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Abstract

This paper analyses how entry by an international bank into a developing economy affects the credit market equilibrium. It offers a novel explanation of how a foreign entrant overcomes asymmetric information problems, and complements extant hard vs. soft information based theories of credit market segmentation. In the model, the banks are protected by limited liability. This introduces an agency problem since, in certain states of the world, it is optimal for the banks to lend to negative net present value projects. The agency problem has an asymmetric impact on the local and the foreign bank. The model illustrates how the diversification of the foreign bank's loan portfolio eliminates the agency problem. In contrast, in certain states of the world, the agency problem frustrates the local bank's ability to raise finance. The paper explores the importance of the foreign bank's ability to provide finance during local liquidity shortages, and illustrates how this can lead to a segmentation of the credit market. In equilibrium, the foreign bank finances local firms with a low exposure to the local economy, and the local bank finances firms with a high exposure to the local economy. The model predicts, that foreign entry increases the domestic financial sector's vulnerability to liquidity shocks.

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1 Introduction

Many ressources have been devoted to the discussion about whether the entry of foreign financial intermediaries into developing economies is a blessing or a curse. Advocates of greater financial integration have argued, that the presence of foreign financial intermediaries leads to better risk management practices and more efficient resource allocations. The opposition has pointed to the financial crises that followed the financial liberalizations of the 1980's and 90's, and argued that increased competition among financial intermediaries aggravates agency problems and lead to greater financial instability. Currently, India and China are in the process of opening their financial sectors to foreign competition and many of the economies in Sub-Sahara Africa are experiencing renewed foreign interest in their financial sector. In this paper, I present a theoretical analysis of the impact of foreign banks on the financial sector of developing economies. I find, that entry by foreign banks can lead to a segmentation of the local credit market, and that this segmentation can aggravate agency problems and reduce the resilience of the local financial sector.

Developing economies are characterised by weak institutional infrastructure and opaque reporting standards. This leads to poor information transparency and uncertainty about the enforceability of property rights. Given banks' ability to alleviate these problems through collateralised lending and borrower screening and monitoring, it is no great surprise that bank lending is an important source of finance to firms in developing economies. Thus, the analysis of how the credit market and the local financial sector is affected by the presence of foreign banks is of particular relevance to these economies.

This paper is motivated by empirical work which indicates, that the behaviour of foreign and local banks differ significantly across the business cycle. As the local economy goes through a bust, local banks contract credit whilst foreign entrants expand credit (Haas and Lelyveld (2006), Peek and Rosengreen (2000), Goldberg et al. (2000)). This suggests, that foreign banks lend to a segment of the credit market which remains solvent as the local economy goes through a bust.

This paper aims to address two questions related to how foreign entry affects the local credit market. First, do foreign banks specialise in lending to a particular segment of the local market? I find, that the foreign bank is a more stable source of finance, and that this renders it the preferred financier of local firms with a low exposure to local business conditions. Second, how do foreign banks affect the stability of the local financial sector? The model suggests, that foreign entry aggravates agency problems and raises the local financial intermediaries exposure to liquidity shocks. In the model, foreign entry reduces the diversification of the local bank's loan portfolio. The local bank operates under limited liability, so this raises their incentives to finance firms with unprofitable projects. To protect themselves against losses, depositors withdraw from the local bank when they expect that it engages in risk shifting. Thus, an aggravation of the agency problem frustrates the local bank's ability to raise finance. The model explores how the foreign entrant can take advantage of the local bank's disability to raise finance, and use this to mitigate inferior information about the local market.

The main idea is as follows. Consider the local economy prior to the entry of the foreign bank. Two types of firms operate in the local economy. One produces for the local market, the other produces for export. The business conditions in the foreign and the domestic market vary independently of each other. To maintain their business, local firms must obtain finance from a local bank which has perfect knowledge about the firms' creditworthiness. The local bank is funded by deposits and operates under limited liability. This introduces the agency problem. The local bank can retain gains from lending and shift losses to depositors, so it may be optimal for the local bank to finance firms with unproftable projects.

Depositors observe a noisy signal about the average firms' creditworthiness and form rational expectations about the local bank's lending policy. Deposits are not subject to a credible deposit insurance, so if the public signal is sufficiently adverse, it is optimal for the depositors to withdraw their deposits from the bank. If the firms that produce for the local market constitute the majority of the firms in the economy, the public signal tends to be unfavourable when the local business conditions are poor. This is so even if the business conditions are prosperous for firms producing for export. Thus, in certain states of the world, the local bank fails to raise deposits and creditworthy firms which produce for export are denied finance.

The foreign entrant is subject to limited liability and is funded by deposits. The entrant has less information about the local economy than the incumbent, and its lending decisions can be made contingent only on the firm's type and on the public signal. The foreign bank is active in many different economies, and therefore it has a well diversified portfolio. This reduces the agency problem that arises from limited liability, and ties down the depositors' expectations about the foreign bank's lending policy. When the portfolio is sufficiently well diversified, the agency problem disappears and the foreign entrant can always raise deposits.

When the local economy goes through a bust, the public signal turns negative and the local depositors withdraw from the local bank. In these states, the foreign bank becomes the monopoly lender to solvent local firms. The prospect of extracting monopoly rents in future periods allows the foreign entrant to contest the incumbents' information advantage. When the fraction of firms producing for the local market is high, the public signal has a high correlation with the state of the local economy. The disability for solvent local firms' to obtain finance from the local bank is therefore more pronounced for firms producing for export. Consequently, the foreign bank's prospect of extracting monopoly rents is higher when it finances exporters than when it finances firms that produce for the local market. If the expected monopoly profits from lending to exporters is sufficient for the entrant to overcome the incumbents information advantage, and if the incumbents' information advantage prevails over the monopoly profits from lending to firms that produce for the local economy, the credit market becomes segmented. The foreign bank lends to firms which produce for export, and the local bank lends to firms which produce for the local market.

The mechanism behind the credit market segmentation has similarities with the idea presented in Froot, Sharfstein and Stein (1993). Froot et al. analyse a firm's optimal risk management decision and conclude that risks which are adversely correlated with the firm's future business opportunities should be hedged. In the model, firms that produce for export borrow from the foreign entrant since this eliminates their exposure to liquidity shocks in states where their business opportunities are good.

The work presented in this paper is related to a number of recent papers that analyse how entry by foreign financial intermediaries affects the credit markets of developing economies (Dell'Ariccia and Marquez (2004), Detragiache et al. (2006), Sengupta (2007) and Gormley (2008)). As in the model presented here, these papers predict, that entry by foreign financial intermediaries leads to a segmentation of the local credit market. Despite this similarity, the theoretical framework in this paper differs on a number of points from the existing models. First, in the extant literature, the credit market segmentation arises from a trade off between the distribution of information and the cost for funds. The entrant has a lower cost of finance than the incumbent, but the incumbent has an information advantage over the entrant. The model I present has the same information asymmetry, but the entrant and the incumbent pays the same real cost of funds. The credit market segmentation arises because the foreign entrant can extend credit as the local economy goes through a bust; a service which arises endogeneously, and which is valuable only to firms with a high probability of being solvent during busts of the local economy. Thus, the model suggests, that foreign entrants can overcome information disadvantages even without access to cheaper finance.

Second, in the extant literature, the credit market segmentation is driven by the firms' transparency (Dell'Ariccia and Marquez (2004) and Detragiache (2006)), or the firms' credit quality (Gormley (2008) and Sengupta (2007)). In the model presented below, the firms are homogenous across both credit quality and information transparency. The credit market segmentation is driven by the correlation between the local firms' business opportunities and the state of the local economy.

A number of papers study the occurrence of clientele effects in credit markets with heterogeneous banks. These studies suggest, that large banks have a comparative advantage in lending to firms that produce hard information, and small banks have a comparative advantage in lending to firms that produce soft information.[1] The comparative advantages arise from the banks' organisational structure (Williamson (1988)), or from the need to control agency problems between the banks' management and the local loan officers (Berger and Udell (2002), Stein (2002)). When applied to the analysis of foreign bank entry, the large bank is interpreted as the foreign entrant, and the

[1] Hard information can be easily quantified and distributed to third parties. Typically, hard information can be found in a firm's annual report. Soft information cannot be quantified or transmitted to third parties. This type of information includes whether the loan applicant appears trustworthy and hard working.

small bank represents the local incumbent (Mian (2006)). In the model presented in this paper, the agency problem that creates the clientele effects is between the financial intermediary and its outside financiers. The credit market segmentation is unrelated to the abilty to process information, as the foreign entrant, over time, can obtain the same information as the local incumbent, and has the same ability to process information. The segmentation of the credit market arises because the more stable finance provided by the foreign entrant is valued higher by firms producing for export than by firms producing for the local market.

This paper also contributes to the literature on how competition between financial intermediaries affect financial stability. In line with the work in Keeley (1990), Boot and Thakor (2000) and Allen and Gale (2004), the model presented in this paper suggests, that increased competition aggravates agency problems and leads to greater financial fragility. In the extant literature, entry aggravates the agency problems because it reduces the banks' rents. In turn, this lowers their expected return on screening and monitoring, and reduces their losses from being pushed into insolvency. These effects enhance the bank' incentives to take risk. In contrast, in the model presented below, the increased financial fragility is driven by the credit market segmentation. Because the foreign bank poaches one segment of the market, it reduces the diversification of the local bank's loan portfolio. As is well know (see for example Cerasi and Daltung (2000) and Tirole (2006)), a lower diversification reinforces the local bank's incentives to engage in risk shifting. Thus, the financial fragility presented in this paper arises from the market segmentation, and does not develop in a setting where the entrant and the incumbent are symmetric.

The paper proceeds as follows. Section 2 presents the model of the local economy, and section 3 contains the analysis of the local economy prior to the entry of the foreign bank. This section illustrates the source of the liquidity shock, and serves as a benchmark to evaluate the impact of foreign bank entry. Section 4 analyses the foreign entrant's behaviour and characterises the equilibrium following the entry of the foreign bank. Section 5 outlines the theory's empirical implications and reviews the empirical evidence. Section 6 concludes. All the proofs are relegated to the appendix.

2 The model

2.1 Basic setup

Consider an economy with three time points ($t = 0, 1, 2$), a continuum of firms, one local bank and a set of depositors. All agents are risk neutral and the firms are segmented into two types. Type D firms, with measure λ, produce goods for the domestic market and type I firms, with measure $(1 - \lambda)$, produce goods for export. I assume that the measure of type D firms exceeds the measure of type I firms, i.e. $\lambda > \frac{1}{2}$.

