Foreign Bank Entry: The Stability Implications of Greenfield Entry vs. Acquisition

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Foreign Bank Entry: The Stability Implications of Greenfield Entry vs. Acquisition

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Abstract

Banks can enter new countries either through greenfield entry or by acquiring local banks. I model the effect of a foreign bank's mode of entry on the stability of the local financial sector. Banks exert costly effort when they extend credit. Limited liability creates an agency problem which leads to under provision of effort. I show that the diversification of the foreign bank's loan portfolio mitigates the agency problem, and permits the foreign bank to extend credit during downturns where the local banks are forced to contract credit. The risk management framework employed by the foreign bank creates a divergence in the behaviour of a greenfield entrant and an acquirer. The greenfield entrant does not own a portfolio of local loans, and therefore, it has a greater risk taking capacity than the acquirer. Thus, competition, and thereby the distortion of the local banks' incentives to exert effort, is greater following greenfield entry than following entry through acquisition.

1   Introduction

Recent banking crises have sparked a debate about the benefits of letting foreign banks enter the financial system of less developed economies. The main point of the debate is whether the efficiency gains from increased competition and improved lending practices outweigh the cost of greater financial instability.[1] This paper analyses the effects of the mode of entry, i.e. acquisition versus greenfield entry, on the stability of the local financial sector. I find, that greenfield entry has a more adverse impact on the credit quality of the local financial intermediaries' loan portfolios than entry via acquisition. Further, I find a difference in the behaviour of foreign entrants and local incumbents, and between greenfield entrants and acquirers. Greenfield entrants extend more credit than acquirers, and are more likely to lend during busts where the local financial intermediaries are insolvent.

Through screening and monitoring, banks alleviate market imperfections related to imperfect information and weak institutional infrastructure. Consequently, bank loans constitute an important source of finance in developing economies, and the impact of foreign banks on the local credit market is therefore particularly important in these economies. Some countries, such as India, have regulated foreign entry and allow only entry through greenfield operations. This stance may be motivated by a desire to shelter the local financial sector from competition, but can have consequences for financial stability.

Empirically, the behaviour of foreign entrants depends on their mode of entry. During busts of the local economy, greenfield entrants expand credit whereas acquirers and local banks contract credit (Haas and Lelyveld (2006)), the average credit quality of the greenfield entrants' loan portfolios exceed the average credit quality of the acquirers' loan portfolios (Kraft 2002, Majnoni et al. (2003)), and greenfield entrants charge lower loan rates (Mody and Peria (2004), Clayes and Hainz (2006)) and expand credit more rapidly that acquirers (Haas and Lelyveld (2006), Kraft (2002)). The model I present in this paper provides one theoretical rationale for these observations.

I model an economy in which banks, local or foreign, exert costly screening effort when they

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[1] See Allen and Gale (2004) for a survey and discussion of the literature on competition between financial intermediaries.

extend credit. Limited liability creates an agency problem which leads to under provision of effort. The foreign bank's loan portfolio is more diversified than local banks' loan portfolio. This limits the foreign bank's agency problem and causes it to exert higher effort. The choice of effort affects the banks' profitability, and as the local economy goes through a bust, only the foreign bank remains solvent. The mechanism through which diversification alleviates the agency problem has similarities with the mechanisms explored in Diamond (1984) and Cerasi and Daltung (2000).

The model's second building block creates a difference in the behaviour of greenfield entrants and acquirers. The foreign bank manages risk in an economic capital framework, under which, each of the local economies is allocated a specific amount of economic capital (see for example Deutsche Bank (2006) or IMF (2007)). The economic capital employed in a given economy is defined as the losses that the bank would incur, if the economy was to realise a pre-specified "worst case" scenario. The worst case scenario is set exogenously by the bank's credit committee and varies with the state of the local economy. Thus, in a given economy, the entrant's lending capacity is constrained by the state of the economy, and by the amount of economic capital allocated to the economy. The upshot of the risk management framework is, that the greenfield entrant's lending capacity exceeds the acquirer's lending capacity. This is so, since the acquisition of the target's loan portfolio consumes part of the acquirer's economic capital. This difference in lending capacity implies, that the local economy can realise a state where it is profitable for both the greenfield entrant and the acquirer to lend, but where the economic capital constraint forces the acquirer to contract credit, i.e. in certain states the acquirer contracts credit whilst the greenfield entrant expands credit.

The financial stability analysis indicates, that the credit quality of the local financial intermediaries' loan portfolios deteriorates more following greenfield entry than following entry through acquisition. This effect arises from a link between competition and incentives to undertake costly screening. Increased competition reduces the banks' profit margins and impairs their incentives to screen borrowers. The greenfield entrant's lending capacity exceeds the acquirer's lending capacity, so competition is more fierce following greenfield entry. Thus, the local banks' under provision of effort is more severe following greenfield entry than following entry through acquisition.

The model suggests, that entry through acquisition can enhance the local banks' incentives to exert effort. An acquisition does not affect the number of players in the local market, and, when the acquirer's economic capital is sufficiently low, it may reduce the aggregate lending capacity. When this occurs, entry through acquisition reduces the competition and enhances the local banks' incentives to exert effort. Greenfield entry unambiguously increases the aggregate lending capacity, and therefore unambiguously reduces the local banks' provision of costly effort.

A comparison of the predicted profitability of greenfield entry to the profitability of acquisition indicates, that greenfield entry is likely in economies which have recently liberalised their financial sector. This suggests, that unregulated foreign entry unambiguously destabilises recently liberalised economies.

An extension of the analysis illustrates, that a deposit insurance scheme enhances the credit quality of the local financial intermediaries' loan portfolios. Deposit insurance reduces the local banks' cost of funds and enhances their incentives to screen borrowers. By a similar logic, when the local banks can borrow in an international interbank market, their average cost of funds increases and the credit quality of their loan portfolios deteriorate. Further, the analysis of the interbank market indicates, that local banks lose access to the interbank market as the local economy goes through a bust.

This paper complements an important strand of literature which analyses how competition between financial intermediaries affects financial stability. This literature finds, that increased competition reduces the financial intermediaries' profits, and thereby enhances their incentives to underwrite risk (Keeley (1990) and Allen and Gale (2000)) and reduces their incentives to undertake costly screening (Boot and Thakor (2000) and Boot and Marinč (2008)).[2] Similar to the model presented below, this suggests that increased competition between financial intermediaries leads to greater financial fragility. The novelty of the model presented in this paper is to highlight a link between the mode of entry, the entrant's behaviour and the stability of the local financial system.

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[2]One deviation from these findings is the result presented in Boyd and DiNicoló (2003), which extends the framework of Allen and Gale (2000) to include a double agency problem (the first agency problem arises from the financial intermediaries' limited liability and the second agency problem arises from the entrepreneurs' limited liability). Under this extension, increased competition between financial intermediaries enhances financial stability.

This link arises from the interaction between the entrant's risk management framework and the degree of competition following entry. Most closely related to the analysis below is Boot and Marinč (2008). Boot and Marinč model competition as an increasing function of the number of players in the local market, and note that since entry through acquisition does not affect the aggregate number of players, competition is greater following greenfield entry than following entry through acquisition. In contrast, in the model presented below competition is a function of the banks' aggregate lending capacity. Combined with the modelling of the entrant's risk managment framework, this approach allows for the analysis of acquisitions which affects the governance structure (risk management framework) of one (or some) of the local banks without changing the aggregate number of players. This drives the conclusion that foreign entry may reduce overall competition, and allows for the analysis of how the mode of entry affects the entrant's behaviour as the local economy goes through a bust; a topic which is not addressed in the analysis of Boot and Marinč.

The work presented in this paper is also 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), Gormley (2008) and Schmidt (2008)). This literature considers only greenfield entry, and focus is on how the foreign entrant overcomes information disadvantages and on how information asymmetries lead to a segmentation of the local credit market. The model presented below arguments the existing literaure by highlighting the importance of the foreign bank's mode of entry for competition, the credit available during busts of the local economy and for the financial stability of the local economy.

Closely related to the questions raised in this paper is Clayes and Hainz (2006) which analyses how a foreign bank's mode of entry affects the lending rates of the local economy. Clayes and Hainz' analysis is cast in an asymmetric information framework akin to Broecker (1990), and a key component of their analysis is an exogenously specified difference between the greenfield entrant's and the acquirer's information set. In the model presented below, the information sets vary only with the amount of screening, and ex ante there is no difference between the information available to the greenfield entrant and the information available to the acquirer. Also, in contrast with the

analysis in Clayes and Hainz, the analysis below is focussed on how the mode of entry affects the availability of credit during busts and on the financial stability of the local economy.

The paper proceeds as follows. Section 2 presents the model. Section 3 contains the main analysis and characterises the equilibrium. Section 4 studies the effect of deposit insurance and of interbank lending. Section 5 contains an overview of the empirical evidence and section 6 concludes. All proofs are relegated to the appendix.

2 The Model

2.1 Basic Setup

The model has three dates $(t = 0, 1, 2)$, universal risk neutrality and no discounting. There is a continuum of entrepreneurs with mass 2, $N \geq 2$ local banks, one international bank, a continuum of depositors and a deposit insurance fund.

At $t = 0$ and $t = 1$, a measure of the entrepreneurs with mass 1 have access to an investment project which requires one unit of finance. The projects mature at $t = 2$ and have two potential outcomes, success or failure. Successful projects return $X > 1$ and unsuccessful projects return 0.

There are two types of entrepreneurs, "Good" and "Bad", which differ in their ability to generate a successful outcome on the investment project. Good entrepreneurs, succeed with probability $p < 1$ and bad entrepreneurs fail with certainty. The fraction of good entrepreneurs in the economy is given by τ^j, where $j \in \{l, h\}$ is the state of the economy. I assume that $\tau^h > \tau^l$. The state variable is realised at time $t = 1$ and $\Pr(j = h) = \rho$. The entrepreneurs' types are unobservable to all agents in the economy.

The entrepreneurs are penniless, so to initiate the investment project, they must obtain a loan from one of the banks. The entrepreneurs' demand for credit, is a decreasing function of the cost of credit.[3] Let $r_t^{j,m}$ be the interest rate on a loan at time t in state j if the foreign bank employs entry mode m, and let $q_t^{j,m}$ be the interest rate as a fraction of the potential surplus on the project,

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[3] If the entrepreneurs have access to an outside opportunity, the downward sloping demand curve arises endogeneously when the return on the outside opportunity is heterogeneous across the entrepreneurs (See Di Niccoló and Loukoianova (2007) for an example of this modelling strategy).

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i.e. $q_t^{j,m} \equiv \frac{r_t^{j,m}}{R}$, where $R \equiv X - 1$. Then, at time t, the entrepreneurs' demand for credit is given by,

$$D\left(q_t^{j,m}\right) = 1 - q_t^{j,m} \text{ for } t \in \{0, 1\}.$$

The banks have access to a screening technology, which can provide them with information about an entrepreneurs type. Screening is subject to a cost of

$$\frac{1}{2}c\left(e_t\right)^2 L_t,$$

where c is a constant, L_t is the amount of credit that the bank extends at time t, and e_t is the bank's screening intensity (effort) at time t. The fraction of good entrepreneurs in a given bank's loan portfolio is an increasing function of the bank's screening effort. I assume, that by exerting effort e_t, the bank increases the fraction of entrepreneurs with good projects in its loan portfolio by a fraction of e_t. Thus, if the bank exerts effort e_t and state j is realised, the fraction of good entrepreneurs out of the total loans the bank extended at time t is $\tau^j + e_t$. To ensure that $\tau^j + e_t < 1$ for all j, I impose the parameter constraint $c > \frac{pX}{1-\tau^h}$. The screening technology is such that, if two banks exert the same effort, they obtain the same information about the borrowers. Further, the information set of a bank with a low screening intensity is a subset of the information set of a bank with a higher screening intensity. Lastly, screening is set period by period.

