Essays on bank monitoring, regulation and competition

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Chapter 6

Bank Foreign Entry and the Role of Bank Capital

Abstract

This chapter asks how capital regulation affects foreign entry. I first show that tighter capital regulation may lead to more foreign entry, which is reminiscent of the results in Chapter 3. I show that especially bad domestic banks may have incentives to merge to prevent entry of foreign banks. Interestingly, increasing capital requirements augments the merger incentives of banks. I then allow for discriminatory policies against foreign bank entry. In particular, I allow for higher capital requirements imposed only on foreign banks.

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6.1 Introduction

This chapter is a direct extension of Chapter 3. I will analyze how foreign market penetration comes about in banking. In particular I will analyze what makes banks competitive in foreign markets, and how their success in cross-border banking is affected by capital regulation, potential expropriation by domestic regulators and banks' own strategic choices.

I analyze these issues in an industrial organization framework of Chapter 3. I distinguish multiple banks and let banks in different countries differ in quality. These quality differences are linked to the banks' abilities in monitoring borrowers and affect the profitability and riskiness of their lending operations. The quality of the banks in a country determines the strength of its banking system. I let banks compete for borrowers and analyze how their choices of monitoring technology, and hence risk, are affected by entry of foreign banks, capital regulation, and the regulatory actions.

I will focus on three extensions of the analysis of bank competition as put forward in Chapter 3. In the first part, I allow for one-sided competition. What I mean by this is that one country opens up its banking system to banks from another country, but this other country keeps its own market closed. I also analyze a de novo bank, without current borrowers, that seeks to enter an established banking market. The de novo bank has no incumbency advantage, but all existing competitors have. This extension highlights the problems that a start-up bank faces.

In this part I show that opening up of a strong banking sector does not affect stability of banks and their investments in monitoring technology. However, opening up of a weak banking sector weakens domestic institutions. They may loose market share and invest less in monitoring technology. Increasing capital requirements further helps high quality foreign banks to enter. That is, higher capital requirements limit the distortionary benefits that deposit insurance brings for weak domestic banks and help strong foreign banks. Weak domestic banks may defend by merging. Merger increases their investment in monitoring technology and prevent an influx of high quality foreign banks.

I also show that higher capital requirements should positively affect merger incentives. That is, when having more capital at stake, banks aim for stability and value monitoring technology more. But precisely merger increases investment in monitoring. Hence, at higher capital requirements banks would merge more likely.

In the second part, I highlight the drawbacks of potential expropriation by domestic regulators and their effect on the behavior of entering banks. I analyze the situation in which the domestic regulator limits the size of entering banks and thereby gives an unfair competitive advantage to local players. Alternatively, the regulator can put entering banks at a disadvantage by imposing tighter capital requirements on them. In the key result I show that increasing capital requirements only for foreign banks may put them at competitive disadvantage. They may loose market share and become riskier. In this case, imposing higher capital requirements on banks increases their risk. This averse effect of capital requirements is especially strong if competition is high.

In the third part, I enrich the set-up by introducing a richer specification of the true added value of banks. In particular, I allow for a more dynamic setting in which banks' staying power becomes important. What I mean by this is that borrowers in dealing with banks might find it important that banks are around in the future as well. This encompasses the notion that the bank-borrower relationship includes mutual long term investments that make staying power important (otherwise these investments cannot be recouped).

This chapter is organized as follows. In Section 6.2, I analyze entry of a foreign banks. In Section 6.3, I allow for expropriation of foreign banks by the domestic regulation. Section 6.4 stresses the importance of staying power. Section 6.5 concludes.

6.2 Foreign Entry

In this section, I analyze two modes of entry. First, banks use cross-border lending to enter the foreign banking system. That is, banks lend to the borrowers abroad using their already established home based monitoring technology. I analyze this mode of entry in a simplified framework allowing for one sided competition in which only one country opens up borders for foreign banks but not the other country. Second, I analyze de novo entry in which the bank has to build monitoring technology in the new market from scratch.