At time $t = 0$ and $t = 1$, each firm has access to an investment project which requires one unit of finance. The projects have a tenure of one period, two potential outcomes (success and failure) and two different qualities (good and bad). Good projects succeed with probability P_G and bad projects succeed with probability P_B, where $P_G > P_B$. Successful projects return X and unsuccessful projects return 0. Only good projects are creditworthy, i.e. $P_G X - R_f > 0$ and $P_B X - R_f < 0$, where R_f is the rate of return on a risk-free asset. The projects' qualities vary over time, such that a type i firm with a good project at time t may hold a bad project at time $t+1$. I assume that this variation is independent over time, and that the probability of obtaining a good project is equal across types, i.e. $\Pr(P_{D_t} = P_j) = \Pr(P_{I_t} = P_j)$ for $j \in \{G, B\}$, where P_{D_t} and P_{I_t} is the succes probability of respectively a type D firm's project and a type I firm's project at time t.[2]

The firms are penniless and consume the returns from the projects immediately, so to initiate a new project, they must obtain a loan from the bank. The firms own a stock of productive assets which they can be pledge to the bank as collateral for the loan.[3] The collateral is subject to a liquidation inefficiency, so if the bank is forced to liqudate the collateral, it recovers only a fraction $\Delta < 1$ of the face value of the collateral.[4]

[2] The assumption of independent identically distributed projects eases the exposition of the main idea. The model retains it qualitative conclusions under the assumption of a positive (but not perfect) correlation between the projects and across time time.

[3] The assets are assumed pivotal to the investment project and therefore, they cannot be sold to finance the investment.

[4] Traditionally, the collateral inefficiency arises because the firms have the best knowledge about the redeployability of the asests, or because the assets are most productive when held by the firms and therefore can only be sold at a discount.

At each point in time, the depositors can invest either in demand deposits issued by the bank or in the risk-free asset. The economy has no deposit insurance scheme, and deposits is the only source of finance to the bank.

The local bank continues to operate in period two independent of the outcome of the projects that it finances in period one. The bank's discount factor is normalised to one.

2.2 Information structure

All agents observe the firm's types and a noisy public signal about the credit quality of the average firm's project. The public signal, γ_t, is given by

$$\gamma_t = \lambda P_{D_t} + (1 - \lambda) P_{I_t} + \tilde{\varepsilon}_t,$$

where $P_{j_t} \in \{P_G, P_B\}$ for $j \in \{D, I\}$ and $\tilde{\varepsilon}_t$ is a noise term,

$$\tilde{\varepsilon}_t \sim N\left(0, \sigma_\varepsilon^2\right).$$

If the bank is the most recent lender to a particular firm (the "relationship lender"), it observes the credit quality of the firms project.[5] At time $t = 0$, the local bank is the relationship lender to both types of firms. All the firms know the quality of their own projects.

All information is revealed simultaneously at the end of each period, so γ_t and P_{j_t} is known at time t.

Depositors, and banks without prior lending relationships, observe only the firms types and the public signal.

2.3 Financial contracts

The bank offers one period loans to the firms. A loan extended at time t is described by a tuple (R_t, C_t) where R_t and C_t is respectively the interest rate and the collateral requirement on the loan.[6] It is costless for the bank to verify both the outcome of a firm's project, and whether the

[5] Initially, there is only one bank which is the relationship lender to all borrowers. The possibility of a non-relationship lender arises following the entry of the foreign bank.

[6] All interest rates are gross rates, i.e. they include both return of principal and accrued interest.

firm diverted funds from the project. Loan contracts are subject to limited recourse, so the bank can secure repayment of the loan only from the returns on the project and by liquidating the collateral.

Demand deposits can be redeemed at any point in time, and carry an interest rate of $\delta_t \equiv \delta(\gamma_t)$.

2.4 Discussion of model setup

In the model, the firms that produce for the local market and the firms that produce for export are subject to different shocks. The business conditions in the local economy can differ from the business conditions in the export markets. This motivates, that both the quality and the outcomes of the projects vary as a function of whether the firm produces for export or for local consumption.

The absence of deposit insurance it not supported empirically, but reflects that the deposit insurance may be non-credible, cover only partial losses, or that settlement from the deposit insurance may be subject to severe delays. Demirgüç-kunt et al. (2005) find, that all banks are subject to either explicit or implicit deposit insurance, but that the deposit insurance most frequently is only partial and subject settlement delays. The run on Northern Rock in September 2007 underscores, that when the depositors have a low degree of confidence in the deposit insurance, they may behave as if it is absent.

The information structure emphasises, that the bank can learn about the firms' business through lending. Bank loans are subject to covenants which gives the lender access to non-public information about the firms' business. The assumption that the relationship lender is the only lender to observe the quality of an individual firm's project, is a modelling abstraction to capture the information transmitted through the lending relationship.

The local bank continues its operations in the second period even if the projects it finances in the first period fails. This assumption is motivated by the weak institutional infrastructure of developing economies. First, given the information structure, it is ex post efficient for a financial regulator to permit the local bank to continue its operations in the second period. A weak institutional infrastructure may obstruct the financial regulator's ability to commit to a specific policy ex ante.

Second, if the repercussions against the loan officer that approved the loans which failed in the first period are low, say if it is easy for the loan officer to get a position at another financial institution, the loan officer may behave as if the bank continues to operate in period two.

3 Credit market equilibrium without foreign banks

In this section, I characterise the equilibrium prior to the entry of the foreign bank, and illustrate the inefficiency that causes the local firms to demand a more stable source of finance.

The equilibrium consists of a set of optimal actions and rational beliefs for each of the agents. The local bank's optimal lending policy varies as a function of the models primitives. To ease the exposition, I impose a set of parameter constraints that fixes the local bank's lending policy. The parameter constraints are set to minimize the agency problem that creates the liquidity shortages. Let the state of the local economy be characterised by the variable P_t, where $P_t \equiv (P_{D_t} P_{I_t})$.

Lemma 1 *Under the parameter constraints, $R_f > \lambda X$, $P_G > \lambda$ and $1 - P_B > \lambda > P_B$, the local bank lends only to type D firms when $P_t = (P_B, P_B)$, and only to firms with good projects when $P_t \in \{(P_B, P_G), (P_G, P_B), (P_G, P_G)\}$.*

Throughout the analysis I assume, that the parameter constraints in Lemma 1 are fulfilled. The agency problem arises when $P_t = (P_B, P_B)$. The local bank is protected by limited liability, so in this state, it is optimal for the bank to finance firms with unprofitable projects and shift the potential losses to the depositors. Indeed, the parameter constraints in Lemma 1 minimizes the agency problem, as risk shifting occurs only when $P_t = (P_B, P_B)$.

3.1 The bank's problem

The local bank is the relationship lender to both types of firms, and therefore, there are no information imperfections in the model. Collateral is subject to a liquidation inefficiency, so it is optimal for the local bank to sort the firms without the use of collateral, i.e. $C_t = 0$. The local bank has monopoly and therefore extends credit at the monopoly lending rate, $R_t = X$. The bank's lending behaviour follows directly from Lemma 1. To maximize profits, the bank offers demand deposit at the deposit rate which render depositors indifferent between financing the bank and investing in the risk-free asset.

3.2 The depositors' problem

Prior to their investment decision, the depositors observe the public signal, γ_t, and form their beliefs about the true state of the economy. Given the realisation of the public signal, the depositors' beliefs are given by,

$$\Pr\left(P_t = (P_i, P_l)\,|\gamma_t\right) = \frac{\phi\left(\frac{\gamma_t - \lambda P_i - (1-\lambda)P_l}{\sigma_\varepsilon}\right)\Pr\left(P_D = P_i\right)\Pr\left(P_I = P_l\right)}{\Pr\left(\gamma_t\right)}, \tag{1}$$

where $i, l \in \{G, B\}$, $\phi(\cdot)$ is the partial distribution function of the standard normal distribution, and

$$\Pr\left(\gamma_t\right) = \sum_{i,l \in \{G,B\}} \phi\left(\frac{\gamma_t - \lambda P_i - (1-\lambda)\, P_l}{\sigma_\varepsilon}\right)\Pr\left(P_D = P_i\right)\Pr\left(P_I = P_l\right),$$

is the probability of the event γ_t.

Irrespective of the value of the public signal, depositors assign a positive probability to the occurrence of state $P_t = (P_B, P_B)$. In this state, the local bank engages in risk shifting and finances firms with unprofitable projects. Consequently, when the depositors are sufficiently certain that state $P_t = (P_B, P_B)$ has materialised, i.e. when the public signal is sufficiently adverse, it is optimal for them to withdraw their deposits from the bank. This implies the existence of a threshold value of the public signal, γ^*, such that, the local bank fails to raise demand deposits if $\gamma_t < \gamma^*$.

An additional condition for depositors to finance the bank is, that the expected return on demand deposits weakly exceeds the return on the risk-free asset. The public signal determines the expected return on demand deposits, so for any realisation of the public signal, there is a threshold value of the deposit rate, δ_t^*, such that, depositors finance the bank only of $\delta_t \geq \delta_t^*$.

Lemma 2 gathers these observations, and characterises the depositors' behaviour.

Lemma 2 *There is a unique value of γ_t, γ^*, and a value of δ_t, δ_t^*, such that, the depositors finance the bank only if $\gamma_t \geq \gamma^*$ and $\delta_t \geq \delta_t^*$.*

The noise in the public signal implies, that the event $\gamma_t < \gamma^*$ can occur even when the true state of the local economy is not $P_t = (P_B, P_B)$. Consequently, the local economy can realise states where one (or both) types of firms have good projects, but where the local bank fails to raise deposits and therefore fails to finance the firms with profitable projects. Subsequently, I refer to the occurrence of these events as a liquidity shocks.

Definition 3 *A liquidity shock is an event such that, the local bank fails to raise deposits and at least one of the firms in the economy have a profitable project.*

Thus, based on definition (3), a liquidity occurs if $\gamma_t < \gamma^*$ and $P_t \in \{(P_G, P_G), (P_G, P_B), (P_B, P_G)\}$.

3.3 The firms' problem

The firms are protected by limited liability and therefore always apply for finance. The bank can verify whether the firm diverts money from the project, so the firm invests in the project when the loan application is successful.

Proposition 4, combines the previous insights to characterise the equilibrium of the local economy prior to the entry of the foreign bank. The proposition illustrates, that liquidity shocks arise endogeneously in equilibrium.