The banks are financed by demand deposits and are supported by a deposit insurance provided by the deposit insurance fund. In return for the deposit insurance, the banks pay a flat fee which is normalised to zero. The banks are subject to a capital adequacy regulation which requires them to hold k units of capital per unit of deposits they raise. For a given bank, if the expected value of its portfolio falls below the value of its liabilities, the deposit insurance fund intervenes and takes control of the bank.[4,5]

I assume that the tenure of the loan contracts offered by the banks match the tenure of the entrepreneurs' projects, and that the loans are non-prepayable.[6] The loan applications are distributed

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[4] With this modelling abstraction, the deposit insurance fund takes the role of the financial regulator.

[5] Subsequently, I refer to a bank as solvent if the expected value of its assets exceeds the value of its liabilities.

[6] In the model, there is no demand for prepayable loans. Banks and borrowers are risk neutral and information is symmetric.

across the banks at random, with each bank obtaining an equal number of loan applications.

2.2 The local banks

Each local bank has a fixed amount of capital, A, so the capital requirement implies, that they have a lending capacity of $\frac{A}{k}$. The local banks are protected by limited liability if the losses on their loan portfolio exceeds their capital. In each period, the local banks choose an optimal screening effort, and, at time $t = 0$, they allocate their lending capacity across the periods to maximize the rent extraction.[7] Let $m \in \{G, A\}$ (greenfield, acquisition) denote the foreign banks mode of entry, and $j \in \{l, h\}$ denote the state of the economy. The local banks' screening effort at time t in state j given the foreign bank enters through mode m is denoted $e_t^{m,j}$, and its allocation of lending capacity to time t is given by L_t.

2.3 The foreign bank

The foreign bank is active in many economies, each of which is a replica of the economy described above. The foreign bank's decision to enter the local economy is made at the end of period 1, just prior to the realisation of the state variable. There are two modes of entry, greenfield banking and acquisition. If the foreign bank enters through acquisition, it pays ϕ to acquire the local bank's credit portfolio and branch network. If it enters via greenfield banking, it must pay a fixed cost, $F \geq 0$, to establish a physical presence, and it must build the local loan portfolio from nil. I assume that the foreign bank's screening effort is non-transferrable across the economies, and that the state realisation is independent across the economies.[8]

The international bank manages its risk exposure to the different economies through an economic

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Consequently, all agents value the option embedded in a prepayable loan the same. Thus, if the exercise of the prepayment option is subject to a minimal transaction cost, the demand for prepayable loans is zero.

[7]Each local bank has a fixed lending capacity, so the amount of credit they extend at time $t = 0$ automatically determines their lending capacity at time $t = 1$.

[8]The assumption of independent state realisation is extreme and is made for expositional purposes. The model's predictions are robust to the assumption that there is a positive correlation across the states of the economies. For example, the state realisation could be driven by a set of common risk factors and an idiosyncratic component. Similarly, the assumption of non-transferable effort is made for expositional purposes. A transferable effort would reinforce the model's predictions.

capital framework.[9] The economic capital employed in a given economy is defined as the losses that the bank would incur if the economy was to realise a pre-specified "worst case" scenario. The worst case scenario is set exogenously by the bank's risk management committee and varies with the state of the local economy. I assume that a loan with notional Λ in state j consumes economic capital $\left(1 - s\left(\tau^j\right)\right)\Lambda$, where $s' > 0$, $s\left(\tau^j\right) \to 1$ for $\tau^j \to 1$, and $s\left(\tau^j\right) \to 0$ for $\tau^j \to 0$. Thus, if the bank commits economic capital EC to the local economy, in state j, its aggregate lending capacity is given by $\frac{EC}{(1-s(\tau^j))}$. Economic capital is allocated across the economies according to an internal optimization procedure. In the following, I take the outcome of this procedure as given, and assume that the amount of economic capital allocated to the local economy is EC.[10]

Upon entry, the foreign bank sets the screening intensity and the amount credit that it is willing to extend. The foreign bank's screening intensity at time $t = 1$ in state j given that it enters through mode m is denoted $\varepsilon^{m,j}$, and its lending at time $t = 1$ is given by $\Lambda^{m,j}$.

To ensure an interior solution to the local banks' problem, I assume that the lending capacity of the local financial sector exceeds the lending capacity of the foreign entrant, that is $N\frac{A}{k} > \frac{EC}{1-s(\tau^j)}$. Further, to ensure that the banks' expected profits are not completely eliminated by the competition, I impose the parameter constraint,

$$N\frac{A}{k} + \frac{EC}{1 - s\left(\tau^h\right)} < 1 - \frac{1}{R}\left(\frac{1 - p\left(\rho\tau^l + (1 - \rho)\tau^h\right)}{p\left(\rho\tau^l + (1 - \rho)\tau^h\right)}\right). \tag{1}$$

This ensures that lending is profitable at time $t = 0$ and in state h at time $t = 1$.

2.4 Strategic interaction

The local banks allocate their lending capacity across the periods to maximize their rents, $q_t^{m,j}R$. The rent extraction affects the entrepreneurs' demand for credit, and in equilibrium $q_t^{m,j}$ clears the credit market. In the analysis, I characterise the Walrasian equilibrium where each bank takes

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[9] Many global banks rely on economic capital to manage risk (see Deutsch Bank (2006) or IMF (2007)). In this paper, I take the state of the global banks' risk management framework as given and explore its implications for the credit market equilibrium. For an analysis of how economic capital and Value at Risk measures affect traders' and loan officers' risk taking incentives, see for example Cuoco et al. (2008).

[10] The analysis compares how greenfield entry affects the local economy relative to how entry through acquisition affects the local economy. If the internal optimization procedure is independent of the mode of entry, the procedure itself does not affect the model's predictions. This motivates the reduced form approach.

the entrepreneurs' demand for credit and the competitors supply of credit as given. The number of local banks, N, is finite, so rationality requires, that the banks internalise how their lending decision affect the behaviour of the competitors and the equilibrium rent extraction. Proposition 6 illustrates, that the features of the Walrasian equilibrium carry through to the setting where the banks behave strategically.

3 Analysis

3.1 Preliminaries

One of the objectives of the paper is to analyse how the mode of entry affects the entrant's ability to lend as the local economy goes through a bust. Thus, I constrain the analysis to a set of states such that the local banks are prevented from lending in state l.

Lemma 1 *If $\tau^h \geq \frac{R}{2+R}$, then there is a value of τ^l, τ^L, such that if $\tau^l < \tau^L$, the local banks are insolvent in state l.*

I assume that $\tau^h \geq \frac{R}{2+R}$ and that $\tau^l < \tau^L$ such that, at time $t = 1$, the local bank lends only if the economy is in state h. The constraint on τ^h in Lemma 1 ensures that τ^L is strictly positive. Given this constraint, I suppress the superscript referring to the state on the local banks choice variables.

3.2 The local banks' problem

Given the demand for credit and the local banks' beliefs about the foreign bank's mode of entry, the local banks choose their screening intensity and allocate their lending capacity across the periods to maximize their profits. If the local bank assigns probability θ to entry through acquisition, then the limited liability and the constraint on τ^l implies, that the local banks' problem is given by,

$$\max_{L_0, L_1, e_0, e_1^A, e_1^G} \left[\rho \left(\tau^h + e_0 \right) pq_0 R - \frac{1}{2} c \left(e_0 \right)^2 \right] L_0$$
$$+ \rho \theta \left[\left(\tau^h + e_1^A \right) pq_1^{A,h} R - \frac{1}{2} c \left(e_1^A \right)^2 \right] L_1 + \rho \left(1 - \theta \right) \left[\left(\tau^h + e_1^G \right) pq_1^{G,h} R - \frac{1}{2} c \left(e_1^G \right)^2 \right] L_1$$

$$s.t.\ L_0 + L_1 \leq \frac{A}{k}.$$

Condition (1) implies, that the local banks' expected profits are positive at time $t = 0$. Therefore, the capacity constraint binds. The first order conditions to the local banks' problem are,

$$e_0 = \frac{1}{c} \rho p q_0 R, \tag{2}$$

$$e_1^G = \frac{1}{c} p q_1^{G,h} R, \tag{3}$$

$$e_1^A = \frac{1}{c} p q_1^{A,h} R, \tag{4}$$

and,

$$\left(\tau^h + e_0 \right) \rho p q_0 R - \frac{1}{2} c \left(e_0 \right)^2 - \lambda = 0, \tag{5}$$

$$\left[\theta \left(\tau^h + e_1^A \right) q_1^{A,h} + (1 - \theta) \left(\tau^h + e_1^G \right) q_1^{G,h} \right] \rho p R - \frac{1}{2} \rho c \left[\theta \left(e_1^A \right)^2 - (1 - \theta) \left(e^G \right)^2 \right] - \lambda = 0, \tag{6}$$

where λ is the constraint multiplier.

The local banks' optimization problem does not incorporate the likelihood that the local bank is acquired at time $t = 1$. To see why this is so, assume to the contrary, that the potential of being acquired increased the local banks' expected profits, and caused them to choose a different screening intensity and capacity allocation that the one characterised above. Since $N \geq 2$, the excess profits from from being acquired would cause the local banks to compete to become the acquirer's preferred target. This competition would drive the expected profits from the acquisition to zero. But, when the expected profits from the acquisition are zero, the first order conditions above characterise the optimal lending and screening intensity. Thus, local banks set their screening intensity and allocate their lending capacity as if the probability of being acquired is zero.

3.3 The foreign bank's problem

The foreign bank is subject to limited liability on the group level.[11] Consequently, losses from one economy must be offset against gains from other economies. Losses can be shifted to the deposit

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[11] In many locations, foreign entrants are required to incorporate a subsidiary in the local economy. This gives the entrant the option to default strategically. I assume, that the reputational cost of strategic defaults and the permanent loss of the local banking licence is sufficiently strong to prevent strategic defaults.

insurance fund only when the foreign bank's aggregate profits are zero. When the entrant is active in many economies, i.e. extends credit in many economies, it behaves as if it was not subject to limited liability.

Lemma 2 *There is a number of economies, $\bar{M}$, such that, when the foreign bank is active in at least $\bar{M}$ economies, its optimization problem is equivalent to the optimization problem of a bank which is not subject to limited liability.*

Lemma 2 follows from an application of the law of large numbers. When the foreign bank is active in many economies, the realised return on its loan portfolio equals the expected return on the portfolio. Thus, limited liability is only valuable if the foreign bank finances entrepreneurs with unprofitable projects in a limited number of economies.[12] This implies, that when limited liability is valuable, the expected profits are bounded. Consider the strategy where the foreign bank lends only in economies which are in state h. By condition (1), lending is profitable in state h, so, since $\rho > 0$ and the state realisation is independent across the economies, the expected profits from this strategy are strictly increasing in the number of economies. Consequently, there is a number of economies, $\bar{M}$, such that, when the foreign bank is active in at least $\bar{M}$ economies, the expected profits from lending only in economies which are in state h exceeds the expected profits from any strategy which renders limited liability valuable. This implies, that when the number of economies available the the entrant is sufficiently large, then foreign banks optimization problem is equivalent to the optimization problem of a bank which is not subject to limited liability.

I assume that the number of economies available to the entrant exceeds $\bar{M}$.