I use the same model specification as given in Chapter 3, Section 3.2. I also assume that Assumption 3.1 in Chapter 3 holds. Assumption 3.1 in Chapter 3 allows us to focus on competition between banks of different types. That is, the competing bank will not try to grab borrowers from banks of equal type. However, the competing bank will try to win market share from banks of lower quality.

6.2.1 One sided competition

The analysis in Chapter 3 has focused on symmetric competition. All banks are at equal footing, and the expected gain in market share (stealing borrowers from other banks) equals in expected value sense the potential loss they face in their own market, see the discussion following Lemma 3.1 in Chapter 3. I are now going to focus on one-sided competition. I consider two countries, where the first opens its domestic banking market, but the second country keeps its market closed. In this setting, I analyze how the symmetric competition results from Chapter 3 are affected. I seek to answer the question whether countries should single-handedly free up their banking markets or whether this should only be done on a reciprocal basis.

I proceed as follows. The country that opens up its market I call the 'open' country (country O). The country that keeps its banking market closed but whose bank is allowed to enter country O I call the "attacking" country A. This means that a bank from country A can enter country O, but not vice versa. Since I want to analyze later whether domestic mergers are an effective response to the threat of competition from foreign banks, I assume that there are two domestic banks in country O, but just one in country A. To make matters interesting, the bank in country A is good.[1] I let all banks be of equal size. I distinguish two cases. In Case 1, both banks in country O are bad; in Case 2, the banks are good.

Proposition 6.1.

Case 1 **– The domestic banks in country** O **are good:** *The banks in country O hold on to their market share and do not change their investments in monitoring technology, but their values decrease because of extra competition from opening up the market. For the bank in country A nothing changes.*

Case 2 **– The domestic banks in country** O **are bad:** *The banks in country O lose market share and value; the good bank from country A now gains market share and value. Anticipating the loss of market shares, the banks in country O reduce their investments in monitoring technology while the bank in country A increases its investment.*

The results in this proposition are quite straightforward. When the domestic banks in the country that opens up are good (Case 1) they can hold on to their market, and also their investments in monitoring technology remain intact. If the banks are bad (Case 2), they will lose out to the foreign competitor and market share is lost. Anticipating this, they will reduce their levels of investment in monitoring.

I analyze next what impact capital requirements have on the results in Proposition 6.1. I focus on the effect that capital requirements have on the profitability of entering country O when that country's banks are bad (Case 2 in Proposition 6.1).

Corollary 6.1. *The attractiveness of entering country O when the banks in that country are bad is increasing in the level of the capital requirements.*

This corollary contrasts to the results in Proposition 3.4 in Chapter 3. There I showed that higher capital requirements encourage de novo entry only when q is high enough and γ takes on interior values. This corollary shows that an existing bank finds it *always* more profitable to enter a new market when capital requirements are higher. Corollary 6.1 provides the interesting empirical implication that in countries with relatively weak banks increasing capital requirements facilitates entry of foreign banks. Whether higher capital requirements also encourage de novo entry depends crucially on the openness of the banking markets; that is, on the parameter q (see Proposition 3.4 in Chapter 3). Only when this parameter is sufficiently high, can more de novo entry be expected. Thus raising capital requirements can have different effects on *de novo* entry versus entry coming from existing banks.[2]

[1] If the bank in country A is bad, it could not succeed in grabbing market share in country O.

[2] The careful reader may counter that entry in Proposition 3.4 in Chapter 3 was analyzed from the perspective of a de novo bank that did not yet know its type, while in Corollary 6.1 the existing bank knows that it is good. Observe however that if the de novo bank in Proposition 3.4 in Chapter 3 knows that it is good for sure, it would always be more likely to enter in response to higher capital requirements when q is high (see also Proposition 3.3, Chapter 3). In Corollary 6.1 I do not need this restriction. A potentially more important consideration is that I implicitly assume that the fixed-cost based monitoring technology of any bank is equally useful across borders. If this technology is country specific, I are in a situation of late entry in which the entering bank needs to build up a new (second) monitoring capacity. This increases the incumbency advantage of the existing incumbent banks and complicates entry. This situation is analyzed in Section 6.2.2.