Proposition 4 *In equilibrium, the depositors' beliefs are given by* (1) *and the depositors finance the bank if and only if* $\gamma_t \geq \gamma^*$ *and* $X \geq \delta_t \geq \delta_t^*$*. The bank lends under the contract* $(X, 0)$ *and offers demand deposits at* $\delta_t = \delta_t^*$*. Subject to the availability of deposits, the bank finances the firms with good projects if* $P_t \in \{(P_G, P_B), (P_B, P_G), (P_G, P_G)\}$ *and only type* D *firms if* $P_t = (P_B, P_B)$*. The firms always apply for finance and invest in the project if the loan application is successful.*

In equilibrium, liquidity shocks arise endogenously as the depositors attempt to protect themselves against risk shifting. The liquidity shocks are costly to the economy, as they force the firms to forego profitable investment opportunities. Since $\lambda > \frac{1}{2}$, liquidity shoks occur more frequently when type I firms hold good projects, than when type D firms hold good projects. To see this, note that

$$\begin{aligned}\Pr\left(P_D = P_G \cap \gamma < \gamma^*\right) &= \Pr\left(P_D = P_G\right)\Pr\left(\gamma < \gamma^* | P_D = P_G\right)\\ &= \Pr\left(P_D = P_G\right)\left[\Pr\left(P_I = P_G\right)\Phi\left(\frac{\gamma^* - P_G}{\sigma_\varepsilon}\right)\right.\\ &\left.+\Pr\left(P_I = P_B\right)\Phi\left(\frac{\gamma^* - \lambda P_G - (1-\lambda)P_B}{\sigma_\varepsilon}\right)\right],\end{aligned}$$

and,

$$\begin{aligned}\Pr\left(P_I = P_G \cap \gamma < \gamma^*\right) &= \Pr\left(P_I = P_G\right)\Pr\left(\gamma < \gamma^* | P_I = P_G\right)\\ &= \Pr\left(P_I = P_G\right)\left[\Pr\left(P_D = P_G\right)\Phi\left(\frac{\gamma^* - P_G}{\sigma_\varepsilon}\right)\right.\\ &\left.+\Pr\left(P_D = P_B\right)\Phi\left(\frac{\gamma^* - \lambda P_B - (1-\lambda)P_G}{\sigma_\varepsilon}\right)\right],\end{aligned}$$

where $\Phi(\cdot)$ is the cumulative distribution function of the standard normal distribution. When $\lambda > \frac{1}{2}$, $\Pr\left(P_D = P_G \cap \gamma < \gamma^*\right) < \Pr\left(P_I = P_G \cap \gamma < \gamma^*\right)$, so liquidity shocks occur more frequently when type I firms hold good projects than when the type D firms hold good project. This happens since $\lambda > \frac{1}{2}$ implies, that the public signal has a higher correlation with the business conditions of the type D firms than the business conditions of the type I firms.

The local economy's exposure to liquidity shocks creates the demand for a more stable source of finance. The subsequent section illustrates why this provides the foreign bank with the opportunity to enter the local economy.

4 Credit market equilibrium and foreign bank entry

In this section, I model the foreign bank and illustrate why it constitutes a more stable source of finance. Hereafter, I analyse how foreign bank entry affects the credit market of the local economy.

4.1 The foreign bank

The foreign bank is financed by deposits and is protected by limited liability on the group level. It has a well established international presence, and can raise deposits and extend loans in N economies. Each of these economies is a replica of the local economy, and I assume, that the realisation of the state variable, P_t, is independent across the economies.[7] I assume, that the depositors in any given economy know the number of markets in which the foreign bank is active, and that they observe the public signal of their own economy only. The information structure implies, that when the foreign bank enters a new economy, it can observe only the firms' types and the public signal. Through lending, the foreign bank can become a relationship lender and obtain the ability to observe the quality of the local firms' projects. I assume that the foreign bank has been active in each of the N economies for at least one period prior to its entry into the local market.

Proposition 5 illustrates, that under these assumptions, the foreign bank is always able to raise finance.

Proposition 5 *If* $\Pr(P_I = P_G) > 0$*, then there exists a number of economies,* N^**, such that, if the foreign bank is active in more than* N^* *economies, it can always raise deposits.*

The result in Proposition 5 exploits, that the agency problem can be controlled through the diversification of the foreign bank's loan portfolio. A high degree of diversification, i.e. a high value of N, weakens the foreign bank's incentives to engage in risk shifting, and therefore reinforces the depositors' incentives to finance the bank. Thus, the proposition suggests, that when the diversifcation of the foreign bank's business is sufficiently high, depositors behave as if their deposits with the foreign bank were subject to a deposit insurance.

The proof of Proposition 5 relies on three lemmas. The first states, that if the bank engages in risk shifting, it is active in a limited number of economies, and therefore, its profits are bounded. The intuition for this result is, that risk shifting is profitable only if the bank can prevent the law of large numbers from coming into play. Thus, for risk shifting to be profitable, the bank must be active in a limited number of economies.

The second lemma states, that when $\Pr(P_I = P_G) > 0$, there is a value of N, N^{**}, such that, when the bank is active in more than N^{**} economies, it finances firms with profitable projects only.

[7] The independence assumption is made for expositional purposes only. The model's conclusions require only that the state of the economies is not perfectly correlated.

The intuition for this result is as follows. The foreign bank obtains positive expected profits when it finances type I firms with good projects. Tus, if the bank finances these firms only, its expected (and realised) profits are stricly increasing in N. The losses from failed projects must be offset against the gains from succesful projects before they can be shifted to the depositors. Therefore, when N is large, the must bank incur the expected losses from financing firms with bad projects. This eliminates the incentive to finance firms with unprofitable projects. Since the first lemma indicates that the bank's expected profits from risk shifting are limited and the bank's expected profits from financing type I firms with good projects only is strictly increasing in N, there is a value of N such that the latter strategy dominates the former.

Finally, the last lemma states, that when N is large, rational depositors correctly anticipate the foreign bank to refrain from lending to firms with unprofitable projects. Therefore, the depositors are always willing to hold demand deposits issued by the foreign bank. In effect, as the number of economies increases, depositors disregard the public signal about their local economy, as they know that the bank finances only firms with profitable projects.

In the ensuing analysis, I assume that $N > N^*$. Consequently, the foreign bank can always raise deposits and finance firms with profitable investment projects.

Let δ_F^* be the deposit rate offered by the foreign bank. Then, since the foreign bank finances only firms with good projects in many economies, the law of large number implies that

$$\delta_F^* = R_f.$$

4.2 Equilibrium under foreign bank entry

The following section contains the body of the analysis. In this section I characterise the equilibrium following the entry of the foreign bank, and illustrate why foreign bank entry raises the occurence of liquidity shocks and leads to a segmentation of the credit market. Throughout the analysis, I assume that the local bank's ability to raise deposits is unaffacted by the presence of the foreign bank.

4.2.1 Preliminaries: strategic interaction and efficient contracts

To ensure the existence of a pure strategy equilibrium, I assume that the sequential structure of the competition between the banks is as follows. At stage one, the banks simultaneously offer a loan contract to the firms. The outcome of stage one is observable to both lenders. At stage two, the relationship lender has the opportunity to improve the contract it offered at stage one.

The firms have a stock of productive assets, so the loans can be subject to collateral requirements. Lemma 6 characterises the efficient loan contracts.

Lemma 6 *There exists a loan contract (the "competitive collateral contract"), which maximises the return to the firms with good projects, and is accepted only by firms with good projects. Under this contract, the lender's expected profits are zero. In addition, there exists a loan contract (the "monopoly collateral contract") which maximises the returns to the lender, and is accepted only by firms with good projects. Under this contract, the lender's expected profits are equal to the monopoly profits. There exists a non-collateralised loan contract,* $\left(\bar{R}, 0\right)$*, which is weakly preferred over the competitive collateral contract by all firms with good projects. If a firm with a good project accepts one unit of finance under this contract, the lender obtains an expected profit of* $\pi^c > 0$*.*

The contracts in Lemma 6 exploits, that firms with bad projects have a higher probability of failure than firms with good projects. This implies, that the former are more reluctant to post collateral than the latter. Consequently, by fixing the collateral requirement and the loan rate appropriately, a collateralised loan contract can be used as a self-selection mechanism to sort firms with good projects from firms with bad projects. Collateral is subject to a liquidation inefficiency, so the lender assigns a lower value to a collateralised loan than the firm. Thus, if the lender can sort the firms without the use of collateral, it can offer the more efficient non-collateralised loan contract, $\left(\bar{R}, 0\right)$.

4.2.2 The banks' problem under foreign bank entry

The model is solved by backwards induction. At time $t = 1$, the banks compete under asymmetric information. For a given firm, the relationship lender can observe the quality of the project, whereas the non-relationship lender must use the public signal and the firm's type to form Bayesian beliefs about the project. The asymmetric information structure exposes the non-relationship lender to adverse selection. The relationship lender matches the terms of the loan contract offered by the non-relationship lender when this is profitable, and rejects the loan applicant when the contract offered by the non-relationship lender is unprofitable. To protect itself against adverse selection, the non-relationship lender offers the competitive collateral contract. In response, if the firm holds a good project, the relationship lender offers the contract $(\bar{R}, 0)$. This contract is weakly preferred by firms with good projects, so the relationship lender obtains an expected profit of π^c.

The strategic interaction between the banks leads to a pure strategy equilibrium, but it implies that more than one outcome can be supported as an equilibrium. The equilibria differ with respect to the local bank's incentives to engage in risk shifting. The model's main transmission mechanism is driven by the foreign bank's ability to finance local firms during the liquidity shock. This feature does not vary across the equilibria, so in the analysis below, I focus on the equilibrium which minimizes the local bank's incentives to engage in risk shifting. Lemma 7 characterizes this equilibrium.

Lemma 7 *At time $t = 1$, the relationship lender finances firms with good projects with which it has a lending relationship under the contract $(\bar{R}, 0)$. The local bank finances firms with bad projects with which it has a lending relationship under the contract $(X, 0)$. Following the occurrence of a liquidity shock, the foreign bank finances the firms with good projects with which it has a lending relationship under the contract $(X, 0)$, and finances all other firms with good projects under the monopoly collateral contract.*

The lemma illustrates, that the foreign bank's presence reinforces the local bank's incentives to engage in risk shifting. Prior to the entry of the foreign bank, the local bank finances firms with bad projects only in state $P_t = (P_B, P_B)$. Following the entry of the foreign bank, when the local bank is the relationship lender to type D firms, it engages in risk shifting in state $P_1 \in \{(P_B, P_G), (P_B, P_B)\}$, and when it is the relationship lender to type I firms, it engages in risk shifting in state $P_1 \in \{(P_G, P_B), (P_B, P_B)\}$. The strenghtening of the local bank's incentives to engage in risk shifting is driven by the segmentation of the credit market. If the foreign bank is the relationship lender to type I firms, in state (P_B, P_G) it has the information advantage which allows it to retain type I firms. The local bank's profits are zero when it refrains from lending, so limited liability implies, that when the foreign bank is the relationship lender to type I firms, it is optimal for the local bank to finance firms with bad projects when $P_1 = (P_B, P_G)$. Similarly, when the foreign bank is the relationship lender to type D firms, limited liability implies that it is optimal for the local bank to engage in risk shifting when $P_1 = (P_G, P_B)$. Last, if the local bank fails to raise deposits, the foreign bank offers the monopoly contracts and finances all firms with good projects. Thus, the foreign bank isolates the local firms' from the occurrence of liquidity shocks.

At time $t = 0$, the banks compete under asymmetric information, and the local bank is the relationship lender to both types of firms. The entrant has the choice between two different contracts. It can offer the competitive collateral contract and obtain zero expected profits, or it can offer a non-collateralised *type* contingent contract (the "pooling contract"). If the entrant offers the latter, it can set the terms of the contract contingent on the public signal, but not contingent on whether the firm has a good or a bad project. Thus, the pooling contract suffers from the inefficiency that, given the firm's type, it pools loan applicants with good and bad projects.

