A Tale of Two Markets: Labor Market Mobility and Bank Information Sharing*

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Abstract

We develop a theory of bank information sharing, highlighting the interactions between credit and labor markets. A better-informed relationship bank competes with a less informed foreign bank for borrowers under asymmetric information about borrowers' creditworthiness. Credit market competition triggers competition for the relationship bank's loan officers, who possess valuable information about the borrowers' creditworthiness. The relationship bank can share credit information to soften the labor market competition, despite intensifying the credit market competition. When labor market mobility is moderate, information sharing emerges as the optimal strategy of the relationship bank.

JEL Classification: D82, G21, L13

Keywords: Credit market, Loan officer, Labor mobility, Information sharing

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1 Introduction

Banks obtain proprietary credit information through lending relationships with borrowers. This information allows banks to become information monopolists, thereby enabling them to attain advantageous positions in credit market competition. However, it is also well documented that banks may voluntarily share information with other lenders through private credit bureaus. According to the World Bank Doing Business data, 54.5 percent of the 191 countries in the survey had a credit bureau until 2010.[1] As information sharing may undermine their advantages in credit market competition with rivals, it is interesting to understand why banks are willing to voluntarily share proprietary credit information with other lenders. This paper takes a novel perspective to explain this puzzling fact by emphasizing the intricate interactions between credit and labor markets.

Our theory of bank information sharing is motivated by two observations. First, loan officers play an essential role in producing proprietary information about borrowers in relationship lending. A loan officer is a person who has frequent personal contact with a bank's borrowers. During a lending relationship, the loan officer screens, monitors, and interacts with the borrowers. Over time, the loan officer gathers valuable information indicative of the borrowers' creditworthiness.[2] In other words, loan officers are repositories of relationship information (Berger and Udell, 2002). Second, banks cannot exercise full ownership of loan officers owing to the inalienability of human capital (Hart and Moore, 1994; Diamond and Rajan, 2000). When hired by a new bank, a loan officer's information about the borrowers of her former bank can be transferred to the new bank. In Berger and Udell (2002), "A loan officer that is fired from or quits a consolidating bank may take this information to an existing local bank or start a de novo bank and keep lending to some of the same borrowers." As a consequence of loan officers' mobility, banks' proprietary information is not fully exclusive (Anand and Galetovic, 2000).

Based on these two observations, we hypothesize that the labor market mobility of key employees can have important implications for competition strategies of a bank. To illustrate this premise, consider a distant foreign bank that intends to enter a new credit market in which a local relationship bank exists. The local bank hires loan officers to process loans and collect credit information about local clients. When entering the local credit market directly, the distant bank will face severe adverse selection problems due to a lack

[1]There are two types of credit reporting institutions: credit registries and credit bureaus. Credit registries are public entities managed by bank supervisors or central banks, while credit bureaus are privately owned and operated. A key distinction between the two entities is that participation is voluntary in a credit bureau, but mandatory in a credit registry. See Miller (2003) and Bruhn et al. (2013) for more details.

[2]There is emerging literature documenting the role of information production by loan officers in relationship lending, see, for instance, Liberti and Mian (2009), Hertzberg et al. (2010), Uchida et al. (2012), Drexler and Schoar (2014), Xu et al. (2020) and Bushman et al. (2021).

of credit information of clients.[3] To mitigate its informational disadvantage, the distant bank can employ a strategy of poaching local banks' loan officers in the local labor market before it enters the credit market. Consequently, competition for the informational advantage of the credit market can trigger competition for human capital in the labor market. However, little theoretical work has incorporated this aspect into the analysis of lending competition.

Building on banks' competition in both the credit and labor markets, we propose a model to explore banks' information sharing decisions and analyze their relationship with labor market mobility. We show that the relationship between labor market mobility and the local bank's optimal information sharing decision is non-monotonic. Surprisingly, information sharing can emerge endogenously as the local bank's optimal "defensive" strategy to respond to the distant bank's competition in both markets when labor market mobility is at a moderate level.

In our model, a foreign bank can compete for a relationship bank's borrowers in a credit market and its loan officers in a labor market. There are two types of borrowers— H-type (high credit quality) and L-type (low credit quality)—applying for new loans in the credit market. Owing to its established lending relationships with the borrowers, the relationship bank privately observes the previous credit record of each borrower, which serves as an informative signal about their type. The relationship bank also inherits loan officers in charge of the bank's borrowers in the previous lending relationships. In addition to credit records, loan officers collect additional information about each borrower's type. For instance, a loan officer can form a subjective judgment about a borrower's integrity, personality, or risk appetite based on repeated interactions with the borrower. Combining these two pieces of information, both the relationship bank and its loan officers perfectly know each borrower's type. Information about the borrowers' types is inalienable to loan officers. Conversely, the foreign bank has no previous lending relationships with the borrowers; therefore, it only knows the prior distribution of each borrower's type and may suffer from adverse selection problems in the credit market competition.

As the information possessed by the bank's loan officers can help it overcome the adverse selection problem, the foreign bank may attempt to poach those loan officers by making wage offers before entering the credit market. To retain the loan officers, the relationship bank must match the foreign bank's wage offers. Whether the loan officers will switch jobs and transfer their information to the new employer also depends on labor market mobility. When labor market mobility is high, the relationship bank can find it

[3]See Dell'Ariccia et al. (1999) and Marquez (2002) for theoretical models that study the effects of adverse selection on the market structure of the banking industry.

costly or impossible to retain loan officers. Consequently, the high compensation cost or the inability to retain loan officers decreases the net profit of the relationship bank.

We model credit information sharing as the unilateral choice of the relationship bank. Our main analysis focuses on banks sharing borrowers' credit records. If it chooses to share information, the relationship bank commits to publicly disclosing (via a credit bureau) its borrowers' credit records once such information is generated. When the level of labor market mobility is moderate, the relationship bank can face an interesting trade-off regarding information sharing. On the one hand, sharing borrowers' credit records intensifies the credit market competition. The relationship bank makes less profit from extending loans to borrowers, as sharing information undermines its informational advantage. On the other hand, information sharing softens the labor market competition. The relationship bank pays less to retain its loan officers because the information they hold becomes less valuable to the foreign bank. Upon observing credit records of borrowers, the foreign bank competes less fiercely for loan officers. When the benefit of saving compensation cost dominates the cost of losing information rent, voluntary credit information sharing endogenously emerges as the optimal choice of the relationship bank. Furthermore, the relationship bank ceases to share information when labor market mobility becomes too low or too high. In the former case, the foreign bank can never enter the labor market to compete for the loan officers, so there is no reason for the relationship bank to give up the information rent in the credit market by sharing information. In the latter case, information sharing has no impact on the competition in both markets. The foreign bank can always acquire loan officers in the labor market, and both banks compete in the credit market with perfect information about the borrowers' types.

We believe that competing banks poaching loan customers from relationship banks by hiring their loan officers is realistic and relevant. A good example is the lawsuit between TD Bank and one of its former loan officers. TD Bank accused the loan officer of sending sensitive customer information such as tax returns, credit approvals, and other documents to the loan officer's new employer, Kearny Federal Savings Bank.[4] The loan officer had an agreement with TD bank that he/she would not solicit or take away any of the bank's customers during the employment or 12 months after. However, the loan officer and Kearny Bank never followed the agreement. In addition, several empirical findings confirm the interaction between labor market competition and credit market competition in our model. In particular, Wang (2019) empirically documents that competing banks may enter local credit markets and establish new branches by poaching the loan officers of relationship banks. However, less contestable labor markets alter the modes of bank expansion. They choose to acquire the branches of relationship banks directly.

[4]See https://www.law.com/njlawjournal/almID/1202677003178/?slreturn=20210412051615# for details.

Related literature: This study proposes that sharing credit information can be the defensive mechanism of a relationship bank to reduce a foreign bank's incentives to poach the former's employees. Therefore, the study contributes to the theoretical literature on bank information sharing in credit markets.[5] Pagano and Jappelli (1993) show that sharing information can help banks to overcome adverse selection problems in loan origination. Information sharing can reduce the moral hazard of borrowers as either a commitment device (Padilla and Pagano, 1997) or a discipline device (Padilla and Pagano, 2000).[6] In Bouckaert and Degryse (2006), sharing borrowers' credit information allows the relationship bank to extract more rents from profitable but unlucky borrowers. We complement this literature by highlighting a novel trade-off between the loss in rent extraction and the reduction in compensation cost in a realistic setting in which banks compete in both the credit and labor markets.

In terms of analyzing information sharing decisions with the interactions between two markets, our model is largely related to Bouckaert and Degryse (2004) and Xiong and Yang (2021). In Bouckaert and Degryse (2004), two ex-ante identical banks compete for borrowers during two periods. Banks may commit to disclosing borrowers' credit information in the second period to soften the first period's competition for market share.[7] Xiong and Yang (2021) analyze non-financial firms' information disclosure decisions and shows that firms face a trade-off between learning from a more price-informative asset market and losing competitive advantage in the product market.[8] Xiong and Yang (2021) suggest that voluntary disclosure by firms is beneficial to real productive efficiency owing to greater price informativeness. In contrast to both papers, we analyze the credit information sharing decisions of a relationship bank and introduce labor market competition for loan officers.

Regarding banks' entry strategies, Marquez (2002) argues that entry may be easier by acquiring branches of a local bank rather than de novo precisely because of the adverse selection problems. On the other hand, in Wang (2019), the author empirically shows that, as constraints on inter-bank labor mobility are relaxed, foreign banks enter new markets by directly establishing branches rather than acquiring branches

[5]Empirically, Jappelli and Pagano (2002) present evidence that bank lending is higher and credit risk is lower in countries where lenders share information. Brown et al. (2009) show that information sharing is associated with improved availability and cheaper credit to firms. Brown and Zehnder (2010) find that asymmetric information in the credit market increases the frequency of information sharing, and stronger competition between lenders reduces information sharing. Houston et al. (2010) show that information sharing is also associated with lower levels of bank risk-taking. In Doblas-Madrid and Minetti (2013), information sharing can reduce contract delinquencies and defaults, especially when firms are informationally opaque. Liberti et al. (2018) find that lenders share information when it allows them to enter into competitive credit markets.

[6]Karapetyan and Stacescu (2014) show that information sharing can increase banks' incentives to collect soft information of borrowers. In Bennardo et al. (2015), information sharing can constrain over-borrowing by the borrowers.

[7]In a banking context, Castiglionesi et al. (2019) analyze the interactions between banks' primary loan and secondary asset markets and show that banks may voluntarily share information to boost the secondary asset market liquidity.

[8]There is a large literature on (non-financial) firms' voluntary information disclosure in oligopolistic markets. See Vives (2008) for an authoritative survey on this literature.

of relationship banks. Our study contributes to this discussion by explicitly modeling competition in both the labor and credit markets. Our model highlights that a foreign bank can poach the loan officers of a relationship bank to gain borrowers' information and reduce its entry barrier in the credit market.