3.3.1 Greenfield entry

The greenfield entrant chooses its screening intensity and lending to maximize its profits subject to the economic capital constraint. In state h, the local banks are active, so the entrant takes

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[12]Limited liability is valuable when the foreign bank finances entrepreneurs with unprofitable projects in many economies. However, the law of large numbers implies, that under limited liability, the expected return from financing entrepreneurs with unprofitable projects in many economies yields an expected profit of zero. In contrast, by financing entrepreneurs with bad projects in a limited number of economies, the bank can prevent the law of large numbers from kicking in, and obtain positive expected profits. Thus, if it finances entrepreneurs with bad projects, it is optimal for the bank to be active in a limited number of economies.

the credit demand as given. In state l, the entrant is the monopoly lender and therefore sets the monopoly quantity. The greenfield entrant solves,

$$\max_{\varepsilon^{G,j},\Lambda^{G,j}} \left\{ \left(\tau^j + \varepsilon^{G,j}\right) p \left(1 + q_1^{G,j} R\right) - 1 - \frac{1}{2}c \left(\varepsilon^{G,j}\right)^2 \right\} \Lambda^{G,j} - F,$$

$$s.t. \ \left[1 - s\left(\tau^j\right)\right] \Lambda^{G,j} \leq EC,$$

for $j \in \{h, l\}$. The first order conditions to this problem are given by,

$$\varepsilon^{G,h} = \frac{1}{c}p\left(1 + q_1^{G,h}R\right), \tag{7}$$

$$\varepsilon^{G,l} = \frac{1}{c}p\left(1 + q_1^{G,l}R\right), \tag{8}$$

$$\Lambda^{G,h} = \frac{EC}{1 - s\left(\tau^h\right)}, \tag{9}$$

$$\Lambda^{G,l} = \begin{cases} \min\left[\frac{EC}{1-s(\tau^l)}, \frac{1}{2}\left(1 - \frac{1+\frac{1}{2}c\left(\varepsilon^{G,l}\right)^2}{p\left(\tau^l + \varepsilon^{G,l}\right)R} + \frac{1}{R}\right)\right] & \text{if } \tau^l \geq \tau^{l*} \\ 0 \text{ if } \tau^l < \tau^{l*} \end{cases}, \tag{10}$$

where τ^{l*} is the lowest value of τ^l such that lending is profitable in state l, i.e. τ^{l*} solves,

$$\left(\tau^l + \varepsilon^{G,l}\right) p \left(1 + q_1^{G,l}R\right) - \frac{1}{2}c \left(\varepsilon^{G,l}\right)^2 = 1.$$

From expression (3) and (7) it follows, that the greenfield entrant's screening intensity exceeds the local banks' screening intensity. This difference between the screening intensities is driven by the local banks' limited liability. This limits their exposure to losses and distorts their incentives to undertake costly screening. In contrast, the diversification of the foreign entrant's loan portfolio, eliminates this distortion, and forces the entrant to exert higher effort.

3.3.2 Acquisition

The acquirer chooses its screening intensity and lending to maximize its profits subject the economic capital constraint. In state h, the local banks are active, so the entrant takes the credit demand as given. In state l, the entrant is the monopoly lender and therefore sets the monopoly quantity. Thus, the acquirer's problem is,

$$\max_{\varepsilon^{G,j},\Lambda^{G,j}} \left\{ \left(\tau^j + \varepsilon^{A,j}\right) p \left(1 + q_1^{A,j} R\right) - 1 - \frac{1}{2}c \left(\varepsilon^{A,j}\right)^2 \right\} \Lambda^{A,j},$$

$$s.t. \ \left[1 - s\left(\tau^j\right)\right] \left(\Lambda^{A,j} + L_0\right) \leq EC,$$

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for $j \in \{h, l\}$. The first order conditions to this problem are given by,

$$\varepsilon^{A,h} = \frac{1}{c} p \left(1 + q_1^{A,j} R\right),$$ (11)

$$\varepsilon^{A,l} = \frac{1}{c} p \left(1 + q_1^{A,l} R\right),$$ (12)

$$\Lambda^{A,h} = \max \left[\frac{EC}{1 - s(\tau^h)} - L_0, 0\right],$$ (13)

$$\Lambda^{A,l} = \begin{cases} \min \left[\max \left(\frac{EC}{1-s(\tau^l)} - L_0, 0\right), \frac{1}{2}\left(1 - \frac{1 + \frac{1}{2}c(\varepsilon^{A,l})^2}{p(\tau^l + \varepsilon^{A,l})R} + \frac{1}{R}\right)\right] \text{ for } \tau^l \geq \tau^{l**} \\ 0 \text{ for } \tau^l \geq \tau^{l**} \end{cases},$$ (14)

where τ^{l**} is the lowest value of τ^l such that lending is profitable in state l, i.e. τ^{l**} solves,

$$\left(\tau^l + \varepsilon^{A,l}\right) p \left(1 + q_1^{A,l} R\right) - \frac{1}{2} c \left(\varepsilon^{A,l}\right)^2 = 1.$$

As in the case of greenfield entry, a comparison of (4) and (11) reveals, that the acquirer's screening effort exceeds the local banks' screening effort. Parallel to the intuition for the greenfield entrant's problem, this observation is driven by the local banks' limited liability, and the diversification of the foreign entrant's portfolio. The main difference between the greenfield entrant's problem and the acquirer's problem arises from the economic capital constraint. The acquisition of the target's loan portfolio implies, that the greenfield entrant has a greater lending capacity than the acquirer.

3.3.3 Equilibrium

In equilibrium, the cost of credit, $q_t^{m,j}$, clears the credit market. Thus,

$$(1 - q_0) = NL_0,$$ (15)

$$\left(1 - q_1^{G,h}\right) = NL_1 + \Lambda^{G,h},$$ (16)

$$1 - q_1^{G,l} = \Lambda^{G,l},$$ (17)

$$\left(1 - q_1^{A,h}\right) = (N - 1) L_1 + \Lambda^{A,h},$$ (18)

$$1 - q_1^{A,l} = \Lambda^{A,l}.$$ (19)

14

The local banks are rational, so the probability they assign to entry through acquisition, θ, corresponds to the probability that the foreign bank acquires a local bank. In the mixed strategy equilibrium, the entrant is indifferent between the two modes of entry. Let V^A be the acquirer's valuation of the target's business at the time of entry, and V^L be the target's valuation of its own business at the time of entry. Then,

$$V^L(\theta) = \max_{e_1^A, e_1^G} \rho \left(\tau^h + e_0 \right) pq_0 RL_0$$
$$+ \rho\theta \left[\left(\tau^h + e_1^A \right) pq_1^{A,h} R - \frac{1}{2} \left(e_1^A \right)^2 \right] L_1 + \rho \left(1 - \theta \right) \left[\left(\tau^h + e_1^G \right) pq_1^{G,h} R - \frac{1}{2} \left(e_1^G \right)^2 \right] L_1, \quad (20)$$

and,

$$V^A(\theta) = \max_{\varepsilon^{A,l}, \varepsilon^{A,h}, \Lambda^{A,h}, \Lambda^{A,l}} \left[\left(\rho\tau^h + (1-\rho)\tau^l + e_0 \right) p \left(1 + q_0 R \right) - 1 \right] L_0$$
$$+ \rho \left[\left(\tau^h + \varepsilon^{A,h} \right) p \left(1 + q_1^{A,h} R \right) - 1 - \frac{1}{2} c \left(\varepsilon^{A,h} \right)^2 \right] \Lambda^{A,h}$$
$$+ (1-\rho) \left[\left(\tau^l + \varepsilon^{A,l} \right) p \left(1 + q_1^{A,l} R \right) - 1 - \frac{1}{2} c \left(\varepsilon^{A,l} \right)^2 \right] \Lambda^{A,l}, \quad (21)$$

$$s.t. \left[L_0 + \Lambda^{A,j} \right] \left[1 - s \left(\tau^j \right) \right] \leq EC,$$

for $j \in \{h, l\}$.

Comparison of (20) and (21) reveals, that the acquirer's valuation of the target's business differs from the target's valuation of its own business. The difference in valuation, $V^A - V^L$, is driven by four effects. First, it is increasing in the difference between the acquirer's and the target's lending capacity ($\Lambda^{A,h}$ versus L_1). Second, the acquirer must offset the losses from the local economy against gains from other parts of its business. This forces it to realise the expected losses on the local bank's loan portfolio in state l (the $(1-\rho)\tau^l$ term in the first term of (21)). Third, the acquirer honours its liabilities irrespective of whether the projects succeed of fail. Therefore, it assigns a higher value to the target's liabilities than the target itself (the -1 term in all three terms of (21)). Both the second and the third effect tend to push V^A below V^L, and the effects are diminishing in the target's screening intensity at time 0. Last, the acquirer may be able to lend in state l, so the difference in valuation is increasing in the profitability of state l lending (the third term of (21)).

If the foreign bank enters through acquisition, the target learns about the mode of entry. Thus, a necessary condition for a successful acquisition is,

$$\phi \geq V^L(1).$$

Further, the acquisition must be profitable to the entrant, so

$$V^A(\theta) - \phi \geq 0.$$

The entrant mixes between acquisition and greenfield entry when,

$$V^A(\theta) - \phi = V^G(\theta, F), \tag{22}$$

where V^G is the value of greenfield entry, that is

$$
V^G(\theta, F) = \max_{\varepsilon^{G,h}, \varepsilon^{G,l}, \Lambda^{G,h}, \Lambda^{G,l}} \rho \left[\left(\tau^h + \varepsilon^{G,h} \right) p \left(1 + q_1^{G,h} R \right) - 1 - \frac{1}{2} c \left(\varepsilon^{G,h} \right)^2 \right] \Lambda^{G,h}
$$
$$
+ (1 - \rho) \left[\left(\tau^l + \varepsilon^{G,l} \right) p \left(1 + q_1^{G,l} R \right) - 1 - \frac{1}{2} c \left(\varepsilon^{G,l} \right)^2 \right] \Lambda^{G,l} - F, \tag{23}
$$
$$
s.t. \ \Lambda^{G,j} \left[1 - s \left(\tau^l \right) \right] \leq EC,
$$

for $j \in \{h, l\}$.

The value of greenfield entry is increasing in the entrant's lending capacity and decreasing in the cost of establishing a physical presence, F.

The difference between the value of entry through acquisition, $V^A - \phi$, and the value of entry through greenfield banking, V^G, is driven by two effects. First, the greenfield entrant is more efficient in its rent extraction, since it sets the optimal screening intensity on the entire loan portfolio. The screening intensity on the acquirer's portfolio is in part determined by the local bank, and therefore, it is inefficient from the entrant's point of view. Second, the acquirer does not incur the cost of establishing a physical presence, F, but it must pay the acquisition price, ϕ.

With these observations, the equilibrium can be characterised.