To determine the optimal loan contracts at time $t = 0$, let γ^{**} be the lowest value of the public signal at which the local bank can raise deposits. Let $R^k_{t,j}$ and $\pi^k_{t,j}$ be respectively the lending rate and the expected profits to bank k from lending to a type j firm at time t, where $j \in \{D, I\}$ and $k \in \{L, F\}$ represents whether the bank is local, L, or foreign, F. Let π^k_j be the present value of bank k's expected profits from lending to a type j firm, i.e. $\pi^k_j = \sum_{t=0}^{1} \pi^k_{t,j}$, and let $\delta_{t,k}$ be the deposit rate offered by bank k at time t.

If, at time $t = 0$, the foreign bank offers the pooling contract, the present value of its expected profits from financing a type j firm is,

$$\pi^F_j = \left(\bar{P}_{0,j} R^F_{0,j} - R_f\right) + E_0\left(\pi^F_{1,j}\right), \tag{2}$$

where,

$$E_0\left(\pi^F_{1,I}\right)=\Pr\left(P_I=P_G\cap\gamma_1\geq\gamma^{**}\right)\pi^c+\Pr\left(P_I=P_G\cap\gamma_1<\gamma^{**}\right)\left(P_GX-R_f\right), \tag{3}$$

$$E_0\left(\pi^F_{1,D}\right)=\Pr\left(P_D=P_G\cap\gamma_1\geq\gamma^{**}\right)\pi^c+\Pr\left(P_D=P_G\cap\gamma_1<\gamma^{**}\right)\left(P_GX-R_f\right), \tag{4}$$

and,

$$\bar{P}_{0,j}=\Pr\left(P_j=P_G|\gamma_0\right)P_G+\Pr\left(P_j=P_B|\gamma_0\right)P_B.$$

Expression (2) is the sum of the foreign bank's expected profits from the first and the second period. The profits from the first period derives from the pooling contract. These profits depend on the realisation of the public signal, since this determines the foreign bank's beliefs about the expected success probability of a type j firm, $\bar{P}_{0,j}$. For all values of the public signal, the foreign bank assigns a positive probability to the event $P_j=P_B$, so $\bar{P}_{0,j}<P_G$. This reflects the inefficiency of the pooling contract. The foreign bank's expected profits from the second period, expression (3) and (4), contains two terms. The first term is the information rents that accrue to the relationship lender. By lending to the firm in the first period, in the second period the foreign bank is the relationship lender and holds the information advantage. The second term reflects, that if a liquidity shock occurs at time $t=1$, the foreign bank is the monopoly lender and therefore extracts the monopoly rents.

The most competitive pooling contract that the foreign bank can offer at time $t=0$, sets the lending rate such that the present value of the foreign bank's expected profits are zero. Thus, the interest rate on the most competitive pooling contract is given by,

$$R^F_{0,j}=\frac{R_f}{\bar{P}_{0,j}}-\frac{1}{\bar{P}_{0,j}}E_0\left(\pi^F_{1,j}\right).$$

At time $t=0$, the present value of the local bank's expected profits from financing a type j firm with a good project is given by,

$$\pi^L_j=P_G\left(R^L_{0,j}-\delta_{0,L}\right)+E_0\left(\pi^L_{1,j}\right), \tag{5}$$

where,

$$E_0\left(\pi_{1,I}^L\right) = \Pr\left(P_I = P_G \cap \gamma_1 \geq \gamma^{**}\right)\pi^c \quad (6)$$

$$+\Pr\left(P_I = P_B \cap \gamma_1 \geq \gamma^{**}\right)P_B\left(X - E_0\left[\delta_{1,L}|\gamma_1 \geq \gamma^{**}, P_I = P_B\right]\right), \quad (7)$$

and,

$$E_0\left(\pi_{1,D}^L\right) = \Pr\left(P_D = P_G \cap \gamma_1 \geq \gamma^{**}\right)\pi^c$$
$$+\Pr\left(P_D = P_B \cap \gamma_1 \geq \gamma^{**}\right)P_B\left(X - E_0\left[\delta_{1,L}|\gamma_1 \geq \gamma^{**}, P_D = P_B\right]\right). \quad (8)$$

The first term in expression (5) is the local bank's expected profits from the first period. At time $t = 0$, the local bank is the relationship lender, so the public signal affects the first period profits only through its impact on the deposit rate. The second term in (5) is the local bank's expected profits from period two. These profits, expression (6) and (8), reflect the information rents that accure to the local bank if it remains the relationship lender in the second period, and the rents that accrue to the local bank from risk shifting.

The most competitive lending rate that the local bank can offer to a type j firm, is set such that the present value of the local bank's expected profits is zero. Thus, the most competitive lending rate that the local bank can offer to firms with good projects is at time $t = 0$ given by,

$$R_{0,j}^L = \delta_{0,L} - \frac{1}{P_G}E_0\left(\pi_{1,j}^L\right) \quad (9)$$

The most competitive pooling contract, and the incumbent's most competitive contract differ in two repsects. First, the inefficiency of the pooling contract implies, that the default rate on the entrant's portfolio exceeds the default rate on the incumbent's portfolio.[8] This effect is measured by the term, $\frac{1}{\bar{P}_{0,j}} > \frac{1}{P_G}$, and tends to push the entrant's lending rate above the incument's lending rate. Second, under the most competitive contracts, both banks use their expected future profits to reduce the lending rate at time zero. The bank's expected profits from period two differs, because the foreign entrant can finance solvent firms at the monopoly rate when the local economy is subject

[8] The term default rate refers to the probability that the projects in the bank's loan portfolio fails.

to a liqudity shock. This effect tends to push the local bank's lending rate above the lending rate offered by the foreign bank.

There are no collateral requirements under the pooling contract or under the contract offered by the local bank, so the firm accepts the contract with the lowest lending rate. Thus, a necessary condition for a segmentation of the credit market is that $R^F_{0,D} \geq R^L_{0,D}$ and $R^F_{0,I} \leq R^L_{0,I}$. Lemma 8 lists the necessary conditions for this to be fulfilled.

Lemma 8 *A necessary condition for a segmentation of the credit market is that* $R^F_{0,D} \geq R^L_{0,D}$ *and* $R^F_{0,I} \leq R^L_{0,I}$*. These conditions are fulfilled if,*

$$\begin{aligned}\bar{P}_{0,D}\delta_{L,0} - R_f + \left(1 - \frac{\bar{P}_{0,D}}{P_G}\right) \Pr\left(P_D = P_G \cap \gamma_1 \geq \gamma^{**}\right)\pi^c \\ + \Pr\left(P_D = P_G \cap \gamma < \gamma^{**}\right)\left(P_G X - R_f\right) \\ - \frac{\bar{P}_{0,D} \Pr\left(P_D = P_B \cap \gamma \geq \gamma^{**}\right) P_B \left(X - E_0\left[\delta_{1,L} | \gamma_1 \geq \gamma^{**}, P_D = P_B\right]\right)}{P_G} \leq 0 \quad (10)\end{aligned}$$

and

$$\begin{aligned}\bar{P}_{0,I}\delta_{L,0} - R_f + \left(1 - \frac{\bar{P}_{0,I}}{P_G}\right) \Pr\left(P_I = P_G \cap \gamma \geq \gamma^{**}\right)\pi^c \\ + \Pr\left(P_I = P_G \cap \gamma < \gamma^{**}\right)\left(P_G X - R_f\right) \\ - \frac{\Pr\left(P_I = P_B \cap \gamma_1 \geq \gamma^{**}\right) P_B \left(X - E_0\left[\delta_{1,L} | \gamma_1 \geq \gamma^{**}, P_I = P_B\right]\right)}{P_G} \geq 0 \quad (11)\end{aligned}$$

Intuitively, condition (10) and (11) ensure, that the foreign bank is the most competitive lender to type I firms, and that the local bank is the most competitive lender to type D firms. The foreign bank attains its competitive advantage from the ability to finance local firms with good projects during local liquidity shocks. This advantage has to be offset against the local banks superior information at time $t = 0$. As illustrated, liquidity shocks are more frequent when type I firms hold good projects than when type D firms hold good projects. This implies, that the entrant has a greater advantage in the competition for type I firms than in the competition for type D firms. Consequently, if the entrant finances type D firms, it will also finance type I firms. The converse is not true, so if both of the banks are active in equilibrium, the credit market must be segmented.

In the following, I assume that condition (10) and (11) are fulfilled.

As an alternative to the pooling contract, the foreign bank can offer collateralised loans in both periods. Under this stategy, the foreign bank offers the competitive collateral contract when the local economy is not subject to a liquidity shocks, and the monopoly collateral contract when the local economy is subject to a liquidity shock. This strategy allows the foreign bank to eliminate the inefficiency of the pooling contract, and to capture the monopoly rents when the local economy is subject to a liquidity shock. The cost of the strategy is two fold. First, the foreign bank surrenders the expected relationship rents from the second period, and second, if the credit market segmentation increases the occurence of liquidity shocks, i.e. if $\gamma^* < \gamma^{**}$, it reduces the likelihood that the entrant becomes the monopoly lender in the second period. Consequently, it is optimal for the foreign bank to offer the pooling contract when the relationship rents are high, and when the credit market segmentation increases the occurrence of liquidity shocks. Lemma 9 provides the conditions under which it is optimal for the foreign entrant to offer the pooling contract to type I firms.

Lemma 9 *The entrant offers the pooling contract to type I firms at time $t = 0$ only if,*

$$\left(\bar{P}_{0,I}\delta_{0,L} - R_f\right) + \left(1 - \frac{\bar{P}_{0,I}}{P_G}\right) \Pr\left(P_I = P_G \cap \gamma \geq \gamma^{**}\right) \pi^c + \left(P_G X - R_f\right) \left[\Pr\left(\gamma < \gamma^{**} \cap P_I = P_G\right) - \Pr\left(\gamma < \gamma^* \cap P_I = P_G\right)\right] \geq 0. \quad (12)$$

Condition (12) illustrates, that when the credit market segmentation increases the occurrence of liquidity shocks (the third term of expression (12)), and when the relationship rents are high (the second term of expression (12)), it is optimal for the foreign bank to offer the pooling contract. In the following, I assume that condition (12) is fulfilled.

In combination, Lemma 8 and 9 implies, that the foreign bank enters at time $t = 0$, and that the entry leads to a segmentation of the credit market. The subsequent section analysis the depositors' problem, and explores how the presence of the foreign bank affects the occurrence of liquidity shocks.

4.3 The depositors' problem

The depositors use the public signal to form beliefs about the true state of the local economy. The presence of the foreign bank does not affect the depositors' information set, so the depositors beliefs are given by (1).

The noise in the public signal implies, that for all possible state realisations, the depositors assign a positive probability to the event $P_D = P_B$. When $P_D = P_B$, the local bank finances firms with unprofitable projects, so in these states it is optimal for the depositors to redeem their demand deposits and invest in the risk-free asset. This implies, that when the public signal is sufficiently adverse, i.e. when $\gamma_t < \gamma^{**}$, the local bank fails to raise deposits.