Our model is also related to the burgeoning literature that analyzes the competition for scarce talent and its implications. Our study is mostly close to Glode and Lowery (2016), wherein the authors study a model in which financial firms compete for a scarce supply of traders. In their model, hiring a trader can improve an employer's ability to appropriate surplus and ensure that the trader will not be employed by its trading counterparts. Consequently, firms bid defensively on traders. In contrast to this literature, we incorporate labor market competition in a banking context and explore its implications for information sharing by banks.

The model explores the relationship between banks' information sharing decisions and labor market mobility. Thus, our study is related to the growing literature on the analysis of labor market mobility in the banking sector. In particular, Lin et al. (2017) exploited the staggered recognition of the Inevitable Disclosure Doctrine (IDD) in the United States to study the effect of inter-bank labor mobility on loan contract terms. Agarwal et al. (2020) find that loan officers' labor mobility affects the origination and modification of the U.S. residential mortgage loans.

The rest of the paper is organized as follows. Section 2 sets up the model. In Section 3.1, we analyze the equilibrium of the credit market competition subgames given the relationship bank's previous decision regarding whether to share information and the outcome of the labor market competition. Section 3.2 solves the equilibrium of the labor market competition subgames. We characterize the relationship bank's optimal information choice in Section 3.3. In Section 4, we discuss the robustness of the model. Section 5 concludes. All proofs are in the online appendix.

2 Model setup

We consider a four-period economy with dates $t = 0, 1, 2, 3, 4$. There are four types of agents in the economy: a continuum of measure 1 borrowers, a relationship bank, a foreign bank, and a loan officer. All agents are risk-neutral. The gross return on the risk-free asset is R_0, and there is no discounting.

Each borrower can access a unit-size investment opportunity at $t = 3$. The borrowers have no wealth, so they have to finance the initial investment outlay by taking bank loans. A borrower's project, once financed, will pay off at $t = 4$. The return on the project depends on the type of borrower. A borrower can be either an H-type or an L-type, with a common prior $Pr(H) = 1 - Pr(L) = \alpha \in (0, 1)$. An H-type borrower always generates a payoff $R > R_0$, whereas an L-type borrower generates R with a probability $p \in (0, 1)$ and 0 with

the complementary probability. We assume $pR < R_0$, so the L-type borrower's project has a negative net present value (NPV). The project risk of L-type borrowers is independent.

A relationship bank inherits established lending relationships with all borrowers from $t = 0$. With these relationships, the relationship bank collects two types of borrower information at $t = 1$. First, the bank privately observes each borrower's credit record. A credit record can take one of two values: $\overline{D}$ (good record) or D (bad record). While an H-type borrower always generates a good record, an L-type borrower produces a good record with probability $\theta \in (0, 1)$ and a bad record with probability $1 - \theta$.[9] The relationship bank also inherits a loan officer who manages the bank's lending business from $t = 0$ to $t = 1$.[10] In addition to observing each borrower's credit record at $t = 1$, the loan officer can produce additional information to evaluate borrowers.[11] For instance, the loan officer can correctly identify an L-type borrower based on frequent interactions with the borrower, although the borrower can produce a $\overline{D}$ record. The loan officer knows each borrower's type based on these two pieces of information. We assume that the relationship bank can also detect each borrower's type by combining the credit records and loan officer's information. This assumption is consistent with the empirical findings in Agarwal and Hauswald (2010) that banks' internal credit scores of loan applicants comprise both verifiable hard information and subjective knowledge collected by loan officers through lending relationships.[12]

A foreign bank appears at $t = 1$ and plans to compete with the relationship bank for borrowers in the $t = 3$ credit market. As it does not have existing relationships with the borrowers, the foreign bank does not possess any information about their types, except the common prior. As will be explained subsequently, there are means by which the foreign bank can obtain information before entering the credit market. For

[9]Note that θ can be different from p. In a business lending context, one may interpret a borrower's type as her ability to select good projects and record D as a late interest rate repayment on a previous business loan. While the H-type borrower never misses an interest repayment and will always select a good project, the L-type borrower incurs a late repayment with probability $1 - \theta$ and will select a gambling project with a success probability of p.

[10]An alternative assumption can be that the relationship bank has N local branches, each of which faces a pool of loan applicants and has a loan officer to take charge of the branch. We show in Section 4.4 that our main results will be qualitatively the same under this alternative "N loan officers and N branches" assumption. Furthermore, the loan officer in our model can be broadly considered as a branch manager or a key employee who has proprietary information about the borrowers.

[11]For empirical evidence, see, e.g., Petersen and Rajan (2002), Berger and Udell (2002), and Agarwal and Hauswald (2010).

[12]Following the banking literature (e.g., Stein, 2002; Liberti and Petersen, 2019), we can interpret these two pieces of information as the hard and soft information about the borrowers. According to Liberti and Petersen (2019), hard information is the information that "...is quantitative, easy to store, and can be transmitted in impersonal ways. Its information content is independent of its collection...". By contrast, soft information is the information that "...is difficult to completely summarize in a numeric score, that requires a knowledge of its context to fully understand, and that becomes less useful when separated from the environment in which it was collected...". These two types of information capture different yet complementary aspects of the borrower's risk profile. Hence, we assume that both types of information are valuable inputs for the evaluation of borrowers' creditworthiness by the relationship bank. This assumption is consistent with lending practice in reality. For instance, Cerqueiro et al. (2011) show that both "rules" (which refers to a standardized pricing model that can be predicted by verifiable information of the applicant), and "discretion" (which reflect the loan officer's judgment), affect the loan rate-setting process, similar to the findings in Agarwal and Hauswald (2010). Liberti (2018) also confirms that banks reply on personal assessments by the loan officer in their loan decision in addition to hard information.

simplicity, we do not analyze the funding side of banks and assume that the cost of funding for both the banks equals R_0.

We consider credit information sharing the relationship bank's unilateral choice at $t = 0$ before acquiring borrowers' credit information. The relationship bank chooses information regime $\Sigma \in \{N, S\}$, where $\Sigma = S$ refers to the bank's choice of entering the information sharing regime, and $\Sigma = N$ implies otherwise. Following the literature, we assume that upon entering regime S, the relationship bank commits to disclosing each borrower's credit record truthfully to the public at $t = 1$ after such information is realized.[13] In regime N, the relationship bank discloses nothing at $t = 1$. We also assume that the relationship bank incurs a tiny cost when communicating credit information.[14] Credit information sharing is the first means by which the foreign bank can obtain borrowers' information. The foreign bank can update its beliefs about each borrower's type based on the observed credit records once the relationship bank enters regime S.

A labor market opens at the beginning of $t = 2$ where the two banks can compete for the loan officer by simultaneously offering wages. The loan officer's reservation utility is zero. Observing the two bids, she maximizes the payoff by deciding between switching to the foreign bank or staying with the relationship bank. When the loan officer is indifferent to both bids, she switches the job or stays with the current employer with equal probability. The winning bank pays the bid to the loan officer, while the losing bank pays zero. Once employed by a bank, the officer's interest is perfectly aligned with the employer's. In particular, she will perfectly screen loan applications in the $t = 3$'s credit market for that bank.[15] The loan officer incurs an observable cost of l to switch from the current employer to the foreign bank. We model such an observable switching cost as a measure of the loan officer's job mobility.[16] It is more likely for the foreign bank to outbid the relationship bank in the labor market competition when the switching cost l is low, that is, the loan officer's job mobility is high. We denote $L \in \{I, E\}$ as the outcome of the labor market competition, where $L = I$ refers to the relationship bank retaining the loan officer, and $L = E$ implies otherwise.

[13] See, e.g., Padilla and Pagano (1997, 2000), Bouckaert and Degryse (2006) and Karapetyan and Stacescu (2014). In the US, the Federal Fair Credit Reporting Act (FCRA) states that both credit bureaus and banks are responsible for providing accurate information on borrowers. Moreover, consumers can dispute the information they deem inaccurate. In the context of non-financial firms, Vives (1984) and Xiong and Yang (2021) also assume full commitment power regarding the information sharing decisions. In Section 4.2, we study a case in which the relationship bank can disclose each borrower's type.

[14] This assumption helps us determine the relationship bank's behavior when it is indifferent between sharing information and not sharing from a net profit perspective.

[15] The assumptions that the loan officer perfectly observes each borrower's type and that the loan officer's and the employer's interests are perfectly aligned are made for analytical simplicity. Our main trade-off and results remain the same when these two assumptions are relaxed.

[16] Here, the switching cost can be interpreted as the loan officer's legal cost of joining a rival bank. A good example is the lawsuit between TD Bank and a former loan officer, as described previously. We provide more discussions of this interpretation in Section 4.1.

The two banks compete for borrowers by simultaneously offering loan rates in a credit market that opens at the beginning of $t = 3$. The H-type borrower maximizes her payoff by deciding which bank to borrow from based on their loan rates. We assume that each H-type borrower incurs a cost of s to switch to the foreign bank. Unlike the loan officer's switching cost, the switching cost of H-type borrower is private information.[17] It is commonly known that s is independently drawn from a uniform distribution $U(0, \overline{s})$. We assume that $R_0 > \frac{2}{3}\overline{s}$, so the borrower's switching cost s is not overly high compared to the funding cost R_0.[18] Lastly, we assume that the L-type borrowers derive non-pecuniary private benefits from initiating loans and always want to borrow if possible. The sequence of events is summarized in Figure 1.

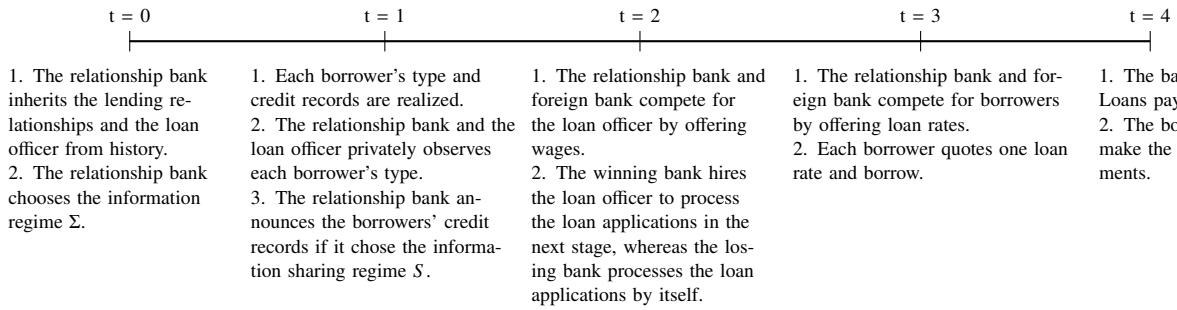


Figure 1: Time line of the model

3 Equilibrium analysis

We apply the subgame perfect equilibrium (SPE) to solve the model.