Lemma 3 *Let F be such that,*

$$V^G(0, F) \geq 0.$$

The model has at least one equilibrium. In any equilibrium, the banks' rent extraction, $q_t^{m,j}$, is determined uniquely as the positive root of

$$\tau^h q_0 + \frac{1}{2}\rho p R (q_0)^2 = \theta \left[\tau^h q_1^{A,h} + \frac{1}{2}pR\left(q_1^{A,h}\right)^2 \right] + (1 - \theta) \left[\tau^h q_1^{G,h} + \frac{1}{2}pR\left(q_1^{G,h}\right)^2 \right],$$

where,

$$q_1^{A,h} = 2 - (N - 1)\frac{A}{k} - \frac{EC}{1 - s\left(\tau^h\right)} - q_0,$$

and,

$$q_1^{G,h} = 2 - N\frac{A}{k} - \frac{EC}{1 - s\left(\tau^h\right)} - q_0.$$

At time $t = 1$, the local banks' lend only in state h. The local banks' capacity allocation is given by,

$$
\begin{aligned}
L_0 &= \frac{1}{N}(1 - q_0), \\
L_1 &= \frac{A}{k} - \frac{1}{N}(1 - q_0),
\end{aligned}
$$

and their screening intensity is given by $(2), (3)$ and (4). Following greenfield entry, the foreign bank's lending is given by (9) and (10), and its screening intensity is given by (7) and (8). Following entry through acquisition, the foreign bank's lending is given by (13) and (14), and its screening intensity is given by (11) and (12).[13]

In equilibrium, the banks' rent extraction is determined uniquely as a function of θ. The model has at least one equilibrium, and may exhibit multiple equilibria with a beliefs determined equilibrium selection. A change in the local banks' beliefs about the foreign bank's mode of entry affects the local banks' screening intensity and capacity allocation. This has an impact both on the price that the acquirer must pay under the acquisition and on the aggregate lending capacity in period two. The acquirer's exposure to the target's loan portfolio, and the difference between the acquirer's and the greenfield entrant's lending capacity implies, that a change in the local banks' beliefs affects the profitability of the two modes of entry in a non-monotone fashion. This implies, that multiple beliefs can be supported in equilibrium.

---

[13]Recall that the rent extraction determines the bank's lending rates.

Proposition 4 and 5 analyse how changes in the mode of entry affects the local banks' incentives to undertake costly screening. This exercise has two potential interpretations. First, when the model exhibits multiple equilibria, this can be interpreted as the effect of moving between equilibria. Second, it describes how a change in the model's primitives, say F, affects the local banks' beliefs and thereby their incentives to undertake screening.

The fraction of good borrowers in the banks' loan portfolio determines the return on lending. In the subsequent, I refer to the fraction of good entrepreneurs in a given bank's loan portfolio as the credit quality of the banks' loan portfolio.

Proposition 4 *In equilibrium, the following is true;*

i) The credit quality of the local banks' loan portfolio is increasing in the likelihood that entry is through acquisition, and decreasing in the likelihood that entry is through greenfield banking, i.e. $\frac{\partial e_0}{\partial \theta} > 0$, and $e_1^G < e_1^A$;

ii) When $\theta > 0$, there exists an EC such that foreign entry enhances the credit quality of the local banks' loan portfolios. If foreign entry is constrained to greenfield entry, i.e. $\theta = 0$, then foreign entry unambiguously leads to a deterioration in the credit quality of the local banks' loan portfolio; and

iii) Lending rates are increasing in the probability that entry is through acquisition.

Result *i)* and *iii)* in Proposition 4 are driven by the impact of the mode of entry on competition and rent extraction. The rent extraction determines the marginal return on screening and thereby the local banks' screening intensity. Lending is profitable in state h, so the foreign bank exploits its entire lending capacity when the economy is in state h. The economic capital consumed by the acquired portfolio implies, that the greenfield entrant's lending capacity exceeds the acquirer's lending capacity. Thus, competition is more fierce following greenfield entry, and consequently, the rent extraction and the local banks' screening intensity is lower under greenfield entry.

Entry through acquisition leads to a reduction in the number of local banks. This drives result *ii)* of Proposition 4. When the entrant's economic capital is low, entry through acquisition can reduce the aggregate lending capacity. This reduces competition, and increases the local banks' rent

extraction and screening intensity. In contrast, greenfield entry leads to an increase in the number of banks and unambiguously increases the aggregate lending capacity. Thus, following greenfield entry, the local banks' rent extraction and screening intensity is lower.

The acquirer's valuation of the target's business, V^A, suggests, that entry through acquisition is facilitated when the local banks exert a high screening effort at time $t = 0$. Typically, economies which have recently liberalised their financial sector are characterised by lax lending standards and a history of government directed lending. Thus, in these economies, foreign entry is likely to be through greenfield banking. Therefore, part $i)$ of Proposition 4 suggests, that unregulated entry in countries which have recently liberalised their financial sector is likely to reduce the screening intensity and credit quality of the local financial intermediaries loan portfolio.

Under the foreign bank's risk management framework, the lending capacity is increasing in τ^l. There is a value of τ^l such that, in state l, the economic capital consumed by the acquired portfolio exhausts acquirer's lending capacity. The greenfield entrant does not own a portfolio of local loans, so its economic capital constraint is more lax than the acquirer's economic capital constraint. Thus, if the greenfield entrant's screening intensity is sufficiently high, it finances local borrowers at values of τ^l at which the acquirer's economic capital constraint forces it to contract credit.

Proposition 5 *There exists values of EC and τ^l such that, in state l*

i) if $\tau^l < \tau^G$, no bank lends;

ii) if $\tau^G \leq \tau^l < \tau^A$ only the greenfield entrant lends; and

iii) if $\tau^A \leq \tau^l < \tau^L$ both the acquirer and the greenfield entrant lends.

At the lower threshold, τ^G, the fraction of good entrepreneurs is so low, that it is unprofitable for the foreign entrant to lend, even if the lender can extract the entire surplus from the good entrepreneurs' projects. For $\tau^G \leq \tau^l < \tau^A$, it is profitable for the entrant to extend some credit in state l, irrespective of its mode of entry. For these parameter values however, the acquirer's economic capital constraint binds and prevents it from lending. The local banks are also prevented from lending at these parameter values, but their constraint is of a fundamentally different nature. The local banks' screening intensity renders their operations unprofitable, so insolvency prevents

them from lending.

The foreign bank's ability to lend during busts does not imply that it stabilises the local economy. Proposition 4 and 5 illustrates that for $\tau^A > \tau^l \geq \tau^G$, the foreign bank lends during the bust, but its presence increases competition and leads to a lower screening effort by the local banks.

Proposition 6 confirms, that the results from the preceding analysis carries through to a setting where the banks incorporate the impact of their lending decisions on the equilibrium rents.

Proposition 6 *The results from Proposition 4 and 5 carry through to the setting where the banks behave strategically.*

4   Extension of the analysis

This section extends the analysis along two lines. First, it illustrates that the model's results are not driven by the assumption of a perfectly credible deposit insurance. Hereafter, it demonstrates how the model's predictions change when the model is extended to include an international interbank market.

4.1   Importance of deposit insurance

In the following, I assume that there is no deposit insurance, and that local depositors can withdraw from the bank at $t = 1$. If the depositors withdraw from the bank, the banks' loans are liquidated at their expected value, and the proceeds from the liquidation are used to honour the banks' obligations to the depositors. Lemma 7 verifies that the results from the previous sections are maintained when the deposit insurance is eliminated.

Lemma 7 *Elimination of the deposit insurance leads to a reduction in the local banks' screening intensity. In state l, the local banks are insolvent for a larger set of parameter values, i.e. there is an τ^l, τ^{L*}, with $\tau^{L*} > \tau^L$ such that, the local banks are insolvent for all $\tau^l < \tau^{L*}$. The results from Proposition 4, 5 and 6 are maintained with τ^L replaced by τ^{L*}.*

In state l, depositors are subject to a loss since the local banks' liabilities exceed the liquidation value of their assets. To finance the bank at $t = 0$, risk neutral depositors require a risk premium. This raises the banks' cost of finance and reduces the marginal return on screening. This drives the deterioration in the credit quality of the local banks' loan portfolios. With a lower level of screening, the local banks are insolvent for higher values of τ^l, so $\tau^{L*} > \tau^L$.

The deposit insurance scheme improves the credit quality of the local banks' portfolio by enhancing the local banks' incentives to undertake costly screening. In addition to the traditional argument of preventing depositor runs, this provides an argument in favour of deposit insurance.[14]

4.2   Interbank market

In the following, I assume the existence of an interbank market where local banks can apply for unsecured credit from risk neutral international financial institutions. Interbank loans have a tenure of one period, and, in any given period, the maximum amount of credit available to any borrower is exogenously fixed at $\bar{D}$. Let $e_t^{mI,j}$ be the local bank's screening intensity at time t in state j following entry mode m. I assume that the lenders in the interbank market obtain a repayment of zero if, at the maturity of the loan, the value of the local bank's liabilities exceeds the expected value of their assets.[15]

Lemma 8 *If $\tau^h \geq \frac{1}{\rho^2 pX}$, the introduction of an interbank market leads to a reduction in the local banks' screening intensity, i.e. $e_0^I < e_0$ and $e_1^{mI,h} < e_1^{m,h}$. In state l, local banks loose access to interbank finance. A sufficient condition for the results from the previous section to be maintained is, that the local banks' capacity constraint binds.*

The mechanism behind Lemma 8 is akin to the mechanism behind Lemma 7. In state l, the local banks are insolvent, so, at time $t = 0$, creditors in the interbank market require a risk premium to finance the local banks. This raises the local banks' average cost of finance, reduces the marginal

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[14] See Diamond and Dybvig (1983) for an outline of how deposit insurance can prevent bank runs in a model with multiple equilibria.

[15] The model's qualitative predictions are not sensitive to the assumption about the repayment of interbank loans when the local bank is insolvent. Any shortfall in the repayments to interbank lenders lead to the conclusions in Lemma 8.

return on screening and leads to a lower quality of the loan portfolio. The constraint on τ^h ensures, that it is profitable for the local banks to borrow in the interbank market at time $t = 0$. In state l, the local banks are insolvent, and therefore, they cannot obtain interbank credit. Irrespective of the state, the entrant lends only to creditworthy borrowers and therefore maintains access to the interbank market. When the local banks' capacity constraints bind, the local banks' problem is equivalent to the problem analysed in the previous section, with the caveat that the lending capacity is increased by $\bar{D}$. Thus, the results from the previous section holds true.

5 Empirical implications and evidence

The model has a set of empirically testable implications. First, during busts, only foreign banks extend credit. As the busts becomes severe, only greenfield entrants continues to lend. Second, the acquisition of the target's portfolio implies, that the average credit quality of the acquirer's loan portfolio is below the credit quality of the greenfield entrant's loan portfolio. Third, greenfield entry leads to a larger aggregate supply of credit than entry via acquisition, and subsequently to lower lending rates.

A series of empirical studies find, that as the local economies go through a bust, the foreign banks expand credit whilst the local banks contract credit.[16] Haas and Lelyveld (2006) contains a detailed analysis of the behaviour of respectively greenfield entrants and acquirers in Central and Eastern Europe during 1993-2001. They find, that foreign banks, on average, expand credit during busts, but that this credit expansion is driven by an expansion by the greenfield entrants and a contraction by the acquirers.

In the case of Croatia, Kraft (2002) find, that the quality of the greenfield entrants' assets exceed the quality of the acquirers' assets. This finding is attributed to the absence of socialist era loans on the greenfield entrants' balance sheets. Further, Kraft (2002) and Haas and Lelyveld (2006) find, that greenfield entrants expand credit more rapidly than acquirers. This suggests, that the quality

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[16]See Goldberg et al. (2000), Mody and Peria (2002) and Peek and Rosengren (2000) for an analysis of foreign banks in Latin America, or Haas and Lelyveld (2006) and Galac and Kraft (2000) for an analysis of the behaviour of foreign banks in respectively Central Eastern Europe and Croatia. Schmidt (2007) provides a further discussion of these results, and additional evidence that foreign entrants expand credit during busts of local economies.

of the acquired loan portfolio limits the entrants ability to extend credit. This finding is reaffirmed in Crystal et al. (2001). Crystal et al. analyse data for the period 1995-2000 for Argentina, Chile and Columbia and find, that foreign banks with an established presence expand credit more rapidly and have a lower ratio of non-performing loans to assets than foreign banks which have established their presence through recent acquisitions. These findings indicate, that the inferior quality of the acquirers' loan portfolio leads to a more conservative lending policy. Majnoni et al. (2003) analyse a dataset for Hungary for the period 1994-2000 and find, that greenfield entrants' operations are more profitable that the operations of acquirers. The difference in performance is attributed to losses on the acquired portfolio.