As an additional condition, the depositors invest in demand deposits only when the expected return on demand deposits weakly exceeds the expected return on the risk-free asset. Consequently, for any given value of the public signal, there is a lower bound on the deposit rate, such that the depositors finance the bank only if the deposit rate exceeds this lower bound.

Lemma 10 formalises these observations and characterises the behaviour of the depositors. Importantly, Lemma 10 highlights, that the presence of the foreign bank frustrates the local bank's ability to raise deposits.

Lemma 10 *There is a unique value of γ_t, γ^{**}, such that, the depositors finance the local bank if and only if $\gamma_t \geq \gamma^{**}$ and $\delta_t \geq \delta_t^{**}$. Furthermore, $\gamma^{**} > \gamma^*$.*

Lemma 10 illustrates, that the foreign bank's presence raises the occurrence of liquidity shocks, i.e. $\gamma^{**} > \gamma^*$. Two effects contribute to this result. First, the foreign bank raises competition. This forces the local bank to reduce its lending rate and thereby the interest rate it can pay on demand deposits. This lowers the expected return on demand deposits and weakens the depositors' incentives to finance the bank. This effect arises purely from competition, and is independent of whether the entrant is a foreign or a local bank. Second, the entry by the foreign bank reduces the diversification of the local bank's loan portfolio and aggravates the agency problem. Prior to the entry of the foreign bank, the local bank engaged in risk shifting when $P_0 = (P_B, P_B)$. The entry by the foreign bank leads to a market segmentation which causes the local bank to engage in risk shifting for $P_0 \in \{(P_B, P_G), (P_B, P_B)\}$. To protect themselves against risk shifting, the depositors withdraw from the local bank for higher values of the public signal. The second effect is completely driven by the segmentation of the credit market, and would not occur if the entrant was a local bank. Thus, Lemma 10 suggests, that the resilience of the local bank depends on whether it competes with a local or a foreign entrant.

Proposition 11 gathers the insights from the previous lemmas, and characterises the equilbrium post the entry of the foreign bank.

Proposition 11 *Under condition* (10), (11) *and* (12), *foreign entry leads to a segmentation of the credit market. In equilibrium, the foreign bank finances type I firms under the pooling contract,* $\left(R^L_{0,I}, 0\right)$, *and the local bank finances type D firms under the contract,* $\left(\bar{R}, 0\right)$. *Foreign entry increases the occurrence of liquidity shocks, as* $\gamma^{**} > \gamma^*$.

The equilibrium reveals a feature which is novel to the literature on foreign bank entry. In extant models, the entrant contests the incumbent's information advantage through the access to a cheaper source of finance. In the model presented above, the entrant and the incumbent pays the same risk adjusted price for deposits. The entrant mitigates the incumbent's information advantage through its ability to provide finance to creditworthy firms in states where the local financial system is subject to a liqudity shock. The segmentation of the credit market arises, because this service is of particular value to firms with a low exposure to the local business conditions. Bank's in developing economies are more frequently subject to liquidity shocks than banks in developed economies, so this analysis is predominantly relevant for foreign bank entry into developing economies.[9]

The structure of the equilibrium suggests, that competition is more severe following entry by a foreign financial intermediary than following entry by a local financial intermediary. The foreign bank increases competition via two channels. First, it offers local firms an alternative source of

[9] Through 1980-2005, the average standard deviation of real cost of deposits was 1.6% in G7 countries but 12.9% in 25 major emerging markets. The standard deviation of real demand deposit growth was 14% for G7 economies and 24% for the 25 major emerging markets (See Mian and Khwaja (2006) for further discussion). For a discussion of the correlation between the variance in deposits and variance in bank credit see Mian and Khwaja (2006) or Berlin and Mester (1999).

finance, which forces the local bank to rennounce some of its monopoly rents. This is a general feature of increased competition, and does not depend on whether the entrant is a local or foreign bank. Second, the foreign bank's ability to supply finance when the local economy goes through a bust, provides it with expected monopoly rents that can be used to ease the terms of its loan contracts further. This effect arises only when the entrant is a foreign bank.

4.4 Welfare considerations

The foreign bank enhances the efficiency of the local financial system by eliminating events where firms with good projects fail to raise finance. On the flip side, the local bank's information about type I firms is discarded and, on average, firms with bad projects are financed under the foreign bank's pooling contract. Overall, welfare is improved if the failure to finance good projects is costly relative to the cost of financing bad projects. That is, at time t, welfare is improved if

$$\Pr(\gamma_t < \gamma^*)\left[\lambda \Pr(P_D = P_G|\gamma_t < \gamma^*) + (1-\lambda)\Pr(P_I = P_G|\gamma_t < \gamma^*)\right](P_G X - R_f) \\ - (1-\lambda)\Pr(P_I = P_B)(R_f - P_B X) \geq 0$$

The stylized framework presented in this paper ignores many of the costs and benefits of foreign bank entry. As illustrated in the model, foreign entry can cause a contraction of the lending spreads.[10] In the model, the demand for credit is inelastic, so this does not affect aggregate welfare. However, with an elastic demand for credit, tighter lending spreads can increase welfare by increasing the number of entrepreneurs with good projects that apply for finance.[11]

Extant literature illustrates, that competition between financial intermediaries can lead to greater financial instability.[12] In the model, the local bank's ability to raise deposits is frustrated by the presence of the foreign bank. When the local economy is subject to a liquidty shock, the foreign bank finances all the entrepreneurs with good projects, so this does not have any welfare

[10] The lending spread is defined as the difference between the interest rate on loans and the interest rate on deposits.

[11] For empirical support of this mechanisms, see Demirgüç-Kunt et. al. (1999), Claessens et. al. (2001) or Peria et. al.(2002)

[12] See Allen and Gale (2004) for a survey.

effects. However, the model ignores that liquidity shocks involve large redistributions of wealth, which are generally not neutral from a welfare persepective.[13]

The model illustrates, that even if the foreign bank extends credit as the local economy goes through a bust, this does not imply that the foreign bank enhances the financial stability of the local economy. In the model, the foreign bank lends during local liquidity shocks, but its presence increases the occurrence of liquidity shocks.

BIS (2004) and BIS (2005) argue, that the presence of a reputable foreign financial institution may enhance the stability of the local economy by allowing local depositors' flight to quality without a negative impact on the capital account. Proposition 5 provides a theoretical rationale for this line of reasoning.

5 Empirical implications and evidence

5.1 Empirical implications

The model has a set of testable implications. First, the credit market segmentation suggests, that firms that produce for export obtain credit from the foreign entrant, and firms that produce for the local market are financed by the local bank. Note, that if the firms that produce for export are large relative to the firms that produce for local consumption, this prediction coincides with the predictions from the information based theories of credit market segmentation.[14] Second, the foreign bank is a more stable source of finance than the local bank, and foreign finance does not contract as the local business conditions deteriorate. Third, local banks are more exposed to liquidity shocks following the entry of foreign banks. Last, foreign entry improves the financing conditions for all firms in the local economy.

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[13] The model predicts, that the foreign entrant makes substantial rents during the bust which reduces local firms realised profits.

[14] Stein (2002) and Berger and Udell (2002).

5.2 Empirical evidence

The empirical tests of clientele effects following the entry of foreign banks into developing economies are complicated by the lack of data on bank and firm relationships, so most empirical results rest on surveys and interviews with bank managers. One exception is Mian (2006) which analyses a detailed data set for Pakistan. Mian finds, that local banks lend to small firms and that foreign banks lend to large firms. This finding is interpreted as evidence that information fictions and agency problems prevent the foreign entrant from lending to small firms. The dataset however, also indicates that sectors with large exports tend to borrow from foreign banks, and therefore, it does not reject the hypothesis presented in this paper.

Based on questionnaire surveys and interviews with bank managers, Galac and Kraft (2000) finds, that one of the most important activities of foreign entrants in Croatia was import-export financing. In addition, some of the foreign bank managers stated that they financed exporters only. Konopielko (1999) conducts a survey among foreign bank managers in Poland, Hungary and Czech Republic and finds, that the foreign banks' main objectives were to finance foreign trade and support existing clients.[15] Haas and Naaborg (2005a) conducts a survey among managers of foreign banks with a presence in Central Eastern Europe and the Baltic States and finds, that upon entry, the foreign banks' objective was to finance multinational firms. In addition, their survey indicates, that as a result of increasing competition, the foreign banks' objective changed over time.

A wide range of empirical literature analyses the behaviour of foreign entrants during busts of the local economies. Overall, this literature finds, that foreign banks continue to lend as the local economy goes through a recession.

Haas and Naaborg (2005a) and Haas and Lelyveld (2006) find, that foreign banks in Central and Eastern Europe maintained credit outstanding during the financial turmoil in the 1990s. Galac and Kraft (2000) finds, that foreign banks with a physical presence in Croatia expanded both direct lending and the supply of liquidity in the interbank market during the banking crisis of the late

[15] As a specific example, Citibank was the 20th bank in terms of loan volumes but the second largest bank in terms of foreign trade finance (Konopielko (1999)).

1990s. Consistent with the model's predictions, foreign entrants in Croatia appear to have made considerable profits from their operations during the banking crisis.

Goldberg et al. (2000) analyse data for Mexico and Argentina and find, that during the periods of financial unrest in the 1990s, the credit growth of foreign banks was less volatile than the credit growth of local banks. These periods of unrest were characterised by depositor flight to quality, and the authors interpret their findings as evidence that access to a more stable source of finance allowed the foreign banks to maintain their credit outstanding. Peria and Moody (2002) and Peek and Rosengren (2000) support this finding in their analysis of a range of Latin American countries. Goldberg (2001) analyses the lending behaviour of US banks in emerging markets, and find this to be uncorrelated with the real demand cycles of the local markets. The author interprets this as evidence that US banks with a physical presence in emerging markets tend to maintain their supply of credit when the local economy goes through a bust.

6 Conclusion

Extant theories on foreign bank entry predict, that information asymmetries between foreign and local banks, and differences in their the costs of finance, can create clientele effects which lead to a segmentation of the credit market. Under this segmentation, the foreign bank finances the best and most transparent of the local firms. This paper has presented an alternative theory of the clientele effects that arise from foreign bank entry. The theory emphasises, that distinct features of the foreign bank's business renders it well suited to finance local firms with a low exposure to local business conditions. The diversification of the foreign bank's business provides it with a stable source of finance, and permits it to maintain credit outstanding as the local economy goes through a bust. This creates a segmentation of the credit market, as the ability to raise finance during a downturn of the local economy is important to firms whose business opportunities have a low correlation with the state of the local economy. Thus, foreign banks finance firms with a low exposure to the local business conditions and local banks finance firms with a high exposure to the local business conditions.

The segmentation of the credit market is along risk factors, so it reduces the diversification of the local bank's loan portfolio. This aggravates the local bank's agency problems and increases the occurrence of liquidity shocks. Thus, the model presented in this paper suggests, that foreign bank entry increases the vulnerability of the local financial intermediaries.

The models empirical implications find some support in existing empirical work with the caveat that much of the evidence on market segmentation, due to data constraints, is based on survey data.