Definition. *At $t = 0$, the relationship bank optimally chooses the information regime Σ^*. At $t = 1$, the relationship bank truthfully discloses the borrowers' credit records if $\Sigma = S$ and shares nothing if $\Sigma = N$. At $t = 2$, given the information regime ($\Sigma = N$ or S), the relationship bank and the foreign bank simultaneously bid B_N^* and b_N^* for the loan officer if $\Sigma = N$, and they simultaneously bid B_S^* and b_S^* if $\Sigma = S$. The labor market competition outcome is realized ($L = I$ or E). At $t = 3$, if $\Sigma = N$ and $L = I$, the relationship bank offers loan rate $R_N^*(H)$ to the H-type borrowers, while the foreign bank offers r_N^* to all borrowers; if $\Sigma = S$ and $L = I$, the relationship bank offers loan rate $R_S^*(H)$ to the H-type borrowers while the foreign bank offers $r_S^*(\overline{D})$ to the borrowers with credit record $\overline{D}$; if $L = E$, the relationship bank and the foreign bank offer loan rates $\tilde{R}^*(H)$ and $\tilde{r}^*(H)$ to the H-type borrowers.*[19]

[17] As the H-type borrowers' switching cost is private information, the relationship bank can only charge a single loan rate to the H-type borrowers. See, for instance, Bouckaert and Degryse (2006) for the same assumption. Klemperer (1995) provides a general discussion of the role of switching cost in market competition.

[18] This assumption is immaterial, and we assume it only to reduce the burden of discussing too many cases.

[19] Note that the foreign bank will not grant loans to borrowers with credit record D if $\Sigma = S$. The loan officer's and borrowers' optimal decisions are straightforward, so we omit them for brevity.

3.1 Credit market competition

We solve the SPE backward starting with the $t = 3$'s credit market competition subgames given the information regime chosen at $t = 0$ and the outcome of the labor market competition at $t = 2$.

3.1.1 The relationship bank wins the labor market competition $L = I$

We analyze the credit market competition subgames when the outcome of the $t = 2$ labor market competition is $L = I$. Depending on the information regime to be N or S, there are two types of credit market competition subgames, both of which feature the relationship bank retaining the loan officer. We solve the two types of subgames, starting with the case when the relationship bank does not share any information.

The relationship bank knows each borrower's type perfectly; thus, it charges a rate of $R_N(H)$ to the H-type borrowers while denying loan applications from the L-type borrowers. Conversely, the foreign bank has no information about the borrowers' type, except for the common prior. Consequently, it offers a single loan rate of r_N for all loan applicants.

Given the loan rates $R_N(H)$ and r_N, an H-type borrower is indifferent between continuing the lending relationship with the relationship bank and switching to the foreign bank if its switching cost $\hat{s}$ satisfies the following condition $R - R_N(H) = R - r_N - \hat{s}$. An H-type borrower switches to the foreign bank if and only if $s < \hat{s} = R_N(H) - r_N$. If $0 < R_N(H) - r_N < \overline{s}$, the relationship bank's loan demand from the H-type borrowers is $D_N = \alpha\frac{\overline{s}-\hat{s}}{\overline{s}} = \alpha\frac{\overline{s}-R_N(H)+r_N}{\overline{s}}$. Instead, if $R_N(H) \leq r_N$, all H-type borrowers will stay with the relationship bank, and thus $D_N = \alpha$, or when $R_N(H) \geq r_N + \overline{s}$, all H-type borrowers will switch to the foreign bank, so $D_N = 0$. For the foreign bank, its loan demand from the H-type borrowers is $d_N = \alpha - D_N$. The loan demand functions of the H-type borrowers for the two banks are

$$D_N = \begin{cases} 0 & R_N(H) \geq r_N + \overline{s} \\ \alpha\frac{\overline{s}-R_N(H)+r_N}{\overline{s}} & r_N < R_N(H) < r_N + \overline{s} \\ \alpha & R_N(H) \leq r_N, \end{cases} \quad \text{and} \quad d_N = \alpha - D_N.$$

In contrast, all L-type borrowers will switch to the foreign bank because, first, their loan applications will be denied by the relationship bank who has perfect information on the borrowers' types, and second, the foreign bank is uninformed. The relationship and foreign banks' profits in the credit market competition are $\Pi_N = (R_N(H) - R_0) D_N$ and $\pi_N = (r_N - R_0) d_N + (pr_N - R_0)(1 - \alpha)$. The two banks simultaneously choose loan rates $R_N(H)$ and r_N to maximize their profits. The following lemma establishes the existence and uniqueness of a Nash equilibrium.

Lemma 1. *In the credit market competition subgame following* $\Sigma = N$ *and* $L = I$*, there exists a unique Nash equilibrium* $R_N^*(H) = R_0 + \frac{2\alpha+(1-\alpha)p}{3\alpha}\overline{s}$ *and* $r_N^* = R_0 + \frac{\alpha+2(1-\alpha)p}{3\alpha}\overline{s}$*. The two banks' market shares of the H-type borrowers are* $D_N^* = \frac{2\alpha+(1-\alpha)p}{3}$ *and* $d_N^* = \frac{\alpha-(1-\alpha)p}{3}$*. All the L-type borrowers borrow from the foreign bank. The two banks' equilibrium profits are* $\Pi_N^* = \frac{(2\alpha+(1-\alpha)p)^2}{9\alpha}\overline{s}$ *and* $\pi_N^* = \frac{(\alpha+2(1-\alpha)p)^2}{9\alpha}\overline{s} - (1-\alpha)(1-p)R_0$.

First, the relationship bank charges H-type borrowers with a higher loan rate than the foreign bank. Two countervailing forces are at play: on the one hand, the H-type borrowers incur costs to switch to the foreign bank, which enables the relationship bank to increase its loan rate over the one charged by its competitor. On the other hand, the foreign bank suffers from an adverse selection problem and has to increase its loan rate to compensate for the loss of financing the L-type borrowers. It can be verified that the force due to switching costs overcomes that due to adverse selection; therefore, we have $R_N^*(H) > r_N^*$. Second, the relationship bank's profit is positive, as it only finances the H-type borrowers. The situation of the foreign bank is more complicated. As the L-type borrowers' projects have negative NPVs, the foreign bank makes a positive profit only when the proportion of the H-type borrowers is not small.[20] In the following analyses, we focus on this case; therefore, the credit market is always contestable for the foreign bank.[21]

We then turn to the case in which the relationship bank chooses $\Sigma = S$ at $t = 0$. Unlike the no information sharing case, the foreign bank now observes borrowers' credit records shared by the relationship bank and screens the loan applications based on such information. Knowing that $Pr(L|D) = 1$, the foreign bank denies loan applications from borrowers with credit record D. Consequently, a proportion $1 - \theta = Pr(D|L)$ of the L-type borrowers is denied financing. However, the foreign bank cannot perfectly screen borrowers because credit records are only imperfect signals about borrowers' types. Therefore, a proportion $\theta = Pr(\overline{D}|L)$ of the "lucky" L-type borrowers can still receive funding from the foreign bank at a rate $r_S(\overline{D})$. Knowing the borrowers' types, the relationship bank charges a loan rate $R_S(H)$ to the H-type borrowers and still rejects loan applications from the L-type borrowers.

[20]Note that our model differs from loan competition models such as Sharpe (1990) and Von Thadden (2004) where no pure strategy Nash equilibrium exists. In our model, competing banks hold local monopoly positions due to borrowers' private and idiosyncratic switching costs. Therefore, the less informed bank can still earn a positive profit on H-type borrowers whose switching costs are small. Once the proportion of H-type borrowers is sufficiently high, even the less informed bank can earn a positive expected profit.

[21]Our focus on the contestable credit market is consistent with the previous literature, such as Bouckaert and Degryse (2006), which explores the possibility of a relationship bank using information sharing as a credit market entry deterrence strategy. This assumption eases our exposition. In the online appendix, we also consider the case in which the credit market is not fully contestable for the foreign bank. We show that the main results still hold with this modification.

Given the loan rates $R_S(H)$ and $r_S(\overline{D})$, we can similarly derive the loan demand functions of the H-type borrowers for the two banks as follows:

$$D_S = \begin{cases} 0 & R_S(H) \geq r_S(\overline{D}) + \overline{s} \\ \alpha \frac{\overline{s} - R_S(H) + r_S(\overline{D})}{\overline{s}} & r_S(\overline{D}) < R_S(H) < r_S(\overline{D}) + \overline{s} \\ \alpha & R_S(H) \leq r_S(\overline{D}), \end{cases} \quad \text{and} \quad d_S = \alpha - D_S.$$

In addition, the two banks' profits in the credit market competition are $\Pi_S = (R_S(H) - R_0) D_S$ and $\pi_S = \left(r_S(\overline{D}) - R_0\right) d_S + \left(p r_S(\overline{D}) - R_0\right)(1-\alpha)\theta$. The following lemma characterizes the credit market equilibrium.

Lemma 2. *In the credit market competition subgame following $\Sigma = S$ and $L = I$, there exists a unique Nash equilibrium $R_S^*(H) = R_0 + \frac{2\alpha + (1-\alpha)p\theta}{3\alpha}\overline{s}$ and $r_S^*(\overline{D}) = R_0 + \frac{\alpha + 2(1-\alpha)p\theta}{3\alpha}\overline{s}$. The two banks' market shares of the H-type borrowers are $D_S^* = \frac{2\alpha + (1-\alpha)p\theta}{3}$ and $d_S^* = \frac{\alpha - (1-\alpha)p\theta}{3}$. A proportion θ of the L-type borrowers is financed by the foreign bank. The equilibrium profits of the two banks are $\Pi_S^* = \frac{(2\alpha + (1-\alpha)p\theta)^2}{9\alpha}\overline{s}$ and $\pi_S^* = \frac{(\alpha + 2(1-\alpha)p\theta)^2}{9\alpha}\overline{s} - (1-\alpha)(1-p)\theta R_0$.*

Similar to the no information sharing case, the relationship bank charges H-type borrowers with a higher loan rate than the foreign bank. The relationship bank's profit is positive because it finances only the H-type borrowers. We again focus on the case in which the foreign bank's equilibrium profit is positive when it finances a proportion θ of the L-type borrowers.

We compare the equilibrium outcomes of the two credit market competition subgames to analyze how credit information sharing affects the competition. Both banks charge lower equilibrium loan rates in the information sharing regime. Because information sharing alleviates the adverse selection problem, the foreign bank competes more intensively for borrowers with a good credit record $\overline{D}$, that is, $r_S^*(\overline{D}) < r_N^*$. As a result, the relationship bank has to lower its loan rate charged to the H-type borrowers to match the foreign bank's offer, that is, $R_S^*(H) < R_N^*(H)$. In the following proposition, we compare each bank's equilibrium profit in the above two subgames and establish sufficient conditions to guarantee that the equilibrium is well defined.