For five Latin American countries during the late 1990s, Mody and Peria (2004) find, that foreign acquirers charge higher lending spreads than foreign greenfield entrants.[17] This finding is corroborated in Clayes and Hainz (2006), which analyses foreign banks' lending rates in 10 Eastern European countries during 1995-2003. Clayes and Hainz find, that local banks reduce their lending rates significantly more following an increase in the greenfield entrants market share than following an increase in the acquirer's market share. The authors interpret this finding as evidence that greenfield entry leads to more intense competition than entry through acquisition.

6 Conclusions

Certain economies restrict foreign banks' mode of entry to greenfield banking. This paper has presented a theoretical framework for the analysis of how the mode of entry affects the credit quality of the local financial intermediaries' loan portfolio. The analysis indicates, that greenfield entry has a more adverse impact on the credit quality of the local banks' loan portfolio than entry through acquisition. The mechanism driving this conclusion is, that greenfield entry leads to more intense competition which reduces the local banks' profitability and their incentives to undertake costly effort. The model has illustrated that the international banks' risk management framework can create a divergence in the behaviour of greenfield entrants and acquirers. Although the greenfield

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

entrants are more likely to extend credit during busts, the conclusion that they enhance financial stability more than acquirers is inappropriate as they also have a more adverse impact on the credit quality of the local banks' loan portfolio. The model suggests, that foreign banks are willing to lend directly to local entrepreneurs during busts, but that they, due to the local banks' agency problem, are unwilling to finance the local banks via the interbank market.

This paper is a first attempt to understand how the foreign banks' mode of entry affects the financial stability of the local financial system. The paper makes some headway but leaves many questions unanswered. For one, it ignores how foreign entry affects the local banks cost of funds and their ability to raise deposits. In addition, much empirical work remains to be done in order to fully understand the implications of the mode of entry on the local financial system.

A strict interpretation of the model's predictions lead to clear policy implications. If local financial authorities are concerned about financial stability, they should favour foreign entry through acquisition rather than through greenfield banking. However, there are many simplifications and shortcomings in the model presented in this paper, so a more appropriate interpretation of the results is, that restrictions on the foreign banks' mode of entry may have undesired and still not well understood economic consequences.

7 APPENDIX

Proof. Lemma 1. Assume to the contrary that the local banks lend in state l. The local banks'

optimization problem is,

$$
\max_{L_0,L_1,e_0,e_1^{A,l},e_1^{A,h},e_1^{G,l},e_1^{G,h}} \left[\left(\rho\tau^h + (1-\rho)\tau^l + e_0\right)pq_0R - \frac{1}{2}c\left(e_0\right)^2\right]L_0
$$

$$
+ \rho\left\{\theta\left[\left(\tau^h + e_1^{A,h}\right)pq_1^{A,h}R - \frac{1}{2}c\left(e_1^{A,h}\right)^2\right] + (1-\theta)\left[\left(\tau^h + e_1^{G,h}\right)pq_1^{G,h}R - \frac{1}{2}c\left(e_1^{G,h}\right)^2\right]\right\}L_1
$$

$$
+ (1-\rho)\left\{\theta\left[\left(\tau^l + e_1^{A,l}\right)pq_1^{A,l}R - \frac{1}{2}c\left(e_1^{A,l}\right)^2\right] + (1-\theta)\left[\left(\tau^l + e_1^{G,l}\right)pq_1^{G,l}R - \frac{1}{2}c\left(e_1^{G,l}\right)^2\right]\right\}L_1,
$$

$$
s.t.\ L_0 + L_1 \leq \frac{A}{k}.
$$

The first order conditions with respect to effort are,

$$
e_0 = \frac{1}{c}\rho pq_0R,
$$

$$
e_1^{A,h} = \frac{1}{c}pq_1^{A,h}R,
$$

$$
e_1^{A,l} = \frac{1}{c}pq_1^{A,l}R,
$$

$$
e_1^{G,h} = \frac{1}{c}pq_1^{G,h}R,
$$

$$
e_1^{G,l} = \frac{1}{c}pq_1^{G,l}R.
$$

If $\left(\tau^l + e_1^{m,l}\right)p\left(1 + q_1^{m,l}R\right) - \frac{1}{2}c\left(e_1^{m,l}\right)^2 < 1$ for $m \in \{G,A\}$, $t \in \{0,1\}$, lending is unprofitable to

the local bank in state l. Inserting the first order conditions for optimal effort and exploiting that

$q_1^{m,l} \leq 1$, the a sufficient condition for the local bank to be insolvent in state l is,

$$
\tau^l < \frac{1 - \frac{1}{c}p^2R\left(1 + \frac{1}{2}R\right)}{pX}.
$$

Thus, the claim is verified by setting $\tau^L = \frac{1-\frac{1}{c}p^2R\left(1+\frac{1}{2}R\right)}{pX}$. $\tau^L > 0$ if $1 - \frac{1}{c}p^2R\left(1 + \frac{1}{2}R\right) > 0$. Since

$c \geq \frac{pX}{1-\tau^h}$ and $pR < X$, a sufficient condition for this to be fulfilled is $\tau^h > \frac{R}{2+R}$. ∎

Proof. Lemma 2. First, note that

$$
\tau^hp\left(1 + q_1^hR\right) - 1 \geq p\left(1 + \left(1 - N\frac{A}{k} - \frac{EC}{1-s\left(h\right)}\right)R\right) - 1 > 0,
$$

25

where the last inequality follows from condition (1). Thus, it is always profitable for the foreign bank to finance borrowers in economies which are in state h.

If the foreign bank is active in a large number of economies (potentially infinite), then, by the law of large numbers, its optimization problem is given by

$$\max_{\varepsilon^{m,j},\Lambda^j} \left(\tau^j + \varepsilon^{m,j}\right) p \left(1 + q_1^{m,j} R\right) - \frac{1}{2} c \left[\left(\varepsilon^{m,j}\right)^2\right] \Lambda^j,$$

where $m \in \{G, A\}$ and $j\{h, l\}$. This is equivalent to the optimization problem for a bank which is not subject to limited liability. Thus, assume that the foreign bank is active in a number of economies such that the law of large number is not brought into play. This implies that the bank's profits are limited. Let these profits be given by π. To seen that the bank can increase its profits above π when the number of economies available to the bank is large, consider the limited liability optimization problem,

$$\max_{\varepsilon^{m,h},\varepsilon^{m,l},\Lambda^{m,h},\Lambda^{m,l},M} \max \left\{ \Lambda^{m,h} \sum_{i=0}^{\rho M} \binom{\rho M}{i} p^i (1-p)^{\rho M-i} \left[i \left(\left(\tau^h + \varepsilon^{m,h}\right) q_1^{m,h} R\right) - (\rho M - i) \right] \right.$$
$$+ \Lambda^{m,l} \sum_{j=0}^{(1-\rho)M} \binom{(1-\rho)M}{j} p^j (1-p)^{(1-\rho)M-j} \left\{ j \left[\left(\tau^l + \varepsilon^{m,l}\right) R\right] - [(1-\rho)M - j] \right\}, 0 \right\}$$
$$- \frac{1}{2} c \left[\left(\varepsilon^{m,h}\right)^2 \Lambda^{m,h} + \left(\varepsilon^{m,l}\right)^2 \Lambda^{m,l} \right]$$

$$\geq \max_{\Lambda^h,M} \Lambda^h \sum_{i=0}^{\rho M} \binom{\rho M}{i} p^i (1-p)^{\rho M-i} \max\left[i\tau^h q_1^{m,h} R - (\rho M - i), 0 \right]$$

$$= \max_{\Lambda^h,M} \Lambda^h \max \left\{ \sum_{i=0}^{\rho M} \binom{\rho M}{i} p^i (1-p)^{\rho M-i} i\tau^h q_1^{m,h} R \right.$$
$$\left. - \sum_{i=0}^{\rho M} \binom{\rho M}{i} p^i (1-p)^{\rho M-i} (\rho M - i), 0 \right\}$$

$$= \max_{\Lambda^h,M} \Lambda^h \max \left\{ \tau^h q_1^{m,h} R \sum_{i=0}^{\rho M} \binom{\rho M}{i} p^i (1-p)^{\rho M-i} i \right.$$
$$\left. - \rho M \sum_{i=0}^{\rho M} \binom{\rho M}{i} p^i (1-p)^{\rho M-i} \left(1 - \frac{i}{\rho M}\right), 0 \right\}.$$

As M becomes large, this term converges to

$$= \max_{\Lambda^h, M} \rho M \max \left\{ \left[\tau^h p q_1^{m,h} R - (1-p) \right], 0 \right\} \Lambda^h$$

$$= \max_{\Lambda^h,, M} \rho M \left[\tau^h p q_1^{m,h} R - (1-p) \right] \Lambda^h,$$

where the second equality follows since $\tau^h p q_1^{m,h} R - (1 - \bar{p}) > 0$. This expression is strictly increasing

in M, so for any π, there is a value $\bar{M}$, $\bar{M} = \frac{\pi}{\rho \left[\tau^h p q_1^{m,h} R - (1-p) \right]}$, such that when the number of

economies available to the bank exceeds $\bar{M}$, the bank can increase its profits above π by being

active in all the economies which are in state h. Thus if $M > \bar{M}$, the foreign bank's optimization

problem is equivalent to the optimization problem of a bank which is not subject to limited liability.

∎

Proof. Lemma 3. Substituting the first order conditions for optimal effort, (4) and (3) into the

first order conditions for credit allocations, (5) and (6), yields

$$\tau^h q_0 + \frac{1}{2} \rho p R (q_0)^2 = \theta \left[\tau^h q_1^{A,h} + \frac{1}{2} p R \left(q_1^{A,h} \right)^2 \right] + (1 - \theta) \left[\tau^h q_1^{G,h} + \frac{1}{2} p R \left(q_1^{G,h} \right)^2 \right]. \tag{24}$$

The market clearing, conditions (15), (16) and (18), and the first order conditions to the entrant's

problem, (9) and (13), implies

$$q_1^{A,h} = 2 - (N-1) \frac{A}{k} - \frac{EC}{1 - s(\tau^h)} - q_0, \tag{25}$$

$$q_1^{G,h} = 2 - N \frac{A}{k} - \frac{EC}{1 - s(\tau^h)} - q_0. \tag{26}$$

Existence and uniqueness follows from observing that the left hand side of (24) is strictly increasing

and continuous in q_0 for $q_0 > 0$, whereas the right hand side by (25) and (26) is strictly decreasing

and continuous in q_0 for $q_0 > 0$. For $q_0 = 0$, the left hand side of (24) equals is zero whereas the

right hand side is positive. This ensures a unique solution to (24).