I show next that domestic banks may choose to merge to protect their market against foreign competition. The following corollary establishes that – given the fixed costs in the monitoring technology – merging indeed helps protect market share.

Corollary 6.2. *A merger between (bad) domestic banks helps defend them against the threat of foreign entry if the incumbency advantage exceeds some minimum level; that is,*

$$S > [\underline{\nu}_G - \underline{\nu}_B]X - \frac{X^2}{c\rho N}, \tag{6.1}$$

and if competition is not too high (i.e., $q < \hat{q}(S)$), where $\frac{\partial \hat{q}}{\partial S} > 0$.

Corollary 6.2 reflects the scale advantage that comes from merging. That is, the merged bank is prepared to make a bigger (ex ante) investment in monitoring technology which elevates its added value in lending. This helps the merged bad bank mitigate its quality disadvantage. The restriction on q follows because the lower q, the more difficult for an entrant to grab market share. Similarly, the condition on S (see (6.1)) guarantees a minimum incumbency advantage to deter the entrant.[3]

Next, I ask the question whether opening up borders encourages domestic mergers. And if so, are merging incentives elevated more for good than for bad domestic banks? I can prove the following.[4]

Corollary 6.3. *For any small positive entry cost to the foreign entrant the threat of entry (weakly) increases the value of merging for bad domestic banks, but has no effect on the merger incentives of high quality domestic banks.*

This corollary shows that the threat of entry encourages weak domestic institutions to merge. Such merger discourages entry because of scale economies. Without the threat of entry domestic banks enjoy a relatively high valuation as stand-alone entities. Particularly for weak institutions this value is at risk when entry comes about. Merging then may help.

I analyze next what impact capital requirements have on incentives of banks to merge. I can show the following.

Corollary 6.4. *Increasing capital requirements augments banks' merger incentives.*

This corollary stems from the following effect. A merger gives the scale advantage to the merged bank and elevates its investment in monitoring technology. Higher capital requirements make such increase in monitoring technology more valuable. Hence, higher capital requirements induce banks to merge more eagerly.

[3]The condition (6.1) poses a potentially stricter lower bound on S than Assumption 3.1 in Chapter 3 does.

[4]To simplify the analysis I assume that the foreign bank faces a small positive entry cost. Note that without entry cost even if the foreign entrant would not succeed in obtaining market share upon entry, it would affect the valuations of good domestic banks (see Proposition 6.1). The latter effect is not present when there is an entry cost.

Several policy implications readily follow from my analysis. What my results in this section show is that opening up a weak domestic banking sector to foreign competitors weakens the domestic institutions (i.e., they lose market share), reduce investments in monitoring and hence become riskier. Increasing capital requirements makes entry even more likely, and using similar arguments as in Corollary 3.3, could undermine monitoring incentives further. The liberalization then does not help improve the quality of the domestic banking sector. While allowing domestic institutions to merge helps them protect market share and possibly favorably affects their monitoring incentives, it simultaneously could prevent the influx of higher quality banks. This would suggest that opening such domestic market should allow for takeovers of weak domestic institutions by foreign entrants.

Lastly, increasing capital requirements might induce more foreign entry and more mergers. Interestingly, that could imply that tightening of capital requirements (Flannery and Rangan (2004) show that banks have increased their capital partially due to higher regulatory requirements) may be additional cause for the merger wave in the banking system.[5]

6.2.2 Asymmetric competition with late entrants

So far, all banks were (initially) allocated the same number of borrowers $1/N$. Now I extend the model to incorporate the possibility that banks may enter late and have no initial (incumbent) borrowers; their established competitors, however, do. This would correspond to foreign entry, in which the foreign bank must invest in a new country from scratch.

Banks are again either good or bad. Assume that all established banks consider the number of banks N to be fixed. Thus, late entry is not anticipated and, hence, the existing banks have chosen the levels of monitoring as given in Proposition 3.1 in Chapter 3. Starting from this equilibrium, a de novo bank may consider late entry. However, this bank misses an incumbency advantage. It can only obtain borrowers by luring them away from existing banks. As before, a late entering bank does not know its own type, yet knows the cross-sectional distribution of being a good or bad type respectively $\{\gamma, [1-\gamma]\}$.