Proposition 1. *In the two credit market competition subgames following $L = I$, we have:*

- *The credit market is fully contestable if $\alpha > \alpha^* \in (0, 1)$.*
- *If the information regime switches from N to S, the relationship bank's equilibrium profit decreases, and the foreign bank's equilibrium profit increases as long as $p < p_1^c \in (0, 1)$.*

Given that the relationship bank wins the labor market competition, sharing the borrowers' credit records undermines its position as an information monopolist and intensifies the credit market competition. The

relationship bank's equilibrium profit unambiguously decreases when the information regime switches from no sharing to sharing as both its equilibrium loan rate and market share of the H-type borrowers depreciate. Suppose that the foreign bank could not poach the loan officer, the relationship bank will never find it profitable to disclose the borrowers' credit information to the foreign bank.

To ensure that the credit market is contestable for the foreign bank despite the adverse selection problem, the proportion of the H-type borrowers has to be sufficiently high, that is, $\alpha > \alpha^*$.[22] In such a contestable credit market, information sharing has an ambiguous effect on the foreign bank's equilibrium profit. Two effects contribute to this result: on the one hand, information sharing benefits the foreign bank by alleviating the adverse selection problem. The foreign bank competes more intensively for the borrowers with good credit records and gains a higher market share of the profitable H-type borrowers. It also improves the screening of borrowers by refusing loan applications from borrowers with bad credit records. The benefit decreases with p because a higher p is associated with a less severe adverse selection problem. On the other hand, the foreign bank charges a lower loan rate when the credit market competition is more intensified, undermining its profit. This negative effect of information sharing increases with p.[23] There exists a cut-off p_1^c such that, when $p < p_1^c$, the positive force due to the alleviation of the adverse selection problem dominates the negative force resulting from the intensified credit market competition. Therefore, information sharing increases the foreign bank's profit if and only if $p < p_1^c$. In the following analyses, we confine our discussion to the parameter constellation $\alpha > \alpha^*$ and $p < p_1^c$.

3.1.2 The foreign bank wins the labor market competition $L = E$

We then analyze the credit market competition subgames when the outcome of the $t = 2$ labor market competition is $L = E$. In both information regimes $\Sigma = N$ and S, the credit market features perfect information on the borrower's type as both the relationship bank and the loan officer on behalf of the foreign bank can observe each borrower's type. Therefore, the relationship bank's choice of sharing borrowers' credit records becomes irrelevant. The relationship bank and the perfectly informed loan officer on behalf of the foreign bank now simultaneously offer loan rates $\tilde{R}(H)$ and $\tilde{r}(H)$ only to the H-type borrowers while denying the loan applications of L-type borrowers.

[22] We analyze the case when α is small in the online appendix, so the foreign bank cannot profitably enter the credit market in regime N. This case corresponds to that the credit market is not fully contestable for the foreign bank. We show that all our main results still hold with this modification. Intuitively, the foreign bank's incentive to compete in the labor market becomes even higher, further increasing the relationship bank's cost of retaining the loan officer. On the other hand, the relationship bank's loss in information rent from sharing information also increases as it can enjoy a monopoly position in regime N. However, the tradeoff between extracting less information rent and saving compensation costs remains.

[23] To be precise, the cost is the difference between the two loan rates r_N^* and $r_S^*(\overline{D})$, which increases with p.

Given loan rates $\tilde{R}(H)$ and $\tilde{r}(H)$, the two banks' loan demand functions from the H-type borrowers are

$$\tilde{D} = \begin{cases} 0 & \tilde{R}(H) \geq \tilde{r}(H) + \overline{s} \\ \alpha \frac{\overline{s} - \tilde{R}(H) + \tilde{r}(H)}{\overline{s}} & \tilde{r}(H) < \tilde{R}(H) < \tilde{r}(H) + \overline{s} \\ \alpha & \tilde{R}(H) \leq \tilde{r}(H), \end{cases} \quad \text{and} \quad \tilde{d} = \alpha - \tilde{D}.$$

We express the two banks' profits in the credit market competition as $\tilde{\Pi} = \left(\tilde{R}(H) - R_0\right)\tilde{D}$ and $\tilde{\pi} = \left(\tilde{r}(H) - R_0\right)\tilde{d}$. The following lemma characterizes the equilibrium.

Lemma 3. *The two credit market competition subgames following $L = E$ feature the same Nash equilibrium $\tilde{R}^*(H) = R_0 + \frac{2}{3}\overline{s}$ and $\tilde{r}^*(H) = R_0 + \frac{1}{3}\overline{s}$, regardless of the information regime Σ. The two banks' market shares of the H-type borrowers are $\tilde{D}^* = \frac{2\alpha}{3}$ and $\tilde{d}^* = \frac{\alpha}{3}$. The L-type borrowers cannot obtain funding. The equilibrium profits of the two banks are $\tilde{\Pi}^* = \frac{4\alpha}{9}\overline{s}$ and $\tilde{\pi}^* = \frac{\alpha}{9}\overline{s}$.*

Regardless of the relationship bank's information sharing choice, the credit market competition features symmetric information on the borrowers' type. Both banks finance only H-type borrowers. Borrowers' switching costs drive the differences in the equilibrium loan rates, market shares, and profits of the two banks. The relationship bank charges a loan premium twice as high as its competitor does and obtains two-thirds of the market share of H-type borrowers.

We are now able to analyze how credit information sharing and labor market competition jointly affect credit market competition. We compare equilibrium profit of each bank in the three aforementioned credit market competition subgames (equilibrium characterized by Lemma 1 to Lemma 3) and summarize the results in Proposition 2.

Proposition 2. *When the parameters are such that $\alpha > \alpha^*$ and $p < p_1^c$, we have:*

- $\Pi_N^* > \Pi_S^* > \tilde{\Pi}^*$. *The relationship bank has the highest equilibrium profit when it wins the labor market competition in regime N. It has the lowest equilibrium profit when it loses the labor market competition.*

- $\tilde{\pi}^* > \pi_S^* > \pi_N^*$. *The foreign bank has the highest equilibrium profit when it wins the labor market competition. It has the lowest equilibrium profit when it loses the labor market competition in regime N.*

Proposition 2 indicates the detrimental (beneficial) consequence of losing (winning) the labor market competition for the relationship (foreign) bank. To gain intuitions of this result, consider the no information

sharing regime. In losing the loan officer to its competitor, the equilibrium profit of the relationship bank drops from Π_N^* to $\tilde{\Pi}^*$. However, the equilibrium profit of the foreign bank increases from π_N^* to $\tilde{\pi}^*$ when it successfully poaches the loan officer. It is then tempting for the foreign bank to poach the loan officer as a pre-entry strategy to overturn its disadvantageous position in the credit market competition.

In both information regimes N and S, the foreign bank's equilibrium profit increases when the outcome of the labor market competition switches from I to E. However, the increase in profit is higher when the relationship bank does not share information, that is, $\tilde{\pi} - \pi_N^* > \tilde{\pi} - \pi_S^*$. The foreign bank then has a higher incentive to compete for the loan officer in the no information sharing regime. To soften the fierce labor market competition, the relationship bank may deliberately choose the information sharing regime to undermine its competitor's benefit of getting the loan officer. Thus, sharing credit records is a viable option for the relationship bank.

3.2 Labor market competition

We move one step backward to analyze the $t = 2$ labor market competition subgames, given the relationship bank's choice of information regime at $t = 0$. We model the two banks' labor market competition as a Bertrand game where the banks compete in wage rates. In the bidding game, the values of the loan officer for both banks are endogenously determined by the equilibrium of the subsequent credit market competition subgames. The two banks simultaneously offer take-it-or-leave-it wage rates $B \geq 0$ and $b \geq 0$ to the loan officer.[24] Observing the two bids, the loan officer decides between switching to the foreign bank or staying with the relationship bank.

3.2.1 Labor market competition without information sharing

We study the $t = 2$ labor market competition subgame when the relationship bank chooses $\Sigma = N$ at $t = 0$. We start by deriving the values of the loan officer for both banks in the bidding game: their profit gains in the credit market from winning the competition for the loan officer. Let Ψ_N and ψ_N be the values of the loan officer for the relationship bank and the foreign bank in regime N, respectively. We define $\Psi_N \equiv \Pi_N^* - \tilde{\Pi}^*$ and $\psi_N \equiv \tilde{\pi}^* - \pi_N^*$, where the expressions of Π_N^*, π_N^* and $\tilde{\Pi}^*$, $\tilde{\pi}^*$ can be found in Lemma 1 and Lemma 3, respectively. By Proposition 2, the values of the loan officer for both banks are strictly positive. The foreign bank anticipates its profit in the credit market to be π_N^* when it loses the labor market competition. In contrast, the foreign bank's profit increases to $\tilde{\pi}^*$ when it wins the labor market competition. Hence, it is willing to bid for the loan officer up to ψ_N to reduce information asymmetry in

[24] As there is no agency problem, it suffices to consider wage offers in the form of pure cash.

credit market competition. Similarly, Ψ_N is the maximum amount that the relationship bank would like to pay for the loan officer to create an informational advantage in credit market competition. The following lemma characterizes an equilibrium of the labor market competition game when $\Sigma = N$.

Lemma 4. *In regime N, the value of the loan officer is higher for the foreign bank than for its competitor if and only if $p < p^* \in (0, p_1^c)$. An equilibrium of the labor market competition is*

- *When $p \in (0, p^*)$, for $l \in [0, \psi_N - \Psi_N]$, the relationship bank randomizes its bids according to a continuous density function $B_N^*(\cdot)$ on $[\Psi_N - \epsilon, \Psi_N]$, and the foreign bank bids $b_N^* = \Psi_N + l$; for $l \in (\psi_N - \Psi_N, \psi_N]$, the relationship bank bids $B_N^* = \psi_N - l$, and the foreign bank randomizes its bids according to a continuous density function $b_N^*(\cdot)$ on $[\psi_N - \epsilon, \psi_N]$; for $l \in (\psi_N, \infty)$, the two banks bid $B_N^* = b_N^* = 0$.*

- *When $p \in [p^*, p_1^c)$, for $l \in [0, \psi_N]$, the relationship bank bids $B_N^* = \psi_N - l$, and the foreign bank randomizes its bids according to a continuous density function $b_N^*(\cdot)$ on $[\psi_N - \epsilon, \psi_N]$; for $l \in (\psi_N, \infty)$, the two banks bid $B_N^* = b_N^* = 0$.*

The two banks now face a simple Bertrand game with asymmetric values. First, we explain why the value of the loan officer is higher for the foreign bank than for the relationship bank when p is sufficiently low (i.e., $p < p^* < p_1^c$). As the relationship bank chooses $\Sigma = N$ in the previous stage, the foreign bank will suffer a severe adverse selection problem in the credit market when it loses the labor market competition. It will finance all the unprofitable L-type borrowers and incur a more significant loss when the success probability p of the L-type borrowers' project becomes lower, $\frac{d\pi_N^*}{dp} > 0$. To avoid the greater loss, the foreign bank has a higher incentive to poach the loan officer when p is small. Consequently, the value of the loan officer for the foreign bank decreases with p, that is, $\frac{d\psi_N}{dp} = -\frac{d\pi_N^*}{dp} < 0$. Conversely, the relationship bank benefits from its informational advantage in the credit market when it wins the labor market competition. When p becomes smaller, the foreign bank competes more fiercely to compensate for the loss of financing the L-type borrowers, $\frac{dr_N^*}{dp} > 0$. To match the foreign bank's loan rate, the relationship bank also needs to reduce its loan rate $R_N^*(H)$ charged to the H-type borrowers. Then, the relationship bank's equilibrium profit in the credit market increases with p, $\frac{d\Pi_N^*}{dp} > 0$. Hence, the value of the loan officer for the relationship bank increases as p increases, that is, $\frac{d\Psi_N}{dp} = \frac{d\Pi_N^*}{dp} > 0$. Following these two arguments, we have $\psi_N > \Psi_N$ when $p < p^*$.