The model may exhibit multiple equilibria with respect to the foreign bank's mode of entry. Let

F be such that

$$V^G (\theta, F) \geq 0.$$

For any given θ, there is a unique value of F, $F^* (\theta)$, which solves,

$$V^A (\theta) - \phi = V^G (F, \theta).$$

Let all equilibrium variables be denoted with the superscript *. To determine $F^*(\theta)$, rewrite the expression for V^A,

$$
\begin{aligned}
V^A(\theta) &= \left[\left(\rho\tau^h + (1-\rho)\tau^l + e_0^*\right)\left(\frac{1}{\rho}ce_0^* + p\right) - 1\right]L_0^* \\
&+ \rho\left[\frac{1}{2}\left(\varepsilon^{A,h*}\right)^2 + \left(\tau^h c + p\right)\varepsilon^{A,h*} + p\tau^h - 1\right]\Lambda^{A,h} \\
&+ (1-\rho)\left[\frac{1}{2}\left(\varepsilon^{A,l*}\right)^2 + \left(\tau^l c + p\right)\varepsilon^{A,l*} + p\tau^l - 1\right]\Lambda^{A,l*},
\end{aligned}
$$

and rewrite the expression for V^G as,

$$
\begin{aligned}
V^G &= \rho\left[\frac{1}{2}\left(\varepsilon^{G,h*}\right)^2 + \left(\tau^h c + p\right)\varepsilon^{G,h*} + p\tau^h - 1\right]\Lambda^{G,h} \\
&+ (1-\rho)\left[\frac{1}{2}\left(\varepsilon^{G,l*}\right)^2 + \left(\tau^l c + p\right)\varepsilon^{G,l*} + p\tau^l - 1\right]\Lambda^{G,l*} - F.
\end{aligned}
$$

Thus, $F^*(\theta)$ is given by,

$$
\begin{aligned}
F^*(\theta) &= \phi - \left[\left(\rho\tau^h + (1-\rho)\tau^l + e_0^*\right)\left(\frac{1}{\rho}ce_0^* + p\right) - 1\right]L_0^* \\
&+ \rho\left[\frac{1}{2}\left(\left(\varepsilon^{G,h*}\right)^2\Lambda^{G,h} - \left(\varepsilon^{A,h*}\right)^2\Lambda^{A,h}\right) + \left(\tau^h c + p\right)\left(\varepsilon^{G,h*}\Lambda^{G,h} - \varepsilon^{A,h*}\Lambda^{A,h}\right)\right. \\
&\left. + \left(p\tau^h - 1\right)\left(\Lambda^{G,h} - \Lambda^{A,h}\right)\right] \\
&+ (1-\rho)\left[\frac{1}{2}\left(\left(\varepsilon^{G,l*}\right)^2\Lambda^{G,l} - \left(\varepsilon^{A,l*}\right)^2\Lambda^{A,l}\right) + \left(\tau^l c + p\right)\left(\varepsilon^{G,l*}\Lambda^{G,l} - \varepsilon^{A,l*}\Lambda^{A,l}\right)\right. \\
&\left. + \left(p\tau^l - 1\right)\left(\Lambda^{G,l} - \Lambda^{A,l}\right)\right].
\end{aligned}
$$

$F^*(\theta)$ is not monotone in θ, so the model may exhibit multiple equilibria. Note that if $F > F^*(\theta)$ for all $\theta \in [0,1]$, then the mode of entry is always acquisition, and if $F < F^*(\theta)$ for all $\theta \in [0,1]$, then the mode of entry is always greenfield banking. Existence of the equilibrium follows from the observation that $F^*(\theta)$ is continuous. If there is an intersection between F and $F^*(\theta)$, then there is at least one equilibrium in mixed strategies. If there are no intersections between F and $F^*(\theta)$, there is exactly one equilibrium in pure strategies.

$V^G(\theta, F)$ is increasing in θ, so $V^G(0, F) \geq 0$ implies that the profits from entry are positive. Thus, it is optimal for the foreign bank to enter. To ensure that the incumbent accepts the entrants offer, let $\phi \geq V^L(1)$. Substituting the equilibrium values of the variables into the expression for

$V^L(1)$ yields,

$$\phi \geq V^L(1)$$

$$= \rho\left(\tau^h + e_0^*\right)pq_0^* RL_0^* + \rho\left[\left(\tau^h + e_1^{A,h*}\right)pq_1^{A,h*}R - \frac{1}{2}\left(e_1^{A,h*}\right)^2\right]L_1^*.$$

Last, in state l, the entrant is the monopolist, and effectively chooses $q_1^{m,l}$ to maximize its profits under the capacity constraint for $m \in \{G, A\}$. The foreign bank's objective function is continuous and bounded which ensures that there is a solution to the maximisation problem over the bounded support, $q_1^{m,l} \in [0, 1]$.

The local banks capacity allocation follows from the market clearing. This completes the proof.

∎

Proof. Proposition 4. First note that by Lemma 3, $q_1^{G,h} = q_1^{A,h} - \frac{A}{k}$. The screening intensity is increasing in the rent extraction, so at time $t = 1$ screening is always higher following acquisition than following greenfield entry. $\frac{\partial e_0}{\partial \theta} = \frac{\partial e_0}{\partial q_0}\frac{\partial q_0}{\partial \theta}$, and since and $\frac{\partial e_0}{\partial q_0} > 0$, the sign of $\frac{\partial e_0}{\partial \theta}$ is determined by $\frac{\partial q_0}{\partial \theta}$. To find $\frac{\partial q_0}{\partial \theta}$, differentiate (24) with respect to q_0 and θ to obtain

$$\frac{\partial q_0}{\partial \theta} = \frac{\tau^h\left(q_1^{A,h} - q_1^{G,h}\right) + \frac{1}{2}pR\left[\left(q_1^{A,h}\right)^2 - \left(q_1^{G,h}\right)^2\right]}{2\tau^h + pR\left(\rho q_0 + \theta q_1^{A,h} + (1-\theta)q_1^{G,h}\right)}.$$

Since $q_1^{A,h} > q_1^{G,h}$, it follows that $\frac{\partial q_0}{\partial \theta} > 0$. This verifies the first claim in the proposition. The third claim is verified by observing that the lending rate is given by $r_t = q_t^{m,j}(X-1)$ and therefore is increasing in $q_t^{m,j}$ for $j \in \{l, h\}$, $m \in \{G, A\}$. Claim ii) states that when $\theta > 0$, there is an EC such that the local banks' screening intensity is higher when foreign banks are allowed to enter than when they are prevented from entering. To see this, first derive the equilibrium without foreign banks. Let $q_t^{NE,j}$ denote the banks rent extraction at time t in state h when foreign banks are not permitted to enter. In absence of foreign bank entry, the local banks problem is equivalent to the local banks' problem under foreign entry with $\theta = 1$, $q_t^{m,j} = q_t^{NE,j}$ and $\frac{EC}{1-s(\tau^h)} = \frac{A}{k}$. Plugging this into equation (24) and (25) yields the equilibrium conditions in the absence of foreign banks,

$$\tau^h q_0^{NE} + \frac{1}{2}\rho pR\left(q_0^{NE}\right)^2 = \tau^h q_1^{NE,h} + \frac{1}{2}pR\left(q_1^{NE,h}\right)^2, \tag{27}$$

and,

$$q_1^{NE,h} = 2 - N\frac{A}{k} - q_0^{NE}.$$

Let $EC^*(\theta)$ be the value of EC such that $q_0 = q_0^{NE}$. Thus, from (27) and (24), $EC^*(\theta)$ solves

$$\theta\left[\tau^h q_1^{A,h} + \frac{1}{2}pR\left(q_1^{A,h}\right)^2\right] + (1-\theta)\left[\tau^h q_1^{G,h} + \frac{1}{2}pR\left(q_1^{G,h}\right)^2\right] = \tau^h q_1^{NE,h} + \frac{1}{2}pR\left(q_1^{NE,h}\right)^2.$$

Exploiting (25) and (26) this expression implies that $EC^*(0) = 0$, $EC^*(1) = \frac{A}{k}$ and $\frac{\partial EC^*(\theta)}{\partial\theta} > 0$. Consequently, for any $\theta > 0$, there is a value of EC, $EC^*(\theta)$, such that if $EC < EC^*(\theta)$ then $q_0 > q_0^{NE}$. Further, if $EC < \left[1 - s\left(\tau^h\right)\right]\frac{A}{k}$, it follows that $q_1^{A,j} > q_1^{NE}$. The local banks' screening intensity is increasing in $q_t^{m,j}$, so it follows that the local banks exert a higher screening effort when foreign banks enter through acquisition if $0 < EC < \min\left(EC^*(\theta), \left[1 - s\left(\tau^h\right)\right]\frac{A}{k}\right)$. To see that foreign entry leads to a reduction in the local banks' screening intensity when foreign entry is constrained to greenfield banking, note that $EC^*(0) = 0$, so $\theta = 0$ implies that $q_0 < q_0^{NE}$ for all $EC > 0$. ∎

Proof. Proposition 5. Recall that $\tau^L = \frac{1 - \frac{1}{c}p^2R\left(1+\frac{1}{2}R\right)}{pX}$. Let τ^G be the lowest value of τ^l such that the greenfield entrant can lend in state l, i.e. τ^G solves $\left(\tau^l + \varepsilon^{G,l}\right)p\left(1 + q_1^{G,l}R\right) - \frac{1}{2}c\left(\varepsilon^{G,l}\right)^2 = 1$, where $q_1^{m,j} = 1$. Inserting the first order conditions for optimal effort yields, $\tau^G = \frac{1 - \frac{1}{2}\frac{1}{c}(pX)^2}{pX}$. Note that $\frac{1}{2}(pX)^2 > p^2R\left(1 + \frac{1}{2}R\right) = \frac{1}{2}(pX)^2 - \frac{1}{2}p$, so $\tau^G < \tau^L$. Let τ^A be the value of τ^l such that the acquirer's capacity constraints prevents it from lending at $t = 1$, i.e. τ^A solves $\left[1 - s\left(\tau^l\right)\right]L_0 = EC \Rightarrow \tau^A = s^{-1}\left(1 - \frac{EC}{L_0}\right)$. Since $s\left(\tau^l\right) \to 0$ for $\tau^l \to 0$, and $s\left(\tau^l\right) \to 1$ for $\tau^l \to \infty$, a value of EC can be found such that $\tau^G < \tau^A < \tau^L$. Since $\Lambda^{G,l} \geq \Lambda^{A,l}$ it follows that $q_1^{G,l} \leq q_1^{A,l}$ and therefore $\varepsilon^{G,l} \leq \varepsilon^{A,l}$. Thus , for $\tau \in \left(\tau^G, \tau^A\right)$, it is profitable for the acquirer to lend to local borrowers, but its economic capital constraint prevents it from doing so. Note, that by the construction of τ^G, it is unprofitable for both greenfield entrants and acquirers to lend if $\tau^l < \tau^G$. ∎

Proof. Proposition 6. Statement *i)* and *iii)* of Proposition 4 generalises if, in the setting with strategic behaviour, $\frac{\partial e_0}{\partial\theta} > 0$, and $q_1^{G,h} < q_1^{A,h}$. That indeed this is the case is verified below. The results in Proposition **5** are driven by the agency problem which causes the foreign bank to set a higher screening intensity than the local banks, and by the observation that the acquirer has a

lower lending capacity than the greenfield entrant. The foreign bank's economic capital constraint, lending capacity and the agency problem are unaffected by the banks' strategic behaviour, so the proof of Proposition 5 is unchanged.