The interpretation of the model presented in this paper, and the reading of its predictions can be widened along two lines. First, the local bank's demand deposits can be interpreted as finance originated in the international interbank market. Typically, interbank finance to banks in developing economies has a short tenure, and is subject to the same reversals as the demand deposits analysed in this paper. Under this interpretation, the local bank's agency problem renders its access to interbank finance is unstable. In contrast, the diversification of the foreign bank's business implies, that interbank is a stable source of finance to the foreign entrant.

Second, the segmentation of the credit market can be interpreted as a result of the entrant's ability to provide a range of services which are particularly valuable to firms producing for export. These services could relate to the firms daily operations, such as the ability to settle trades in different currencies, or to risk management and finance issues, such as the ability to originate and distribute debt securities denominated in foreign currencies. Under this interpretation, the segmentation of the credit market occurs because the profile of the services offered by the foreign bank is a better match to the firms producing for export than to the firms producing for the local economy.

To assess the welfare implications of foreign competition, it is important to understand how the presence of foreign banks affects the local credit market. This paper is silent on a range of questions which are important in this respect. For example, how important is the foreign bank's mode of entry (greenfield entry versus acquisition versus cross border lending)? And, how does the entrant and the incumbent interact in the deposit and interbank markets? An analysis of these questions can shed more light on how foreign banks affect the local financial system, and on the particular features of the local economy which may render foreign entry welfare enhancing.

7 Appendix

Proof. Lemma 1. The parameter constraint, $R_f > \lambda X > (1-\lambda) X$ implies, that when the bank finances both types of firms, they must both succeed for the bank to repay depositors in full. The bank is protected by limited liability, so in state (P_B, P_B), the expected return from financing only type D firms is

$$\lambda P_B (X - \delta).$$

$\lambda > \frac{1}{2}$, so $\lambda P_B (X - \delta) > (1-\lambda) P_B (X - \delta)$ and therefore, if the local bank finances only one type of firm, it finances the type D firms. Under limited liability, financing both types of firms yields a return of

$$P_B^2 (X - \delta),$$

and since $\lambda > P_B$, it follows that

$$\lambda P_B (X - \delta) > P_B^2 (X - \delta).$$

Thus, in state (P_B, P_B) the local bank finances only type D firms.

In state (P_G, P_B), the return to financing only type D firms is given by

$$\lambda P_G (X - \delta).$$

The return to financing type I firms is

$$(1-\lambda) P_B (X - \delta),$$

and since $\lambda > (1-\lambda)$ and $P_G > P_B$, it follows that if the bank finances only one type of firm, it finances type D firms. Under limited liability, the return from financing all firms is given by

$$P_B P_G (X - \delta).$$

Since $\lambda > P_B$,

$$\lambda P_G (X - \delta) > P_B P_G (X - \delta),$$

so the local bank finances only type D firms.

In state (P_B, P_G), the return to financing type D firms is given by

$$\lambda P_B (X - \delta),$$

and the return to financing only type I firms is given by

$$(1 - \lambda) P_G (X - \delta).$$

Since $(1 - \lambda) > P_B$ and $P_G > \lambda$ it follows that, if the local bank finances only one type of firm, it finances type I firms. The return from financing both types of firms is,

$$P_G P_B (X - \delta),$$

and since $(1 - \lambda) > P_B$ it follows that

$$(1 - \lambda) P_G (X - P_G) > P_G P_B (X - \delta).$$

Thus, in state (P_B, P_G), the local bank only finances type I firms.

Last, in state (P_G, P_G) the return to the limited liability bank from financing both types of firms is given by

$$P_G^2 (X - \delta),$$

and the return from financing only type D firms is,

$$\lambda P_G (X - \delta),$$

so since $P_G > \lambda$, it follows that

$$P_G^2 (X - \delta) > \lambda P_B (X - \delta).$$

Thus, in state (P_G, P_G) the local bank finances both types of firms (it follows straight forward that it is never optimal for the local bank to finance type I firms only). This verifies the claim in the lemma. ■

Proof. Lemma 2. The depositors finance the bank if the expected return on demand deposits weakly exceeds the return on the risk-free asset. The expected return on demand deposits is increasing in δ_t, so since $\delta_t \leq X$, it follows that γ^* solves

$$\begin{aligned}
&\lambda \Pr\left(P_t = (P_B, P_B)\,|\gamma_t\right)(P_B X - R_f) + \Pr\left(P_t = (P_G, P_G)\,|\gamma_t\right)(P_G X - R_f) \\
&\quad + \lambda \Pr\left(P_t = (P_G, P_B)\,|\gamma_t\right)(P_G X - R_f) + (1-\lambda)\Pr\left(P_t = (P_B, P_G)\,|\gamma_t\right)(P_G X - R_f) = 0 \Leftrightarrow \\
&\lambda \Pr\left(P_t = (P_B, P_B)\,|\gamma_t\right)(P_B X - R_f) + \left[1 - \Pr\left(P_t = (P_B, P_B)\,|\gamma_t\right)\right](P_G X - R_f) = 0 \\
&\left[\Pr\left(P = (P_B, P_B)\,|\gamma_t\right) P_B + \left(1 - \Pr\left(P = (P_B, P_B)\,|\gamma_t\right)\right) P_G\right] X = R_f. \qquad (13)
\end{aligned}$$

There is a unique value of γ^* that solves expression (13). This follows since the left hand side of (13) is continous and strictly increasing in γ_t, and it goes to $\lambda (P_B X - R_f) < 0$for $\gamma = -\infty$ and to $P_G X - R_f > 0$ for $\gamma \to \infty$.

Depositors finance the local bank if the expected return on demand deposits, conditional on the realisation of the public signal and the bank's lending policy, weakly exceeds the return on the risk-free asset. That is, depositors invests in demand deposits if $\delta_t \geq \delta_t^*$, where δ_t^* solves,

$$\begin{aligned}
&\left[\Pr\left(P_t = (P_B, P_G)\,|\gamma_t\right) + \Pr\left(P_t = (P_G, P_B)\,|\gamma_t\right)\right] P_G \delta_t \\
&\quad + \Pr\left(P_t = (P_G, P_G)\,|\gamma_t\right)\left[P_G^2 \delta_t + P_G (1 - P_G) X\right] + \Pr\left(P_t = (P_B, P_B)\,|\gamma_t\right) P_B \delta_t = R_f. \qquad (14)
\end{aligned}$$

■

Proof. Proposition 4. The proof follows directly from Lemma 1 and the presiding discussion. ■

Proof. Proposition 5. The proof consists of three lemmas which in conjunction verify the proposition.

Lemma 12 *If the foreign bank finances loan applicants with bad projects, it will do so in a finite number of economies only.*

Proof. Assume that all firms in all economies hold bad projects. Let n be the number of economies in which the foreign bank lends, and let i be the number of economies with successful outcomes. Let $E(\pi_t(n))$ be foreign bank's expected profits. The bank's profits are increasing in the lending rate, so assume that the bank lends at X. Assume that the foreign bank finances only type I firms (that indeed this is the case is verified in 11). Limited liability implies that the foreign bank obtains positive profits if $i > \frac{\delta_I}{X} n$, where δ_I is the foreign banks deposit rate. Thus, the optimal n solves,

$$\max_n E\left(\pi_t\left(n\right)\right) = \max_n \left(1-\lambda\right) \sum_{i=\frac{\delta_I}{X}n}^{n} \binom{n}{i} P_B^i \left(1-P_B\right)^{n-i} \left(iX - n\delta_I\right).$$

It follows that,

$$\begin{aligned}
&(1-\lambda) \sum_{i=\frac{\delta_I}{X}n}^{n} \binom{n}{i} P_B^i \left(1-P_B\right)^{n-i} \left(iX - n\delta_I\right) \\
&\quad = (1-\lambda)\, n \sum_{i=\frac{\delta_I}{X}n}^{n} \binom{n}{i} P_B^i \left(1-P_B\right)^{n-i} \frac{\left(iX - n\delta_I\right)}{n} \\
&\quad \leq (1-\lambda)\left(X-\delta_I\right) n \sum_{i=\frac{\delta_I}{X}n}^{n} \binom{n}{i} P_B^i \left(1-P_B\right)^{n-i} \\
&\quad = (1-\lambda)\left(X-\delta_I\right) n \Pr\left(i \geq \frac{\delta_I}{X} n\right) \\
&\quad = (1-\lambda)\left(X-\delta_I\right) n \Pr\left(\frac{i}{n} X \geq \delta_I\right).
\end{aligned}$$

$\lim_{n\to\infty} \frac{i}{n} = P_B$, so $\lim_{n\to\infty} \frac{i}{n} X = P_B X < R_f < \delta_I$. Thus, a $\upsilon > 0$ can be found such that $\left(P_B + \upsilon\right) X < \delta_I$, and, for every such υ, there exists an $n < \infty$, $\tilde{n}$, such that $\left|\frac{i}{\tilde{n}} - P_B\right| < \upsilon$. Consequently, $\Pr\left(\frac{i}{\tilde{n}} X \geq \delta_I\right) \leq \Pr\left(\left(P_B + \upsilon\right) X \geq \delta_I\right) = 0$ so $n \Pr\left(\frac{i}{n} X \geq \delta_I\right) = 0$ for all $n \geq \tilde{n}$ and therefore $E\left(\pi_t\left(n\right)\right) = 0$ for $n \geq \tilde{n}$. $E\left(\pi_t\left(n\right)\right)$ is closed and $E\left(\pi_t\left(1\right)\right) = \left(1-\lambda\right) P_B \left(X - \delta_I\right) > 0$, so there is an optimal n, n^*, with $n^* \in [1, \tilde{n})$. ■

Lemma 13 *Let α be the average fraction of firms with good projects. If $\alpha > 0$, then there exists a value N^{**} such that the foreign bank lends only to firms with good projects if $N > N^{**}$.*

Proof. Let β be the average fraction of type I firms with good projects in each economy, i.e. $\beta = \alpha\left(1-\lambda\right)$, and β^c be the average fraction of type I firms with bad projects in each economy, i.e. $\beta^c = \left(1-\alpha\right)\left(1-\lambda\right)$. Let $E\left(\pi_t \middle| \left(y_G, y_B\right)\right)$ be the foreign bank's expected profits when it finances good projects with a measure y_G and bad projects with a measure y_B. Let i be the number of economies where type I firms with good projects are successful and l be the number of economies where type I firms with bad projects are successful. The bank's profits from lending to firms with good projects are positive when $i > \frac{\delta_I}{X} \alpha N$. By the law of large numbers, the number of economies where type I firms hold good projects is αN. Thus since the foreign bank is protected by limited liability,

$$E\left(\pi_t|\left(\beta N,0\right)\right)=\sum_{i=\frac{\delta_I}{X}\alpha N}^{\alpha N}\binom{\alpha N}{i}P_G^i\left(1-P_G\right)^{\alpha N-i}\left(i\left(1-\lambda\right)X-\beta N\delta_I\right).$$