The values of the loan officer for the two banks and the loan officer's switching cost jointly determine the equilibrium of the bidding game. Following Blume (2003), we characterize the equilibrium in undominated strategies of the asymmetric Bertrand game. We illustrate the equilibrium with the case $p < p^*$ and $0 \leq l \leq$

$\psi_N - \Psi_N$. For the foreign bank, the net value of the loan officer is $\psi_N - l$; that is, the value of the loan officer nets the officer's switching cost l borne by the foreign bank. For the relationship bank, the net value of the loan officer is Ψ_N. When labor market mobility is high, the foreign bank has a higher net value than its competitor, $\psi_N - l \geq \Psi_N$. Even if the foreign bank has to cover l to induce the switching of the loan officer, it can still outbid its competitor. Notably, given the relationship bank randomizing its bids on the interval $[\Psi_N - \epsilon, \Psi_N]$, the foreign bank finds it optimal to bid $\Psi_N + l$ and wins the loan officer with a probability of one. On the other hand, given the foreign bank's bid $\Psi_N + l$, the relationship bank loses the loan officer with a probability of one by randomizing its bids on the interval $[\Psi_N - \epsilon, \Psi_N]$. The relationship bank never bids beyond the value of the loan officer Ψ_N and loses the loan officer if its bid is below $\Psi_N - \epsilon$.[25] By the same logic, one can check the equilibrium for other levels of labor market mobility l.

Technically, our labor market bidding game features multiple equilibria. For instance, when $p < p^*$ and $0 \leq l \leq \psi_N - \Psi_N$, a strategy "the relationship bank randomizes its bids according to a continuous density function $B_N^*(\cdot)$ on the interval $[\Psi_N + \eta - \epsilon, \Psi_N + \eta]$ with $\eta \in (0, \psi_N - \Psi_N - l]$, and the foreign bank bids $b_N^* = \Psi_N + l + \eta > \Psi_N + l$" is also an equilibrium. However, the strategy described in Lemma 4 is the undominated equilibrium. This corresponds to $\eta = 0$ and leads to the lowest compensation cost for banks. In the following discussion, we focus on this undominated equilibrium. We present Proposition 3 to summarize the equilibrium outcomes.

Proposition 3. *In regime N, the outcomes of the undominated equilibrium of the labor market bidding game are as follows:*

- *When $p \in (0, p^*)$, for $l \in [0, \psi_N - \Psi_N]$, the foreign bank wins the labor market competition with a compensation cost $\Psi_N + l$; for $l \in (\psi_N - \Psi_N, \psi_N]$, the relationship bank wins with a compensation cost $\psi_N - l$; for $l \in (\psi_N, \infty)$, the relationship bank wins with zero compensation cost.*

- *When $p \in [p^*, p_1^c)$, for $l \in [0, \psi_N]$, the relationship bank wins the labor market competition with a compensation cost $\psi_N - l$; for $l \in (\psi_N, \infty)$, the relationship bank wins with zero compensation cost.*

Following Proposition 3, we can calculate the two banks' lowest compensation costs corresponding to each level of labor market mobility l in regime N. Denote the relationship bank's and the foreign bank's

[25] Note that the relationship bank's single bid Ψ_N and the foreign bank's bid $\Psi_N + l$ cannot be an equilibrium under our assumption that the loan officer will switch the job or stay with the current employer with an equal probability when the two bids make her indifferent. Indeed, the foreign bank would always have incentive to increase its bid an ϵ amount above $\Psi_N + l$ to win the loan officer with certainty instead of winning the loan officer with a probability $\frac{1}{2}$.

compensation costs as Ω_N and ω_N, respectively. We have:

$$\Omega_N = \begin{cases} 0 & 0 \le l \le \psi_N - \Psi_N \\ \psi_N - l & \psi_N - \Psi_N < l \le \psi_N \\ 0 & l > \psi_N \end{cases} \quad \text{and} \quad \omega_N = \begin{cases} \Psi_N + l & 0 \le l \le \psi_N - \Psi_N \\ 0 & \psi_N - \Psi_N < l \le \psi_N \\ 0 & l > \psi_N \end{cases}$$

when $p \in (0, p^*)$. Note that when $0 \le l \le \psi_N - \Psi_N$, the relationship bank loses the labor market competition even if it randomizes its bids on the interval $[\Psi_N - \epsilon, \Psi_N]$. According to our assumption, the bank incurs zero compensation cost as the loan officer accepts the bid $\Psi_N + l$ from the foreign bank and switches the job. In addition, we have:

$$\Omega_N = \begin{cases} \psi_N - l & 0 \le l \le \psi_N \\ 0 & l > \psi_N \end{cases} \quad \text{and} \quad \omega_N = 0$$

when $p \in [p^*, p_1^c)$.

3.2.2 Labor market competition with information sharing

We turn to the $t = 2$'s labor market competition subgame when the relationship bank chooses $\Sigma = S$ at $t = 0$ and discloses each borrower's credit record at $t = 1$. We derive the two banks' maximum willingness to pay for the loan officer in the labor market bidding game. Let Ψ_S and ψ_S be the values of the loan officer for the relationship bank and the foreign bank in regime S, respectively. We define $\Psi_S \equiv \Pi_S^* - \tilde{\Pi}^*$ and $\psi_S \equiv \tilde{\pi}^* - \pi_S^*$, where the expressions of Π_S^* and π_S^* can be found in Lemma 2. Both values are positive as established by Proposition 2. For the same reasons aforementioned, the labor market bidding game features multiple equilibria. We again focus on the undominated equilibrium, which is characterized in the following Lemma 5.

Lemma 5. *In regime S, the value of the loan officer is higher for the foreign bank than that for its competitor if and only if $p < p_2^c \in (0, 1)$, and we have $p^* < p_2^c$. The undominated equilibrium of the labor market competition is as follows:*

- *When $p \in (0, p_2^c)$, for $l \in [0, \psi_S - \Psi_S]$, the relationship bank randomizes its bids according to a continuous density function $B_S^*(\cdot)$ on $[\Psi_S - \epsilon, \Psi_S]$, and the foreign bank bids $b_S^* = \Psi_S + l$; for $l \in (\psi_S - \Psi_S, \psi_S]$, the relationship bank bids $B_S^* = \psi_S - l$, and the foreign bank randomizes its bids according to a continuous density function $b_S^*(\cdot)$ on $[\psi_S - \epsilon, \psi_S]$; for $l \in (\psi_S, \infty)$, the two banks bid $B_S^* = b_S^* = 0$.*

- *When $p \in [p_2^c, p_1^c)$, for $l \in [0, \psi_S]$, the relationship bank bids $B_S^* = \psi_S - l$, and the foreign bank randomizes its bids according to a continuous density function $b_S^*(\cdot)$ on $[\psi_S - \epsilon, \psi_S]$; for $l \in (\psi_S, \infty)$, the two banks bid $B_S^* = b_S^* = 0$.*[26]

The proof follows that of Lemma 4, and the intuition is almost the same. We present Proposition 4 to summarize the equilibrium outcomes in the labor market.

Proposition 4. *In regime S, the outcomes of the undominated equilibrium of the labor market bidding game are as follows:*

- *When $p \in (0, p_2^c)$, for $l \in [0, \psi_S - \Psi_S]$, the foreign bank wins the loan officer with a compensation cost $\Psi_S + l$; for $l \in (\psi_S - \Psi_S, \psi_S]$, the relationship bank wins with a compensation cost $\psi_S - l$; for $l \in (\psi_S, \infty)$, the relationship bank wins with zero compensation cost.*

- *When $p \in [p_2^c, p_1^c)$, for $l \in [0, \psi_S]$, the relationship bank wins the labor market competition with a compensation cost $\psi_S - l$; for $l \in (\psi_S, \infty)$, the relationship bank wins the loan officer with zero compensation cost.*

Similar to the case in regime N, we can calculate the (lowest) compensation costs Ω_S and ω_S of the relationship and foreign banks in regime S.

$$\Omega_S = \begin{cases} 0 & 0 \le l \le \psi_S - \Psi_S \\ \psi_S - l & \psi_S - \Psi_S < l \le \psi_S \\ 0 & l > \psi_S \end{cases} \quad \text{and} \quad \omega_S = \begin{cases} \Psi_S + l & 0 \le l \le \psi_S - \Psi_S \\ 0 & \psi_S - \Psi_S < l \le \psi_S \\ 0 & l > \psi_S \end{cases}$$

when $p \in (0, p_2^c)$ and

$$\Omega_S = \begin{cases} \psi_S - l & 0 \le l \le \psi_S \\ 0 & l > \psi_S \end{cases} \quad \text{and} \quad \omega_S = 0$$

when $p \in [p_2^c, p_1^c)$.