The subsequent establishes existence of the equilibrium, and proves that $\frac{\partial e_0}{\partial \theta} > 0$ and $q_1^{G,h} < q_1^{A,h}$. In step one, assume that there is a corner solution to the entrant's problem, $\Lambda^{G,h} = \frac{EC}{1-s(\tau^h)}$ and $\Lambda^{A,h} = \frac{EC}{1-s(\tau^h)} - L_0$. The second step of the proof illustrates that the results hold for $\Lambda^{m,h} < \frac{EC}{1-s(\tau^h)}$. Let the local banks be indexed by subscript $w \in \{1, 2, .., N\}$. In equilibrium, $(1 - q_0) = \sum\limits_{w=1}^{N} L_{0,w}$, $(1 - q_1^G) = \sum\limits_{w=1}^{N} L_{1,w} + \Lambda^{G,h}$ and $(1 - q_1^A) = \sum\limits_{w=1}^{N-1} L_{1,w} + \Lambda^{A,h}$, where $L_{t,w}$ is amount bank w's lends at time t. $e_{t,w}^{m,j}$ is the local bank number w's screening intensity at time t is state h following entry mode m. A representative local bank solves the problem,

$$\max_{L_{0,w}, L_{1}, e_{0,w}, e_{1,w}^{A,h}, e_{1,w}^{G,h}} \rho \left[\left(\tau^h + e_{0,w} \right) pq_0 R - \frac{1}{2} c \left(e_{0,w} \right)^2 \right] L_{0,w}$$

$$+ \rho \left\{ \theta \left[\left(\tau^h + e_{1,w}^A \right) q_1^{A,h} pR - \frac{1}{2} c \left(e_{1,w}^A \right)^2 \right] + (1 - \theta) \left[\left(\tau^h + e_{1,w}^G \right) q_1^{G,h} pR - \frac{1}{2} c \left(e_{1,w}^G \right)^2 \right] \right\} L_{1,w},$$

$$s.t. L_{0,w} + L_{1,w} \leq \frac{A}{k}.$$

By assumption, lending is profitable in state h, so the local bank's capacity constraint is binding. The first order conditions are given by,

$$e_{0,w} = \frac{1}{c} \rho q_0 pR,$$

$$e_{1,w}^A = \frac{1}{c} q_1^{A,h} pR,$$

$$e_{1,w}^G = \frac{1}{c} q_1^{G,h} pR,$$

and,

$$\rho \left(\tau^h + e_{0,w} \right) p \left(q_0 - L_{0,w} \right) R - \frac{1}{2} c \left(e_{0,w} \right)^2 - \lambda = 0,$$

$$\rho\theta \left[\left(\tau^h + e_{1,w}^A \right) \left(q_1^{A,h} - L_{1,w} \right) pR - \frac{1}{2} c \left(e_{1,w}^A \right)^2 \right]$$

$$+ \rho (1 - \theta) \left[\left(\tau^h + e_{1,w}^G \right) \left(q_1^{G,h} - L_{1,w} \right) pR - \frac{1}{2} c \left(e_{1,w}^G \right)^2 \right] - \lambda = 0,$$

where λ is the constraint multiplier. In equilibrium, the local banks are symmetric, so $L_{0,w} = L_0$

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and $e^{m,h}_{t,w} = e^{m,h}_t$. Thus,

$$\left(\tau^h + e_0\right)\left(q_0 - L_0\right)\rho p R - \frac{1}{2}c\left(e_0\right)^2 = \lambda, \tag{28}$$

$$\rho\theta\left[\left(\tau^h + e_1^A\right)\left(q_1^{A,h} - L_1\right)pR - \frac{1}{2}c\left(e_1^A\right)^2\right]$$
$$+ (1-\theta)\rho\left[\left(\tau^h + e_1^G\right)\left(q_1^{G,h} - L_1\right)pR - \frac{1}{2}c\left(e_1^G\right)^2\right] = \lambda. \tag{29}$$

Thus,

$$\left(\tau^h + e_0\right)\left(q_0 - L_0\right)\rho p R - \frac{1}{2}c\left(e_0\right)^2 =$$
$$\rho\theta\left[\left(\tau^h + e_1^A\right)\left(q_1^{A,h} - L_1\right)pR - \frac{1}{2}c\left(e_1^A\right)^2\right]$$
$$+ \rho(1-\theta)\left[\left(\tau^h + e_1^G\right)\left(q_1^{G,h} - L_1\right)pR - \frac{1}{2}c\left(e_1^G\right)^2\right]. \tag{30}$$

From the market clearing conditions, (15), (16) and (18),it follows that

$$q_0 = 1 - NL_0,$$

$$q_1^G = 1 - NL_1 - \frac{EC}{1 - s\left(\tau^h\right)},$$

and,

$$q_1^A = 1 - (N-1)L_1 - \frac{EC}{1 - s\left(\tau^h\right)} + L_0.$$

This implies that,

$$q_1^G = 1 - N\frac{A}{k} - \frac{EC}{1 - s\left(\tau^h\right)} - q_0, \tag{31}$$

and

$$q_1^A = 1 - (N-1)\frac{A}{k} - \frac{EC}{1 - s\left(\tau^h\right)} - q_0. \tag{32}$$

Exploiting these expressions and differentiating (30) with respect to q_0 and θ yields,

$$\frac{\partial q_0}{\partial \theta} = \frac{\alpha}{\beta},$$

where,

$$\alpha = \tau^h p\left(q_1^{A,h} - q_1^{G,h}\right)pR + e_1^{A,h}\left(\frac{1}{2}ce_1^{A,h} - pL_1R\right) + e_1^{G,h}\left(\frac{1}{2}ce_1^{G,h} - pL_1R\right),$$

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and,

$$\beta = \frac{1}{c}\left(q_0 - L_0\right)\left(pR\right)^2 + \left[\tau^h\left(1 + \frac{1}{N}\right) + e_0\frac{1}{N}\right]pR$$
$$+ \theta\left[\frac{1}{c}\left(q_1^{A,h} - L_1\right)\left(pR\right)^2 + \left[\tau^h\left(1 + \frac{1}{N}\right) + e_1^{A,h}\frac{1}{N}\right]pR\right]$$
$$+ \left(1 - \theta\right)\left[\frac{1}{c}\left(q_1^{G,h} - L_1\right)\left(pR\right)^2 + \left[\tau^h\left(1 + \frac{1}{N}\right) + e_1^{G,h}\frac{1}{N}\right]pR\right].$$

From (31) and (32), $q_1^{A,h} > q_1^{G,h}$, which by the first order conditions to the local banks' problem implies $e_1^{G,h} > e_1^{A,h}$ and therefore $e_1^{A,h}\left(\frac{1}{2}ce_1^{A,h} - pL_1R\right) > e_1^{G,h}\left(\frac{1}{2}ce_1^{G,h} - pL_1R\right)$. Thus, $\alpha > 0$. Since the local bank's capacity constraint it binding, $\lambda > 0$ for all values of θ, so by (28) and (29), $\left(q_0 - L_0\right) > 0$ and $\left(q_1^{A,h} - L_1\right) > 0$ and $\left(q_1^{G,h} - L_1\right) > 0$. Thus, $\beta > 0$ and,

$$\frac{\partial q_0}{\partial \theta} > 0.$$

When the foreign bank's capacity constraint is not binding, the greenfield entrant's problem is,

$$\max_{\varepsilon^{G,j},\Lambda^{G,j}} \left[\left(\tau^j + \varepsilon^{G,j}\right)p\left(1 + q_1^{G,j}R\right) - 1 - \frac{1}{2}c\left(\varepsilon^{G,j}\right)^2\right]\Lambda^{G,j} - F,$$

and the acquirer's problem is,

$$\max_{\varepsilon^{A,j},\Lambda^{A,j}} \left[\left(\tau^j + \varepsilon^{A,j}\right)p\left(1 + q_1^{A,j}R\right) - 1 - \frac{1}{2}c\left(\varepsilon^{A,j}\right)^2\right]\Lambda^{A,j},$$

for $j \in \{l, h\}$. The first order conditions for optimal effort are,

$$\varepsilon^{G,h} = \frac{1}{c}p\left(1 + q_1^{G,h}R\right),$$

$$\varepsilon^{A,h} = \frac{1}{c}p\left(1 + q_1^{A,h}R\right).$$

In state h, the first order conditions for optimal lending are,

$$\left(\tau^h + \varepsilon^{G,h}\right)p\left[1 + \left(q_1^{G,h} - \Lambda^{G,h}\right)R\right] - 1 - \frac{1}{2}c\left(\varepsilon^{G,h}\right)^2 = 0,$$

$$\left(\tau^h + \varepsilon^{A,h}\right)p\left[1 + \left(q_1^{A,h} - \Lambda^{A,h}\right)R\right] - 1 - \frac{1}{2}c\left(\varepsilon^{A,h}\right)^2 = 0,$$

Substituting the expression for optimal effort into the first order conditions for optimal lending yields,

$$\Lambda^{G,h} = \frac{1}{R} + \frac{\tau^h c\varepsilon^{G,h} + \frac{1}{2}c\left(\varepsilon^{G,h}\right)^2}{\left(\tau^h + \varepsilon^{G,h}\right)pR},$$

$$\Lambda^{A,h} = \frac{1}{R} + \frac{\tau^h c \varepsilon^{A,h} + \frac{1}{2} c \left(\varepsilon^{A,h} \right)^2}{\left(\tau^h + \varepsilon^{A,h} \right) pR}.$$

In equilibrium the credit markets clear, so $1 - q_1^{G,h} = NL_1 + \Lambda^{G,h}$ and $1 - q_1^A = (N-1) L_1 + \Lambda^{A,h}$

and since $1 - q_0 = NL_0$,

$$q_1^{G,h} = 2 - N\frac{A}{k} - \Lambda^{G,h} - q_0, \tag{33}$$

$$q_1^{A,h} = 2 - N\frac{A}{k} + L_1 - \Lambda^{A,h} - q_0. \tag{34}$$

Consequently, $q_1^{A,h} > q_1^{G,h}$. Differentiating the expressions for $\Lambda^{G,h}$ and $\Lambda^{A,h}$ with respect to q_0,

and exploiting

$$\frac{\partial q_1^{G,h}}{\partial q_0} = -1 - \frac{\partial \Lambda^{G,h}}{\partial q_0},$$

$$\frac{\partial q_1^{A,h}}{\partial q_0} = \frac{1}{N} - 1 - \frac{\partial \Lambda^{A,h}}{\partial q_0},$$

yields,

$$-1 - \frac{\partial \Lambda^{G,h}}{\partial q_0} = -\frac{1}{1 + \tau^h + \frac{1}{2} \frac{\left(\varepsilon^{G,h} \right)^2}{\tau^h + \varepsilon^{G,h}}} < 0,$$

$$\frac{1}{N} - 1 - \frac{\partial \Lambda^{A,h}}{\partial q_0} = -\frac{N-1}{N} \frac{1}{1 + \tau^h + \frac{1}{2} \frac{\left(\varepsilon^{A,h} \right)^2}{\tau^h + \varepsilon^{A,h}}} < 0.$$

By assumption, the local banks' aggregate lending capacity exceeds the entrant's lending capacity, so there is an interior solution to the local bank's capacity allocation problem. The first order conditions to the local bank's problem are unchanged from the analysis when the foreign bank's capacity constraint is binding. Differentiating (30) with respect to θ yields,

$$\frac{\partial q_0}{\partial \theta} = \frac{\alpha}{\beta'},$$

where α is as above, and

$$\beta' = \tau^h \left(1 + \frac{1}{N} \right) + e_0 \frac{1}{N} pR + \frac{1}{c} \rho \left(pR \right)^2 (q_0 - L_0)$$

$$- \theta \left[\left[\frac{1}{c} (pR)^2 \left(q_1^{A,h} - L_1 \right) + \tau^h pR \right] \frac{\partial q_1^{A,h}}{\partial q_0} - \frac{1}{N} pR \left(\tau^h + e_1^A \right) \right]$$

$$- (1 - \theta) \left[\frac{1}{c} (pR)^2 \left(q_1^{G,h} - L_1 \right) + \tau^h pR - \frac{1}{N} pR \left(\tau^h + e_1^G \right) \right] \frac{\partial q_1^{G,h}}{\partial q_0}.$$

