the financial sector does not affect stability in the financial sector. The only parameter that changes is μ . A bigtech chooses to keep a higher share μ^* of total expected profits of the financial sector when it has the bargaining power.

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