Let n^* be number of economies in which the foreign bank finances firms with bad projects. By the previous lemma, n^* is finite. Then,

$$E\left(\pi_t|\left(\beta N,\beta^c n^*\right)\right)$$

$$\begin{aligned}
=\max[&\sum_{l=0}^{\frac{\delta_I}{X}(1-\alpha)n^*}\binom{n^*}{l}P_B^l\left(1-P_B\right)^{n^*-l}\left(l\left(1-\lambda\right)X-\beta^c n^*\delta_I\right)\\
&+\sum_{l=\frac{\delta_I}{X}(1-\alpha)n^*+1}^{n^*}\binom{n^*}{l}P_B^l\left(1-P_B\right)^{n^*-l}\left(l\left(1-\lambda\right)X-\beta^c n^*\delta_I\right)\\
&+\sum_{i=0}^{\frac{\delta_I}{X}\alpha N}\binom{N}{i}P_G^i\left(1-P_G\right)^{N-i}\left(i\left(1-\lambda\right)X-\beta N\delta_I\right)\\
&+\sum_{i=\frac{\delta_I}{X}\alpha N+1}^{\alpha N}\binom{\alpha N}{i}P_G^i\left(1-P_G\right)^{\alpha N-i}\left(i\left(1-\lambda\right)X-\beta N\delta_I\right),0]. \quad (15)
\end{aligned}$$

Note that the first two terms is the return to financing firms with bad projects in n^* economies. Since n^* is finite, the value of these two expressions is finite. The third and fourth terms is the return on financing firms with good projects in αN economies. Thus,

$$\begin{aligned}
&\sum_{i=0}^{\frac{\delta_I}{X}\alpha N^{**}}\binom{N^{**}}{i}P_G^i\left(1-P_G\right)^{N^{**}-i}\left(i\left(1-\lambda\right)X-\beta N^{**}\delta_I\right)\\
&+\sum_{i=\frac{\delta_I}{X}\alpha N^{**}+1}^{\alpha N^{**}}\binom{\alpha N^{**}}{i}P_G^i\left(1-P_G\right)^{\alpha N^{**}-i}\left(i\left(1-\lambda\right)X-\beta N^{**}\delta_I\right)\\
&=\left(1-\lambda\right)XP_G\alpha N^{**}-\beta N^{**}\delta_I\\
&=\left(1-\lambda\right)\alpha N^{**}\left[P_GX-\delta_I\right].
\end{aligned}$$

Since n^* is finite and the outcome of the projects is independent across the economies, there is a value of N, N^{**}, such that $\delta_I \leq P_GX$. Therefore, the expected return from financing firms with good projects is increasing in N^{**}, so there must be a value of N^{**} such that the third and the fourth term in (15) exceeds the first and the second term in (15). Consequently, when $N \geq N^{**}$, the foreign bank's limited liability can be ignored. Further, the third term in (15) goes to zero as N^{**} increases. To see this, note that

$$\begin{aligned}
&\sum_{i=0}^{\frac{\delta_I}{X}\alpha N}\binom{\alpha N}{i}P_G^i\left(1-P_G\right)^{\alpha N-i}\left(i\left(1-\lambda\right)X-\beta N\delta_I\right)\\
\leq\;& 0,
\end{aligned}$$

and

$$\begin{aligned}
& \sum_{i=0}^{\frac{\delta_I}{X}\alpha N} \left(\begin{array}{c} \alpha N \\ i \end{array} \right) P_G^i \left(1-P_G\right)^{\alpha N-i} \left(i\left(1-\lambda\right)X - \beta N \delta_I\right) \\
\geq \quad & -\delta_I \beta N \sum_{i=0}^{\frac{\delta_I}{X}\alpha N} \left(\begin{array}{c} \alpha N \\ i \end{array} \right) P_G^i \left(1-P_G\right)^{\alpha N-i} \\
= \quad & -\delta_I \beta N \Pr\left(i \leq \alpha N \frac{\delta_I}{X}\right) \\
= \quad & -\delta_I \beta N \Pr\left(\frac{i}{\alpha N} \leq \frac{\delta_I}{X}\right).
\end{aligned}$$

By the law of large numbers, $\lim_{N\rightarrow\infty} \frac{i}{\alpha N} = P_G$, so for any $\upsilon \leq P_G\left(1-P_G\right)$, there is a value of N, N^{**}, such that $\frac{i}{\alpha N^{**}} \geq P_G - \upsilon$. For $N \geq N^{**}$,

$$\begin{aligned}
& -\delta_I \beta N \Pr\left(\frac{i}{\alpha N} \leq \frac{\delta_I}{X}\right) \\
\leq \quad & -\delta_I \beta N \Pr\left(P_G - \upsilon \leq \frac{\delta_I}{X}\right).
\end{aligned}$$

As noted, since n^* is finite, the diversification of the foreign bank's portfolio implies that $\lim_{N^{**}\rightarrow\infty} \delta_I \leq \frac{R_f}{P_G}$. Thus,

$$\begin{aligned}
\lim_{N^{**}\rightarrow\infty} \Pr\left(P_G - \upsilon \leq \frac{\delta_I}{X}\right) \quad & \leq \quad \Pr\left(P_G - \upsilon \leq \frac{\frac{R_f}{P_G}}{X}\right) \\
& \leq \quad \Pr\left(X\left(1 - \frac{P_G\left(1-P_G\right)}{P_G}\right) \leq R_f\right) \\
& = \quad \Pr\left(P_G X \leq R_f\right) = 0.
\end{aligned}$$

Therefore,

$$-\delta_I \beta N^{**} \Pr\left(P_G - \upsilon \leq \frac{\delta_I}{X}\right) = 0,$$

and the third term of (15) goes to zero as claimed. Consequently,

$$\begin{aligned}
E\left(\pi_t | \left(\beta N, \beta^c n^*\right)\right) \quad = \quad & E\left(\pi_t | \left(\beta N, 0\right)\right) \\
& + \sum_{i=0}^{\frac{\delta_I}{X}(1-\alpha)n^*} \left(\begin{array}{c} n^* \\ i \end{array} \right) P_B^i \left(1-P_B\right)^{n^*-i} \left(iX - \beta^c n^* \delta_I\right) \\
& + \sum_{i=\frac{\delta_I}{X}(1=\alpha)n^*+1}^{n^*} \left(\begin{array}{c} n^* \\ i \end{array} \right) P_B^i \left(1-P_B\right)^{n^*-i} \left(iX - \beta^c n^* \delta_I\right) \\
< \quad & E\left(\pi_t | \left(\beta N, 0\right)\right),
\end{aligned}$$

where the last inequality follows since the second and third term equals the expected return on bad projects in n^* economies. Consequently, it is optimal for the international bank to finance only firms with good projects if $N \geq N^{**}$. ■

Lemma 14 *If* $\Pr(P_I = P_G) > 0$*, then there exists a number of markets,* $N^* \geq N^{**}$*, such that the foreign bank can always raise deposits when it is active in more than* N^* *markets.*

Proof. Define $\beta' \equiv \Pr(P_I = P_G)$. For $N \geq N^{**}$, the foreign bank finances firms with bad projects only if $\alpha = 0$. Let γ_t^k be the public signal observed by firms in economy k. Then, the probability that firms in economy k assign to the event $\alpha = 0$ is

$$\Pr\left(\alpha = 0 | \gamma_t^k < \gamma^*\right) = \Pr\left(P_I = P_B | \gamma_t^k\right) \left[\Pr\left(P_I = P_B\right)\right]^{N-1}.$$

Let the rate at which the foreign bank lends to firms be given by $\bar{R}$. Conjecture that in equilibrium, $P_G \bar{R} > R_f$. That indeed this is the case is verified in Proposition 11. Consider a state where $\gamma_t^k < \gamma^*$. Let n^* be as defined in the previous lemma, and let N' be the number of economies in which the foreign bank must be active to attract deposits from depositors in economy k. Then N' solves

$$\begin{aligned}
&\left[1 - \Pr\left(\alpha = 0 | \gamma_t^k\right)\right] \times \\
&\quad \left[\sum_{i=0}^{\frac{\delta_I}{R}\beta' N} \binom{\beta' N}{i} P_G^i \left(1 - P_G\right)^{\beta' N - i} \frac{i \bar{R}}{\beta' N} + \sum_{i=\frac{\delta_I}{R}\beta' N+1}^{\beta' N} \binom{\beta' N}{i} P_G^i \left(1 - P_G\right)^{\beta' N - i} \delta_I\right] \\
&+ \Pr\left(\alpha = 0 | \gamma_t^k\right) \left[\sum_{i=0}^{\frac{\delta_I}{R} n^*} \binom{n^*}{i} P_B^i \left(1 - P_B^i\right)^{n^* - i} \frac{i \bar{R}}{n^*} + \sum_{i=\frac{\delta_I}{R} n^*+1}^{n^*} \binom{n^*}{i} P_B^i \left(1 - P_B\right)^{n^* - i} \delta_I\right] \\
&\geq R_f,
\end{aligned}$$

where $\frac{i\bar{R}}{\beta' N}$ and $\frac{i\bar{R}}{n^*}$ are the depositors repayment when the return on the bank's portfolio is insufficient to repay the depositors in full. The maximal deposit rate that the bank can credibly promise its depositors is equal to the rate it charges its firms, so $\delta_I \leq \bar{R}$. Let $\delta_I = \bar{R}$. Thus, N' is the lowest value of N which ensures,

$$\begin{aligned}
&\left[1 - \Pr\left(\alpha = 0 | \gamma_t^k\right)\right] \left[\sum_{i=0}^{\beta' N} \binom{\beta' N}{i} P_G^i \left(1 - P_G\right)^{\beta' N - i} \frac{i \bar{R}}{\beta' N}\right] \\
&\qquad + \Pr\left(\alpha = 0 | \gamma_t^k\right) \left[\sum_{i=0}^{n^*} \binom{n^*}{i} P_B^i \left(1 - P_B^i\right)^{n - i} \frac{i \bar{R}}{n^*}\right] \geq R_f. \quad (16)
\end{aligned}$$

$\lim_{N\to\infty} \Pr\left(\alpha = 0|\gamma_t^k < \gamma^*\right) = 0$, so for $N \to \infty$, the left hand side of (16) goes to

$$\sum_{i=0}^{\beta' N} \left(\begin{array}{c} \beta' N \\ i \end{array} \right) P_G^i \left(1 - P_G\right)^{\beta' N - i} \frac{i\bar{R}}{\beta' N}$$

$$\frac{\beta' N P_G \bar{R}}{\beta' N} = P_G \bar{R} > R_f.$$

$\lim_{N\to 1} \Pr\left(\alpha = 0|\gamma_t^k < \gamma^*\right) = \Pr\left(P_t = (P_B, P_B)\,|\gamma_t^k < \gamma^*\right)$, so for $N \to 1$, the left hand side of (16) goes to

$$\Pr\left(P_t \neq (P_B, P_B)\,|\gamma_t^k\right) P_B \bar{R} + \left[1 - \Pr\left(P_t = (P_B, P_B)\,|\gamma_t^k\right)\right] P_G \bar{R} < R_f,$$

where the inequality follows since $\gamma_t^k < \gamma^*$. Thus, for any given realisation of the public signal, γ_t^k, there is a value of N, $N^* = \min\left(N', N^{**}\right)$, such that depositors in economy k are willing to finance the foreign bank. Note, that if $\gamma_t^k \geq \gamma^*$, the depositors will finance both the foreign and the local bank. ■ ■