Since $\frac{\partial q_1^{G,h}}{\partial q_0} < 0$ and $\frac{\partial q_1^{A,h}}{\partial q_0} < 0$, the logic used to show $\beta > 0$ implies that $\beta' > 0$, and therefore,

$$\frac{\partial q_0}{\partial \theta} > 0.$$

The proof is concluded by establishing existence. Under market clearing, (33) and (34) are fulfilled. This implies that the right hand side of equation (30) is increasing in q_0, and the left hand side of (30) is decreasing in q_0. To see this, differentiate the left hand side, and exploit $q_0 - L_0 = \left(1 + \frac{1}{N}\right) q_0 - \frac{1}{N}$ to get,

$$\left[\frac{1}{c} (q_0 - L_0) + \left(1 + \frac{1}{N}\right) \tau^h + \frac{1}{N} e_0 \right] \rho p R > 0,$$

and rewrite the right hand side to,

$$\rho \theta \left[\tau^h \left(q_1^{A,h} - L_1 \right) + e_1^{A,h} \left(\frac{1}{2} q_1^{A,h} - L_1 \right) \right] pR + \rho (1 - \theta) \left[\tau^h \left(q_1^{G,h} - L_1 \right) + e_1^{G,h} \left(\frac{1}{2} q_1^{G,h} - L_1 \right) \right] pR.$$

Since $\frac{\partial q_1^{m,h}}{\partial q_0} < 0$, $\frac{\partial e_1^{m,h}}{\partial q_0} < 0$ and $\frac{\partial L_1}{\partial q_0} = -\frac{\partial L_0}{\partial q_0} = \frac{1}{N} > 0$ if follows that the right hand side is decreasing in q_0. Further, note that evaluated in $q_0 = 0$, the left hand side of (30) is below the right hand side of (30). This follows since $q_0 \to 0$ implies that the left hand side goes to $-\tau^h \rho p L_0 R \leq 0$. The right hand side goes to

$$\rho \theta \left[\tau^h \left(q_1^{A,h} - L_1 \right) + e_1^{A,h} \left(\frac{1}{2} q_1^{A,h} - L_1 \right) \right] pR$$
$$+ \rho (1 - \theta) \left[\tau^h \left(q_1^{G,h} - L_1 \right) + e_1^{G,h} \left(\frac{1}{2} q_1^{G,h} - L_1 \right) \right] pR > 0.$$

To see the inequality, note that $q_0 \to 0$ implies $q_1^{m,h} = 2 - N\frac{A}{k} - \Lambda^{m,h}$. By (1) $1 > N\frac{A}{k} + \Lambda^{m,h}$, so for $q_0 \to 0$, $q_1^{m,h} > 1$. Thus, $q_1^{m,h} > N\frac{A}{k} + \Lambda^{m,h} > N\frac{A}{k}$ which implies that $\frac{1}{N} q_1^{m,h} > \frac{A}{k} \geq L_1$. Since $N \geq 2$, the latter term implies that $\frac{1}{2} q_1^{m,h} > L_1$, which proves that the right hand side of (30) is positive for $q_0 \to 0$. Consequently, the right hand side of (30) exceeds the left hand side of (30), and since both sides are continuous in q_0, there is a unique solution to (30). ∎

Proof. Lemma 7. Let $\delta_t^{m,j}$ be the interest rate depositors require to finance the local banks at time t in state j following entry mode m, for $j \in \{h, l\}$ and $m \in \{A, G\}$. In the absence of deposit insurance, let $\bar{e}_t^{m,j}$ denote local banks' screening at time t in state j following entry mode m. The local banks cannot commit to a specific level of screening, so they take the deposit rate as given.

The local bank problem is given by,

$$\max_{L_0,L_1,\bar{e}_0,\bar{e}_1^{A,j},\bar{e}_1^{G,j}} \left[\left(\rho\tau^h + (1-\rho)\,\tau^l + \bar{e}_0 \right) p \left(q_0 R - \delta_0 \right) - \frac{1}{2}c\,(\bar{e}_0)^2 \right] L_0$$

$$+ \rho\theta \left[\left(\tau^h + \bar{e}_1^{A,h} \right) p \left(q_1^{A,h} R - \delta_1^{A,h} \right) - \frac{1}{2}c \left(\bar{e}_1^{A,h} \right)^2 \right] L_1$$

$$+ \rho\,(1-\theta) \left[\left(\tau^h + \bar{e}_1^{G,h} \right) p \left(q_1^{G,h} R - \delta_1^{G,h} \right) - \frac{1}{2}c \left(\bar{e}_1^{G,h} \right)^2 \right] L_1$$

$$+ (1-\rho)\,\theta \left[\left(\tau^l + \bar{e}_1^{A,l} \right) p \left(q_1^{A,l} R - \delta_1^{A,l} \right) - \frac{1}{2}c \left(\bar{e}_1^{A,l} \right)^2 \right] L_1$$

$$+ (1-\rho)\,(1-\theta) \left[\left(\tau^l + \bar{e}_1^{G,l} \right) p \left(q_1^{G,l} R - \delta_1^{G,l} \right) - \frac{1}{2}c \left(\bar{e}_1^{G,l} \right)^2 \right] L_1,$$

$$s.t. L_0 + L_1 \le \frac{A}{k}, \text{ for } j \in \{h,l\}\,.$$

The first order condition with respect to screening in state l, is

$$\bar{e}_1^{m,l} = \frac{1}{c} \left[q_1^{m,l} pR - \delta_1^{m,l} \right],$$

for $m \in \{G, A\}$. $\delta_1^{m,l}$ solves,

$$p \left(1 + \delta_1^{m,l} \right) = 1.$$

Since $p < 1$, it follows that $\delta_1^{m,l} > 0$. This implies that the local banks' screening intensity is lower in the absence of deposit insurance than in the presence of deposit insurance. Thus, an τ^l can be found, τ^{L*}, such that $\tau^{L*} > \tau^L$ and $\left(\tau^l + \bar{e}_1^{m,l} \right) p \left(1 + q_1^{m,l} R \right) - \frac{1}{2}c \left(\bar{e}_1^{m,l} \right)^2 = 1$. For $\tau^l < \tau^{L*}$, depositors withdraw their deposits upon the occurrence of state l. The diversification of the foreign bank's portfolio implies that the foreign entrant's cost of funds is independent of the deposit insurance. Thus, subject to replacing τ^L with τ^{L*}, the results from the main analysis carry through. $\left(\tau^l + e_1^{m,l} \right) p \left(1 + q_1^{m,l} R \right) - \frac{1}{2}c \left(e_1^{m,l} \right)^2 < 1$ ∎

Proof. Lemma 8. Let $D_t^{m,j}$ be the amount of credit the local bank obtains in the interbank market at time t in state j following entry mode m. Let the interest rate on an interbank loan be given by the lending rate in the interbank market be given by $\iota_t^{m,j}$. Let $\tilde{e}_t^{m,j}$ denote the local banks' screening intensity in the presence of the interbank market. Lenders in the interbank market are

risk neutral and, so

$$
\begin{aligned}
1 &= \rho p \left(1 + \iota_t^{m,j} \right) \Leftrightarrow \\
\iota &= \frac{1}{\rho p} - 1.
\end{aligned}
$$

Thus, the necessary and sufficient condition for local banks to obtain credit in the interbank market is,

$$
\begin{aligned}
\rho \tau^h X &\geq 1 + \iota \Leftrightarrow \\
\tau^h &\geq \frac{1}{\rho^2 p X}.
\end{aligned}
$$

Let $LIA_t^{m,j}$ denote the local banks' liabilities at time t in state j when the entrant has employed mode m, that is $LIA_t^{m,j} = L_t^{m,j} + D_t^{m,j} \left(1 + \iota_t^{m,j} \right) > \left(L_t^{m,j} + D_t^{m,j} \right)$. The local banks' optimization problem is given by,

$$
\begin{aligned}
\max_{L_0, L_1, \tilde{e}_0, \tilde{e}_1^{m,j}, D_t^{m,j}} & \left[\left(\rho \tau^h + (1 - \rho) \tau^l + \tilde{e}_0 \right) p \left(1 + q_0 R - \frac{LIA_0}{(L_0 + D_0)} \right) - \frac{1}{2} c \left(\tilde{e}_0 \right) \right] (L_0 + D_0) \\
& + \rho \theta \left[\left(\tau^h + \tilde{e}_1^{A,h} \right) p \left(1 + q_1^{A,h} R - \frac{LIA_1^{A,h}}{\left(L_1 + D_1^{A,h} \right)} \right) - \frac{1}{2} c \left(\tilde{e}_1^{A,h} \right)^2 \right] \left(L_1 + D_1^{A,h} \right) \\
& + \rho (1 - \theta) \left[\left(\tau^h + \tilde{e}_1^{G,h} \right) p \left(1 + q_1^{G,h} R - \frac{LIA_1^{G,h}}{\left(L_1 + D_1^{G,h} \right)} \right) - \frac{1}{2} c \left(\tilde{e}_1^{G,h} \right)^2 \right] \left(L_1 + D_1^{G,h} \right) \\
& + (1 - \rho) \theta \left[\left(\tau^l + \tilde{e}_1^{A,l} \right) p \left(1 + q_1^{A,l} R - \frac{LIA_1^{A,l}}{\left(L_1 + D_1^{A,l} \right)} \right) - \frac{1}{2} c \left(\tilde{e}_1^{A,l} \right)^2 \right] \left(L_1 + D_1^{A,l} \right) \\
& + (1 - \rho)(1 - \theta) \left[\left(\tau^l + \tilde{e}_1^{G,l} \right) p \left(1 + q_1^{G,l} R - \frac{LIA_1^{G,l}}{\left(L_1 + D_1^{G,l} \right)} \right) - \frac{1}{2} c \left(\tilde{e}_1^{G,l} \right)^2 \right] \left(L_1 + D_1^{G,l} \right),
\end{aligned}
$$

$$
\begin{aligned}
s.t. L_1 + L_2 &\leq \frac{A}{k}, \\
D_t^{m,j} &\leq \bar{D},
\end{aligned}
$$

for $m \in \{A, G\}$ and $j \in \{h, l\}$. The first order conditions with respect to screening are,

$$
\begin{aligned}
\tilde{e}_0 &= \frac{1}{c} p \left(1 + q_0 R - \frac{LIA_0}{(L_0 + D_0)} \right), \\
\tilde{e}_1^{m,h} &= \frac{1}{c} p \left(1 + q_1^{m,h} R - \frac{LIA_1^{m,h}}{\left(L_1 + D_1^{A,h} \right)} \right), \\
\tilde{e}_1^{m,l} &= \frac{1}{c} p \left(1 + q_1^{m,l} R - \frac{LIA_1^{m,l}}{\left(L_1^{m,l} + D_1^{m,l} \right)} \right),
\end{aligned}
$$

Since $LIA_t^{m,j} > \left(L_t^{m,j} + D_t^{m,j} \right)$, the access to the interbank market leads to a reduction in the screening intensity. Thus, if it is not optimal to lend to the banks when $\tau^l < \tau^L$, it is not optimal to lend to them in the interbank market.

When the local banks' capacity constraint binds, the local banks borrow $\bar{D}$ in the interbank market, and the local banks' and the foreign bank's problem are equivalent to the problems analysed in the previous section, with the caveat the the lending capacity is increased by $\bar{D}$. Thus, the conclusions from the previous section holds true ∎

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