Now, we analyze the relationship bank's optimal choice of information regime at $t = 0$. To reduce the discussion burden, we further restrict our analysis to the parametric constellation defined by the following conditions[27]

$$\alpha > \alpha^* \tag{1}$$

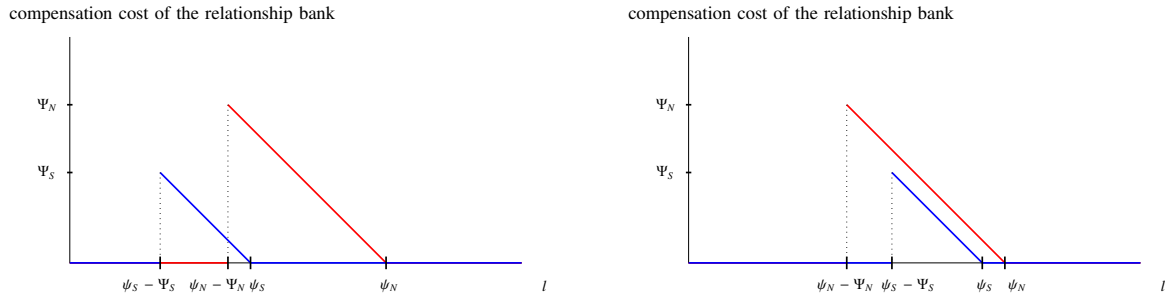
$$0 < p < p^*. \tag{2}$$

[26] In fact, whether p_2^c is smaller than p_1^c will depend on the value of other parameters. For simplicity, we consider $p_2^c < p_1^c$. Assuming otherwise will not compromise our main result because we can further focus the discussion of optimal information sharing choice on a smaller parameter set $0 < \alpha < \alpha^*$ and $0 < p < p^*$.

[27] Recall that Section 3.1.1 imposes the parametric condition $0 < p < p_1^c$, which includes $0 < p < p^*$.

The parametric condition (1) indicates that the proportion of H-type borrowers is sufficiently high. As stated in Proposition 1, it suffices to guarantee a contestable credit market. The success probability of the L-type borrowers' project is sufficiently low under the parametric condition (2). Recall that $p^* < p_1^c$ and $p^* < p_2^c$ by Lemma 4 and 5. The parametric condition (2) implies the following: first, the inequality $p < p_1^c$ ensures that the foreign bank has a higher equilibrium profit in regime S; and second, the inequalities $p < p^* < p_2^c$ ensures that the value of the loan officer is higher for the foreign bank than that for its competitor in both regimes $\Sigma = N$ and S.[28]

The following graphs depict the relationship bank's compensation costs in regimes N and S under the parametric conditions (1) and (2). In the figure, we depict two cases: Figure (2a) plots the case $\psi_S - \Psi_S < \psi_N - \Psi_N$, while Figure (2b) plots the case $\psi_S - \Psi_S \geq \psi_N - \Psi_N$. It is interesting to note that information sharing will emerge only if $\psi_S - \Psi_S < \psi_N - \Psi_N$. The foreign bank will compete more intensively and win the loan officer more often in the labor market competition when it perceives the loan officer to be more valuable than its competitor. Then, for the relationship bank to share information to mitigate labor market competition, the foreign bank's incentive to compete for and the ability to win the loan officer must be higher in regime N than in regime S. For instance, in Figure (2a), the relationship bank loses the loan officer in regime N but wins in regime S when $l \in (\psi_S - \Psi_S, \psi_N - \Psi_N]$. Information sharing allows the relationship bank to retain the loan officer in this case. However, in Figure (2b), the relationship bank can win the loan officer in regime N; instead, it loses the loan officer in regime S when $l \in (\psi_N - \Psi_N, \psi_S - \Psi_S]$. Information sharing intensifies labor market competition in this situation.



(a) The case $\psi_S - \Psi_S < \psi_N - \Psi_N$

(b) The case $\psi_S - \Psi_S \geq \psi_N - \Psi_N$

Figure 2: The relationship bank's compensation costs when $\Sigma = N$ ("red line") and S ("blue line")

[28]Note that the purpose of the current paper is to identify a novel tradeoff between information rent extraction and compensation cost reduction faced by the relationship bank when making the information sharing decision. The tradeoff is most evident when labor market competition is relatively intensive, that is, $\psi_N > \Psi_N$ and $\psi_S > \Psi_S$. It can be seen from Proposition 3 and 4 that the relationship bank will always win the labor market competition when $\psi_N \leq \Psi_N$ and $\psi_S \leq \Psi_S$. To make the analysis interesting, we focus on the parameter confined by the parametric condition (2).

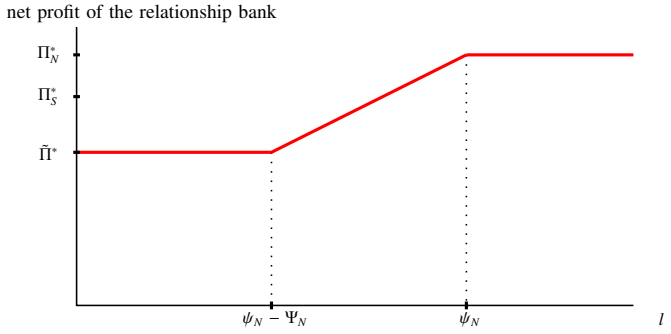
3.3 Endogenous information sharing decision

This section explores the relationship bank's decision of information regime at $t = 0$. We define the relationship bank's net profit Φ in a given information regime as its equilibrium profit in the credit market nets the compensation cost in the labor market. We start with the no information sharing case $\Sigma = N$ and express the relationship bank's net profit as follows:

$$\Phi_N = \begin{cases} \tilde{\Pi}^* & l \leq \psi_N - \Psi_N \\ \Pi_N^* - (\psi_N - l) & \psi_N - \Psi_N < l \leq \psi_N \\ \Pi_N^* & l > \psi_N. \end{cases} \tag{3}$$

Following Proposition 3, the foreign bank will win the labor market competition when labor market mobility is sufficiently high, i.e., $l \in [0, \psi_N - \Psi_N]$. In this situation, the relationship bank earns the lowest profit $\tilde{\Pi}^*$ in the credit market but pays zero compensation cost. When labor market mobility decreases, that is, $l \in (\psi_N - \Psi_N, \psi_N]$ or $l \in (\psi_N, \infty)$, the relationship bank will always win the labor market competition. In these situations, the relationship bank can earn the highest profit Π_N^* in the credit market because the information asymmetry between the two banks is the highest. In particular, for a moderate level of labor market mobility $l \in (\psi_N - \Psi_N, \psi_N]$, the relationship bank needs to pay a compensation of $\psi_N - l$ to retain the loan officer because of the foreign bank's competition in the labor market. However, when the switching cost l is higher than the value of the loan officer for the foreign bank ψ_N, the relationship bank can incur zero compensation cost to retain the loan officer. To illustrate this, we plot the relationship banks' equilibrium net profit in the no information sharing regime in Figure 3.

Figure 3: The relationship bank's net profit when $\Sigma = N$ (the "red line")

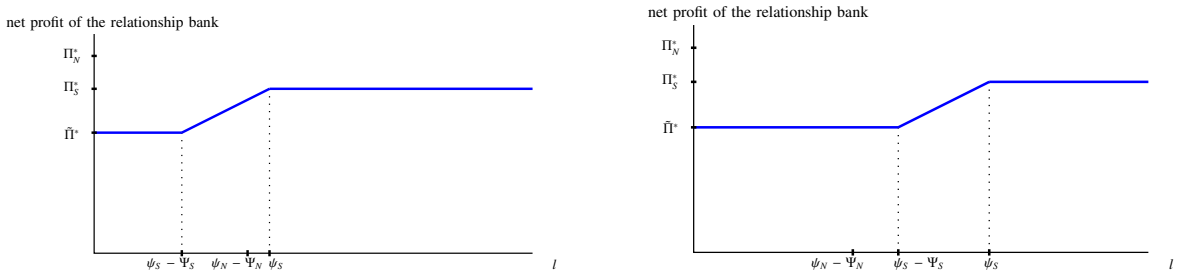


We can also derive the relationship bank's equilibrium net profit in the information sharing regime $\Sigma = S$ as follows:

$$\Phi_S = \begin{cases} \tilde{\Pi}^* & l \leq \psi_S - \Psi_S \\ \Pi_S^* - (\psi_S - l) & \psi_S - \Psi_S < l \leq \psi_S \\ \Pi_S^* & l > \psi_S . \end{cases} \tag{4}$$

Similar to the previous case without information sharing, the foreign bank will win the labor market competition for a sufficiently high level of labor market mobility $l \in [0, \psi_S - \Psi_S]$, in which case the relationship bank obtains the net profit $\tilde{\Pi}^*$. For relatively low labor market mobility, $l \in (\psi_S - \Psi_S, \psi_S]$ or $l \in (\psi_S, \infty)$, the relationship bank retains the loan officer and pays a compensation cost of $\psi_S - l$ in the former situation and 0 in the latter case. Meanwhile, the relationship bank earns a profit Π_S^* in the credit market when it wins the loan officer. The profit is less than Π_N^* because its informational advantage in the credit market is undermined by its own choice of sharing borrowers' credit records. We plot the relationship bank's net profit in regime $\Sigma = S$ in Figure 4. In the figure, we depict two cases depending on the magnitude of $\psi_N - \Psi_N$

Figure 4: The relationship bank's net profit when $\Sigma = S$ (the "blue line")



(a) The case $\psi_S - \Psi_S < \psi_N - \Psi_N$

(b) The case $\psi_S - \Psi_S \geq \psi_N - \Psi_N$

and $\psi_S - \Psi_S$. Recall that ψ_N and Ψ_N (ψ_S and Ψ_S) are the values of the loan officer for the foreign bank and the relationship bank in regime N (regime S). Thus, their difference gauges the incremental value of the loan officer for the foreign bank against that for the relationship bank in a given information regime.[29] For example, if the relationship bank bids its maximum willingness to pay Ψ_N, the foreign bank is willing to pay an additional amount up to $\psi_N - \Psi_N$ to attract the loan officer in regime N. It is next shown how the existence of the relationship bank's voluntary information sharing depends on the relative magnitude between $\psi_N - \Psi_N$ and $\psi_S - \Psi_S$. In particular, endogenous information sharing emerges only if $\psi_N - \Psi_N > \psi_S - \Psi_S$.

[29]Under the parametric condition (2) , we have $\psi_N - \Psi_N > 0$ and $\psi_S - \Psi_S > 0$.

To analyze the relationship bank's optimal information decision, we compare the relationship bank's equilibrium net profits Φ_N and Φ_S in regimes N and S. Proposition 5 characterizes the optimal information sharing decision and its relationship with the loan officer's job mobility l.

Proposition 5. *The incremental value of the loan officer for the foreign bank in regime N is higher than that in regime S, i.e., $\psi_N - \Psi_N > \psi_S - \Psi_S$, if and only if $p < p^{**} \in (0,1)$, and we have $p^{**} < p^*$.*

- *For $p \in (0, p^{**})$, the relationship bank optimally chooses information sharing when labor market mobility $l \in (\psi_S - \Psi_S, l^c)$, where $l^c = (\psi_N - \Psi_N) + \Psi_S \in (\psi_S - \Psi_S, \psi_N)$. For a very high level ($l \leq \psi_s - \Psi_S$) or a very low level ($l \geq l^c$) of labor market mobility, information sharing cannot emerge.*
- *For $p \in [p^{**}, p^*)$, information sharing cannot emerge regardless of the level of labor market mobility.*

The relationship between labor market mobility and the relationship bank's optimal information sharing decision is non-monotonic if and only if the parameters are confined by condition (1) and $0 < p < p^{**}$.[30] A case of particular interest is when the level of labor market mobility $l \in (\psi_N - \Psi_N, \psi_N]$. In this case, the relationship bank faces a trade-off between saving compensation cost in the labor market competition and extracting less information rent in the credit market competition when it shares information. Sharing information can endogenously emerge as the optimal strategy for the relationship bank.