Proof. Lemma 6. The incentive and compatibility constraints of the competitive collateral contract are given by,

$$\begin{aligned} P_B\left(X - R\right) - \left(1 - P_B\right) C &\leq 0, \\ P_G\left(X - R\right) - \left(1 - P_G\right) C &\geq 0, \end{aligned}$$

$$\left(P_G R - R_f\right) + \left(1 - P_G\right) \Delta C \geq 0,$$

where the third equality exploits that, when the bank's loans are subject to collateral, the bank's real cost of funds is R_f. Under the contract which maximizes the surplus of the firms with good projects, the first and third constraint are binding, so

$$\begin{aligned} R &= \frac{\left(1 - P_B\right) R_f - \left(1 - P_G\right) P_B \Delta X}{\left(1 - P_B\right) P_G - \left(1 - P_G\right) P_B \Delta}, \\ C &= \frac{\left(P_G - P_B\right) R_f + \left(1 - P_G\right) P_G P_B \left(1 - \Delta\right) X}{\left(1 - P_B\right) P_G - \left(1 - P_G\right) P_B \Delta}. \end{aligned}$$

Indeed, this contract fulfils the participation constraint of firms with good projects. If the first equality if fulfilled with equality,

$$C = \frac{P_B}{1 - P_B}\left(X - R\right),$$

and therefore

$$\begin{aligned} & P_G(X-R)-(1-P_G)C \\ = \; & P_G(X-R)-\frac{1-P_G}{1-P_B}P_B(X-R) \\ = \; & \left(P_G-\frac{1-P_G}{1-P_B}P_B\right)(X-R)>0. \end{aligned}$$

For a firm with a good project, the expected cost of a collateralised loan is

$$P_G R+(1-P_G)C=\frac{(P_G-P_B)R_f+(1-P_G)P_G P_B(1-\Delta)X}{(1-P_B)P_G-(1-P_G)P_B\Delta}.$$

Thus, if a bank offers the competitive collateral contract, and the competitor can observe the quality of the firms' projects, then the competitor can offer the contract $(\bar{R},0)$, where

$$\begin{aligned} P_G\bar{R} &= P_G R+(1-P_G)C \iff \\ \bar{R} &= \frac{1}{P_G}\frac{(P_G-P_B)R_f+(1-P_G)P_G P_B(1-\Delta)X}{(1-P_B)P_G-(1-P_G)P_B\Delta}. \end{aligned}$$

firms with good projects weakly prefer this contract to the collateral contract. Let π^c denote the expected profits to the relationship lender when the competitor offers a collateralized loan. Then,

$$\begin{aligned} \pi^c &= P_G\bar{R}-R_f \\ &= \frac{(1-P_G)P_B(1-\Delta)(P_G X-R_f)}{(1-P_B)P_G-(1-P_G)P_B\Delta}>0, \end{aligned}$$

where the last inequality follows since $\Delta<1$.

If a bank is the only active lender in the market and it observes only the firms type and the public signal, then the contract which is accepted by good firms and rejected by bad firms and which maximizes the bank's profits fulfils the constraints,

$$\begin{aligned} P_G(X-R)-(1-P_G)C &= 0, \\ P_B(X-R)-(1-P_B)C &< 0, \\ C &= \rho, \end{aligned}$$

where $\rho\to 0$. The first and the third equation yields,

$$C=\rho \text{ and } R=X-\frac{1-P_G}{P_G}\rho.$$

Since $P_B < P_G$, so this contract ensures that firms with bad project reject the contract. For $\rho \to 0$, this contract allows the lender to extract the monopoly profits. This verifies the statements in the lemma. ■

Proof. Lemma 7. To prove the lemma, I construct the strategies which supports the outcome listed in the lemma, and show that indeed these strategies constitute a Nash equilibrium. Consider the following strategies:

Stage 1: The relationship lender offers the competitive collateral contract to firms with which it does not have a lending relationship, and the contract $(\bar{R}, 0)$ to firms with good projects with which it has a lending relationship. The local bank offers the contract $(X, 0)$ to firms with bad projects with which it has a lending relationship.If a liquidity shocks has occurred, the foreign bank offers the contract $(X, 0)$ to firms with good projects with which it has a lending relationship, and the monopoly collateral contract to all other firms.

Stage 2: Recall, that for a given firms, only the relationship lender has the opportunity to change its contract at this stage. If the non-relationship lender has offered the most competitive contract to firms with good projects at stage 1, the relationship lender matches the contract offered by the non-relationship lender to firms with good projects. If the local bank has offered credit to a firm with which it does not have a lending relationship at stage 1, the foreign bank matches the local bank's contract irrespective of whether the borrower has a good or a bad project.

These strategies support the outcome listed in the lemma and constitute a Nash equilibrium. To see this, first note that given the actions of the local bank, the foreign bank does not have an incentive to deviate. The foreign bank's strategy maximizes its returns from financing firms with which it has a lending relationship, as it finances only borrowers with good projects, and does so at the highest possible rate given the local bank's strategy. The foreign bank cannot deviate from the contract it offers to firms with which is does not have a lending relationship. If it offered these firms a non-collateralised contract, it would finance only firms with bad projects. Any collateral contract gives an expected profit of zero, so it can also not deviate to another collateral contract. A similar argument shows that the foreign bank cannot deviate. Note, that although the limited liability implies, that it may be optimal for the local bank to offer a non-collateralised contract to firms with which it does not have a lending relationship, the foreign bank's strategy at stage 2 deters the local bank from a deviating from the strategy outlined above. ■

Proof. Lemma 8. Condition (10) follows from $R^D_{0,F} \geq R^D_{0,L}$ and condition (11) follows from $R^I_{0,L} \geq R^I_{0,F}$. The proof follows directly from the discussion in the text. ■

Proof. Lemma 9. The foreign bank's expected profits from offering the competitive collateral contract in period one and offering the optimal monopoly contract in period two is given by

$$\Pr\left(P_I = P_G \cap \gamma < \gamma^*\right)\left(P_G X - R_f\right).$$

If the foreign bank offers the pooling contract, the interest rate on the pooling contract is such that the type I firm is exactly indifferent between accepting the pooling contract or the contract offered by the relationship lender, i.e. the foreign bank sets the interest rate in the pooling contract equal to $R^I_{0,L}$. The expected profits from offering the pooling contract to type I firms in period one and lending to type I firms with good projects in period two is,

$$\left(\bar{P}_{0,I} R^I_{0,L} - R_f\right) + \left[\Pr\left(P_I = P_G \cap \gamma \geq \gamma^{**}\right)\pi^c + \Pr\left(P_I = P_G \cap \gamma < \gamma^{**}\right)\left(P_G X - R_f\right)\right].$$

The foreign bank offers the pooling contract if

$$\left(\bar{P}_{0,I} R^I_{0,L} - R_f\right) + \left[\Pr\left(P_I = P_G \cap \gamma \geq \gamma^{**}\right)\pi^c + \Pr\left(P_I = P_G \cap \gamma < \gamma^{**}\right)\left(P_G X - R_f\right)\right] >$$
$$\Pr\left(P_I = P_G \cap \gamma < \gamma^*\right)\left(P_G X - R_f\right).$$

Inserting the expression for $R^I_{0,L}$, (9), yields,

$$\left(\bar{P}_{0,I}\delta_{0,L} - R_f\right) + \left(1 - \frac{\bar{P}_{0,I}}{P_G}\right)\Pr\left(P_I = P_G \cap \gamma \geq \gamma^{**}\right)\pi^c +$$
$$\left(P_G X - R_f\right)\left[\Pr\left(\gamma < \gamma^{**} \cap P_I = P_G\right) - \Pr\left(\gamma < \gamma^* \cap P_I = P_G\right)\right] \geq 0.$$

This yields the condition in the lemma. ■

Proof. Lemma 10. The lower bound on the deposit rate ensures, that for a given value of the public signal, depositors are indifferent between investing in demand deposits and in the risk-free asset. The local bank lends only to type D firms, so $\delta^{**}_{t,D}$ solves,

$$\left[\Pr\left(P_D = P_B|\gamma_t\right)P_B + \Pr\left(P_D = P_G|\gamma_t\right)P_G\right]\delta_{t,D} = R_f.$$

The depositors finance the bank when the expected return on demand deposits weakly exceeds the return on the risk-free asset. The highest deposit rate that the bank can credibly promise investors is given by $\bar{R}$. A higher deposit rate is non-credible, since the local bank lends to firms with good projects at rate $\bar{R}$. Thus, γ^{**} solves,

$$\left[\Pr\left(P_D = P_B|\gamma_1\right)P_B + \left(1 - \Pr\left(P_D = P_B|\gamma_1\right)\right)P_G\right]\bar{R} = R_f, \tag{17}$$

To see that (17) has a unique solution for γ^{**}, note that for $\gamma \to \infty$, the left hand side of the equation goes to $P_G\bar{R} > R_f$. For $\gamma \to -\infty$, the left hand side of the equation goes to $P_B\bar{R} < R_f$. Thus the existence of a unique solution follows from the observation that the left hand side is continous and strictly increasing in γ.

To see that $\gamma^{**} > \gamma^*$, note that if $\Pr\left(P_D = P_B|\gamma^{**}\right) \leq \Pr\left(P_t = \left(P_B, P_B\right)|\gamma^*\right)$ then $\gamma^{**} > \gamma^*$. By (13) and (17),

$$\begin{aligned}&\left[\Pr\left(P_D = P_B|\gamma^{**}\right)P_B + \left(1 - \Pr\left(P_D = P_B|\gamma^{**}\right)\right)P_G\right]\bar{R}\\&\qquad = \left[\Pr\left(P_t = \left(P_B, P_B\right)|\gamma^*\right)P_B + \left(1 - \Pr\left(P = \left(P_B, P_B\right)|\gamma^*\right)\right)P_G\right]X \Leftrightarrow\end{aligned}$$

$$\begin{aligned}&\Pr\left(P_D = P_B|\gamma^{**}\right)P_B + \left(1 - \Pr\left(P_D = P_B|\gamma^{**}\right)\right)P_G >\\&\qquad \Pr\left(P_t = \left(P_B, P_B\right)|\gamma^*\right)P_B + \left(1 - \Pr\left(P_t = \left(P_B, P_B\right)|\gamma^*\right)\right)P_G \Leftrightarrow\\&\qquad \Pr\left(P_D = P_B|\gamma^{**}\right) < \Pr\left(P_t = \left(P_B, P_B\right)|\gamma^*\right).\end{aligned}$$

Thus, $\gamma^{**} > \gamma^*$. ■

8 Literature

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