First, we explain why the incremental value of the loan officer for the foreign bank is higher in the no information sharing regime when $p < p^{**}$. The intuition of this result can be understood against the backdrop of Proposition 1. Note that one can express the difference in the incremental values as $(\psi_N - \Psi_N) - (\psi_S - \Psi_S) = (\pi_S^* - \pi_N^*) + (\Pi_S^* - \Pi_N^*)$, that is, the difference in the foreign bank's profits between regime S and N plus that of the relationship bank. Recall from Proposition 1 that the relationship bank incurs a loss in information rent in the credit market when the regime switches from N to S, $\Pi_N^* > \Pi_S^*$. Meanwhile, when the regime switches from N to S, the foreign bank's benefit of alleviating the adverse selection problem dominates the cost of intensified price competition, $\pi_N^* < \pi_S^*$, under the parametric condition $0 < p < p_1^c$. When p becomes smaller, the benefit increases while the cost decreases. To guarantee a higher incremental value in the no information sharing regime, the foreign bank's benefit from information sharing must overcome its cost and the relationship bank's loss. This implies an even smaller range of p, i.e., $p < p^{**} < p_1^c$.

Second, we derive the relationship bank's optimal information choice when $p < p^{**}$ and its relationship with the loan officer's job mobility l. Let $\Delta\Phi = \Phi_S - \Phi_N$ be the difference in the net profit of the relationship bank with and without information sharing. The bank optimally discloses borrowers' credit records if and

[30] Note that $0 < p < p^{**}$ is a smaller set included in the set defined by condition (2).

only if $\Delta\Phi > 0$. We first analyze the relationship bank's net profit difference when $p \in (0, p^{**})$ and further illustrate with the case $\psi_S > \psi_N - \Psi_N > \psi_S - \Psi_S$.[31] In this case, $\Delta\Phi$ can be expressed as follows:

$$\Delta\Phi = \begin{cases} 0 & l \leq \psi_S - \Psi_S \\ -(\psi_S - \Psi_S) + l & \psi_S - \Psi_S < l \leq \psi_N - \Psi_N \\ (\psi_N - \Psi_N) - (\psi_S - \Psi_S) & \psi_N - \Psi_N < l \leq \psi_S \\ (\psi_N - \Psi_N) + \Psi_S - l & \psi_S < l < l^c \\ -(\Psi_N - \Psi_S) & l^c \leq l. \end{cases} \tag{5}$$

For $l \in [0, \psi_S - \Psi_S]$, the value of the loan officer is higher for its competitor in both regimes; therefore, the relationship bank expects to lose the labor market competition and obtain a net profit $\tilde{\Pi}^*$ whether it shares information. In this case, $\Delta\Phi = 0$. For $l \in (\psi_S - \Psi_S, \psi_N - \Psi_N]$, the relationship bank expects to outbid its competitor in the labor market with an offer $\psi_S - l$ and obtain a net profit $\Pi_S^* - (\psi_S - l)$ in regime S. Instead, the relationship bank loses the loan officer and obtains $\tilde{\Pi}^*$ in regime N. In this case, $\Delta\Phi = \Pi_S^* - (\psi_S - l) - \tilde{\Pi}^* = -(\psi_S - \Psi_S) + l > 0$, thus information sharing helps the relationship bank retain the loan officer and earn a greater net profit. For $l \in (\psi_N - \Psi_N, \psi_S]$, the relationship bank makes a net profit $\Pi_S^* - (\psi_S - l)$ in regime S and $\Pi_N^* - (\psi_N - l)$ in regime N. In this case, $\Delta\Phi = [\Pi_S^* - (\psi_S - l)] - [\Pi_N^* - (\psi_N - l)] = (\psi_N - \Psi_N) - (\psi_S - \Psi_S) > 0$. Information sharing reduces the relationship bank's compensation cost of retaining the loan officer more than the loss of rent in the credit market. For $l \in (\psi_S, \psi_N]$, the same trade-off between saving compensation costs and losing information rent applies. However, the benefit of saving compensation costs decreases with l. For $l \geq l^c$, the expense of a lower profit in the credit market exceeds the benefit. The relationship bank can win the labor market competition for a zero bid and obtain a net profit Π_S^* with information sharing. Without information sharing, its net profit is $\Pi_N^* - (\psi_N - l)$. In this case, $\Delta\Phi = (\psi_N - \Psi_N) + \Psi_S - l$. There exists a unique cutoff $l^c \in (\psi_S, \psi_N]$ such that $\Delta\Phi > 0$ for $l \in (\psi_S, l^c)$, and $\Delta\Phi \leq 0$ for $l \in [l^c, \psi_N]$.[32] For $l \in (\psi_N, \infty)$, information sharing has no impact on the labor market competition. The relationship bank can win the labor market competition by making a zero bid regardless of the information regime. As pointed out in Proposition 1, sharing credit records only undermines the relationship bank's informational advantage in the credit market. In this case, $\Delta\Phi = -(\Psi_N - \Psi_S) = -(\Pi_N^* - \Pi_S^*) < 0$.

[31] The case $\psi_N - \Psi_N \geq \psi_S$ can be analyzed in the same token. Although the functional form of $\Delta\Phi$ is slightly different, the result is the same as that for $\psi_S > \psi_N - \Psi_N > \psi_S - \Psi_S$. We present the analysis in the proof of Proposition 5 of the online appendix.

[32] This result follows from the observation that $\lim_{l \to \psi_S} \Delta\Phi = (\psi_N - \Psi_N) - (\psi_S - \Psi_S) > 0$, $\lim_{l \to \psi_N} \Delta\Phi = -(\Psi_N - \Psi_S) = -(\Pi_N^* - \Pi_S^*) < 0$, and $\frac{d\Delta\Phi}{dl} < 0$. Hence there exists a unique cutoff $l^c \in (\psi_S, \psi_N]$ such that $\Delta\Phi = (\psi_N - \Psi_N) + \Psi_S - l^c = 0$.

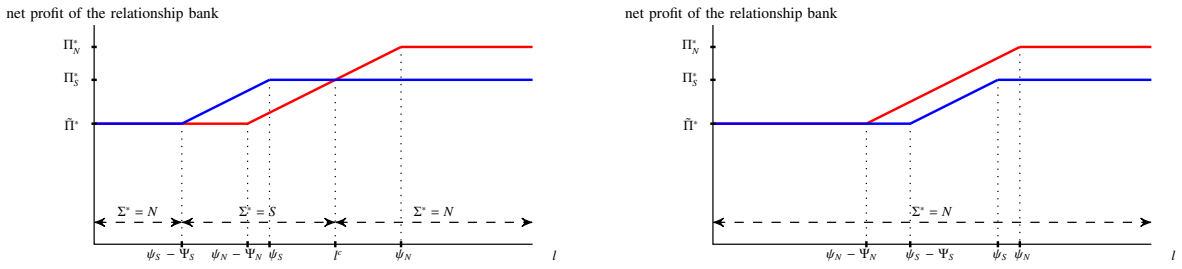
Finally, we explain why the relationship bank chooses not to share information when $p \in [p^{**}, p^{*})$ (i.e., $\psi_N - \Psi_N \leq \psi_S - \Psi_S$). The relationship bank's net profit difference can be expressed as follows:

$$\Delta\Phi = \begin{cases} 0 & l \leq \psi_N - \Psi_N \\ (\psi_N - \Psi_N) - l & \psi_N - \Psi_N < l \leq \psi_S - \Psi_S \\ (\psi_N - \Psi_N) - (\psi_S - \Psi_S) & \psi_S - \Psi_S < l \leq \psi_S \\ (\psi_N - \Psi_N) + \Psi_S - l & \psi_S < l \leq \psi_N \\ -(\Psi_N - \Psi_S) & \psi_N < l. \end{cases} \tag{6}$$

For $l \in [0, \psi_N - \Psi_N]$ and $l \in (\psi_N, \infty)$, the discussion is the same as before. For the remaining cases, when $l \in (\psi_N - \Psi_N, \psi_S - \Psi_S]$, the relationship bank expects to lose the labor market competition and obtain $\tilde{\Pi}^*$ in regime S. Instead, it can win the loan officer and obtain a net profit $\Pi_N^* - (\psi_N - l)$ in regime N. In this case, $\Delta\Phi = \tilde{\Pi}^* - [\Pi_N^* - (\psi_N - l)] = (\psi_N - \Psi_N) - l < 0$. For $l \in (\psi_S - \Psi_S, \psi_S]$, information sharing reduces the relationship bank's compensation cost at the expense of a lower profit in the credit market. Unlike the case when $p \in (0, p^{**})$, the cost dominates the benefit. For $l \in (\psi_S, \psi_N]$, the situation is the same as $l \in (\psi_S - \Psi_S, \psi_S]$. The relationship bank's cost of information sharing dominates its benefit.

When $p \in [p^{**}, p^{*})$, the foreign bank will compete more fiercely in the labor market in regime S than in regime N. For instance, when $l \in (\psi_N - \Psi_N, \psi_N - \Psi_N]$, the relationship bank can win the labor market competition in regime N; instead, it loses the loan officer to the foreign bank in regime S. Consequently, information sharing can never emerge when $p \in [p^{**}, p^{*})$. We plot the relationship bank's net profits in regime S and regime N for the two cases $\psi_S > \psi_N - \Psi_N > \psi_S - \Psi_S$ and $\psi_N - \Psi_N \leq \psi_S - \Psi_S$ in Figure 5.

Figure 5: Optimal information sharing



(a) The case $\psi_S > \psi_N - \Psi_N > \psi_S - \Psi_S$

(b) The case $\psi_N - \Psi_N \leq \psi_S - \Psi_S$

Figure (5a) and (5b) plot the relationship bank's net profits as functions of labor market mobility l in regime N (Φ_N) and S (Φ_S) with "red line" and "blue line", respectively.

It is interesting to compare our results with the classic papers. Bouckaert and Degryse (2006) endogenize information sharing as part of the relationship bank's optimal strategy in the credit market competition. In their model, a good borrower succeeds with a positive probability while a bad borrower always defaults. By sharing borrowers' credit records, the relationship bank can extract more rents from the "unlucky" good borrowers with bad records. In contrast, an H-type borrower always generates a good credit record in our model, so the mechanism that drives Bouckaert and Degryse (2006)'s result does not exist. Our model's key innovation is introducing labor market competition, which allows the foreign bank to overcome the informational disadvantage through poaching the relationship bank' loan officer. Information sharing can emerge as the relationship bank's optimal "defensive" strategy in response to the foreign bank's competition in both the credit and labor markets.

Our theoretical prediction of a regime change in the information sharing decision as labor market mobility falls from moderate to a very low level is broadly consistent with the empirical evidence. In a corporate context, Li et al. (2018) find that firms significantly reduce the disclosure of their customers' identities after adopting the inevitable disclosure doctrine (IDD) by state courts, thereby significantly reducing labor market mobility.

4 Discussions and extension

This paper provides an analysis of bank information sharing in a stylized model, highlighting the interaction between the credit and labor markets. In this section, we discuss our modeling of labor market mobility and show that our main results are robust to several changes in assumptions.

4.1 Labor market mobility

In this study, the switching cost of the loan officer plays an important role in determining the equilibrium outcome. In real life, switching costs can arise for legal reasons. For example, non-competition agreements, which restrict workers from joining competing companies, are one of the most important mechanisms that restrict labor market mobility (Garmaise, 2011). The use of non-competition agreements is prevalent in the U.S. labor market (Shi, 2020). Based on a comprehensive survey of the U.S. labor force participants, Prescott et al. (2016) find that about 30 million workers are subject to non-competition agreements. Kini et al. (2021) find that among CEOs with employment contracts in the ExecuComp database, 62.47% sign non-competition agreements. Moreover, enforcement of non-competition agreements varies significantly from state to state in the U.S. Some recent studies show that the enforcement of non-competition agreements can also affect workers' switching costs (e.g., Marx et al., 2009; Wang, 2019). In the banking context, as

observed by the former chief of the antitrust litigation section of the U.S. Department of Justice (Kramer, 1999), "the branch manager and loan officer are critical in small business and retail lending and tying up good branch managers or loan officers with non-competition agreements can be detrimental to a new foreign bank's ability to attract or retain customers."

In addition to the non-competition agreements, non-disclosure agreements may represent another source of legal costs that restrict workers' switching. By exploiting the staggered adoption of the inevitable disclosure doctrine (IDD) as natural experiments, a strand of literature study the implications of labor market mobility on firms or banks, such as Png (2017), Lin et al. (2017), Klasa et al. (2018), Li et al. (2018), Agarwal et al. (2020), and Chen et al. (2021). IDD is a trade secret law that increases the protection of a firm's trade secrets (e.g., customer lists, cost information, formulas, and business plans) by reducing the mobility of its workers to its rivals. Specifically, it maintains that if an employee who knows a firm's trade secrets would inevitably use or disclose knowledge of such trade secrets in her new employment, state courts can prevent the employee from working for the firm's competitor or limit the employee's responsibilities in the new firm. In particular, Png and Samila (2015) find that precedent rulings of the state court in favor of inevitable disclosure are associated with lower mobility of workers. Similarly, Klasa et al. (2018) provide evidence that the adoption of an IDD in a given state significantly reduces the mobility of workers who know trade secrets to rival firms.

4.2 Sharing borrowers' type

In Section 3, information sharing is modeled as the relationship bank's commitment to a "partial disclosure policy". If the relationship bank chooses to share information, it can only disclose verifiable information on its borrowers' credit records. For robustness, we analyze the setting where the relationship bank can share verifiable information on the borrowers' true types. Now $\Sigma \in \{N, S, T\}$, where the action "T" stands for sharing the borrowers' true types. We show that introducing this full disclosure choice will not affect any of our results.

To start with, we consider the equilibrium of the credit market competition subgames. The only difference from Section 3.1 is that there are new credit market competition subgames following $\Sigma = T$. Since the relationship bank now discloses the borrowers' true types, both banks have perfect information on the borrowers. Consequently, the equilibrium is the same as the one when the foreign bank wins the labor market competition. In particular, the two banks' equilibrium profits are: $\Pi_T^* = \tilde{\Pi}^* = \frac{4\alpha}{9}\overline{s}$ and $\pi_T^* = \tilde{\pi}^* = \frac{\alpha}{9}\overline{s}$. We then move backward to analyze the labor market competition subgames. Again, the labor market competition subgames following $\Sigma = N$ and S are unchanged. For the subgame with $\Sigma = T$, we can see that

the values of the loan officer for both banks are zero, i.e., $\Psi_T = \Pi_T^* - \tilde{\Pi}^* = 0$ and $\psi_T = \tilde{\pi}^* - \pi_T^* = 0$. Similar to the results established in Proposition 3 and 4, the undominated equilibrium in regime T features the relationship bank retaining the loan officer with zero compensation cost. The relationship bank's net profit becomes $\Phi_T = \Pi_T^* = \tilde{\Pi}^*$. Lastly, we reconsider the relationship bank's optimal choice of information regime among N, S and T. Irrespective of labor market mobility l, the relationship bank has no incentive to share the borrowers' true types.

Proposition 6. *Sharing the borrowers' types is the relationship bank's (weakly) dominated strategy, irrespective of labor market mobility. It never commits to a full disclosure policy.*

4.3 The adversely selected relationship bank

In our model, the foreign bank may compete in the labor market to alleviate the adverse selection problem in the credit market. The relationship bank is assumed to be perfectly informed about the borrowers' types even if it loses the labor market competition. In this section, we assume that the relationship bank only possesses the borrowers' previous credit records, i.e., whether a borrower has a good credit record ($\overline{D}$) or a bad credit record (D). In this case, the relationship bank will become less informed than its competitor once it loses the labor market competition. We illustrate that this modification will not alter our main results qualitatively.

Consider first the equilibrium of the credit market competition subgames. The credit market competition subgames when the relationship bank wins the labor market competition are unchanged. The difference from Section 3.1 lies in the credit market competition when the relationship bank loses the labor market competition. Now the relationship bank only knows the borrowers' credit records, so it will finance $(1-\alpha)\theta$ L-type borrowers. On the other hand, the loan officer will perfectly screen the borrowers for the foreign bank. One can show that the two banks' equilibrium profits are: $\tilde{\Pi}^* = \frac{(2\alpha+2(1-\alpha)p\theta)^2}{9\alpha}\overline{s} - (1-\alpha)\theta(1-p)R_0$ and $\tilde{\pi}^* = \frac{(\alpha+(1-\alpha)p\theta)^2}{9\alpha}\overline{s}$. Note that we have $\tilde{\Pi}^* < \Pi_S^* < \Pi_N^*$ and $\tilde{\pi}^* > \pi_S^* > \pi_N^*$ when the success probability p of the L-type borrowers' project is lower than a cutoff. Regarding the labor market competition subgames, we can follow the same procedure to compute the two banks' willingness to pay for the loan officer in different information regimes, Ψ_N, ψ_N, Ψ_S, and ψ_S. Again, we can show that $\psi_N - \Psi_N > \psi_S - \Psi_S > 0$ when p is lower than a cutoff. Consequently, the result in Proposition 5 will still hold for sufficiently small p.

4.4 Multiple loan officers

We model the role of the loan officer in its simplest form: a single loan officer processes all the loan applicants. The model can be easily extended to a setting with multiple loan officers. Following the setup in Pagano and Jappelli (1993), suppose that there is a country with M towns. The relationship bank has M branches, each of which hires a loan officer to process loan applications in a separate town. Each branch of the relationship bank faces a continuum of measure one of borrowers uniformly distributed on the interval $[0, 1]$, and the borrower's type is independent and identically distributed with $Pr(H) = 1 - Pr(L) = \alpha$. During lending relationships, each loan officer collects precise information about each borrower's type in her town. The game's timing is as before, except that the foreign bank now competes for M loan officers in the labor market and then for borrowers in M towns in the credit market. As the labor market and credit market competition in each town is identical to the previous analyses, all results remain the same.

5 Conclusion

This study develops a theory of bank information sharing based on intricate interactions between the labor and credit markets. Our theory is motivated by two important observations regarding the role of loan officers: first, loan officers accumulate valuable credit information about borrowers during lending, and second, loan officers' human capital is inalienable. When switching to a new bank, a loan officer can bring information about borrowers of the former bank to the new bank.

We incorporate a local labor market for loan officers into a credit market competition model between two asymmetrically informed lenders: a local relationship bank and a distant foreign bank. The relationship bank possesses two types of information indicative of local borrowers' creditworthiness. First, it can privately collect the credit records of borrowers. Additionally, the relationship bank obtains information about borrowers from its loan officers who directly screen, monitor, and routinely interact with them. Combining these two pieces of information, the relationship bank can establish each borrower's creditworthiness. In contrast, the foreign bank has no lending relationship with local borrowers. It will face severe adverse selection problems if directly entering the local credit market of the relationship bank. To mitigate its informational disadvantage, the foreign bank may want to poach loan officers from the relationship bank and use their information to screen borrowers. Consequently, competition for the credit market's informational advantage can trigger competition for human capital in the labor market. When local inter-bank job mobility is high, the relationship bank may find it very costly or impossible to retain the loan officers.

Surprisingly, credit information sharing can emerge as the optimal "defensive" choice of the relationship bank when the foreign bank competes in both the labor and credit markets. In particular, the relationship bank can face a trade-off between losing information rent in the credit market and saving compensation costs in the labor market. On the one hand, sharing borrowers' credit information undermines the informational advantage of the relationship bank in the credit market along with decreased profits due to intensified credit market competition. On the other hand, information sharing mitigates adverse selection problems and increases the profits of the foreign bank. It is then less imperative for the foreign bank to compete for loan officers because their information becomes less valuable. Less competition in the labor market saves the compensation costs of the relationship bank to retain the loan officer. For a moderate level of labor market mobility, the benefit of lower compensation costs owing to information sharing dominates the cost of less rent extraction. The relationship bank optimally shares the credit information of borrowers. Conversely, when labor market mobility is very low or very high, it is not worthwhile for the relationship bank to share information.

The essential component of our model is that the competition for scarce human capital and profitable lending opportunities can be closely intertwined: human capital affects the outcome of the credit market competition, and the intensity of the credit market competition determines the value of scarce human capital, which in turn affects compensation costs and profits of a bank. While our analysis is within the scope of banking, our model's ingredients may also be relevant in a (non-financial) firm context. For example, many firms rely on trade secrecy to protect their proprietary information, such as customer lists and market data. Similar to the relationship bank in our model, firms face the risk of losing valuable information when competitors can poach their key employees who can access trade secrets. In this study, we focus on the role of information sharing as a defensive strategy in competition. Firms may also adopt other strategies in response to competition in the labor market. For example, firms can meticulously design key employees' compensation contracts to shield the poaching of competing firms. It would be interesting to understand the interactions between information sharing and other possible strategies. Are they complements or substitutes? If there is an optimal combination of these strategies? We leave these questions for future work.

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