I can now analyze which factors affect the profitability of late entry.

Proposition 6.2. *Late entry occurs if q is sufficiently high, the existing banking market is of intermediate quality (i.e., $\gamma \in [\underline{\gamma}(q), \bar{\gamma}(q)]$), and the incumbency advantage is sufficiently small; that is,*

$$S < [\underline{\nu}_G - \underline{\nu}_B]X - \frac{X^2}{c\rho N}. \tag{6.2}$$

Observe that restriction (6.2) puts a stricter upper bound on S than Assumption 3.1 does.[6] This is intuitive. With late entry, the new entrant is at a distinct competitive disadvantage because it has no incumbent borrowers. Consequently, a substantial scale

[5] Berger, Demsetz, and Strahan (1999) review causes for consolidation of banking industry. The literature mostly focuses on cost efficiency and market power rationale for bank consolidation.

[6] In the proof of Proposition 6.2 in Chapter 3, I show that there is a non-empty set of parameter values for which late entry can occur. Interestingly, note that the conditions in Corollary 6.2 and Proposition 6.2 are the mirror image of each other, and hence can never be jointly satisfied. Because Corollary 6.2 refers to

advantage needs to be overcome. Hence, the incumbency advantage S should be small. The other conditions in the proposition mimic those in the earlier results. That is, the banking market needs to be sufficiently open (q high) such that the entering bank can obtain access to borrowers. The restrictions on γ guarantee that the entering bank has a sufficiently favorable image about its own quality. This explains the lower bound $\underline{\gamma}(q)$; only then can it expect to take a market share. The upper bound $\bar{\gamma}(q)$ guarantees that (in expectation) it can expect to encounter some weaker banks to take market share from.

In the spirit of Proposition 3.4 in Chapter 3, I can also show that higher capital requirements make late entry more profitable whenever the conditions in Proposition 6.2 in Chapter 3 are satisfied. Thus

Corollary 6.5. *In a region in which late entry is profitable (i.e., condition* (6.2) *holds, q is sufficiently high, and $\gamma \in [\underline{\gamma}(q), \bar{\gamma}(q)]$), higher capital requirements always enhance the profitability of late entry, and hence induce more late entry.*

Corollary 6.5 is similar to Proposition 3.4 in Chapter 3, yet less restrictive. That is, strengthening capital regulation always helps encourage late entry whenever late entry is profitable.

In Section 6.2.1 I analyze cross-border competition, in which foreign banks could use their own technology when entering a new market. In this section I have assumed de novo entry in which a foreign bank cannot use the monitoring technology from its home market when operating abroad. In particular, the foreign bank must invest in monitoring in a new market from scratch and cannot rely on the scale advantage from its home market. One could argue that the magnitude of the differences between home and foreign lending markets defines the mode of entry. Banks can more successfully apply the already-installed lending technology to similar cultural, regulatory, and legal environment; see Degryse and Ongena (2004). In this case, the analysis in Section 6.2.1 would apply. Yet, if the difference between lending markets is substantial, banks must invest in the new market from scratch and the analysis of this section applies.

6.2.3 Different regulation across countries

So far I have assumed that capital requirements are equal across countries. Now I allow the regulators to choose the optimal levels of capital for their own countries. I can show the following result.

Lemma 6.1. *The welfare optimizing regulator in a weak banking system chooses lower capital requirements than the regulator in a strong banking system.*

The intuition for Lemma 6.1 is the following. Capital regulation has a limited effect on bad banks (see Proposition 3.2 in Chapter 3). This is why the regulator of a weak banking

foreign entry of existing banks and Proposition 6.2 to de novo entry, they are not fully comparable. However, these results do show that, in circumstances in which merging is effective in deterring foreign entry, late entry is also not feasible (even without merging).

system is reluctant to set overly high capital requirements. High capital requirements result in additional cost to banks but do not change their risk much. This contrasts with the situation in a strong banking system. Capital regulation greately affects good banks; hence the regulator chooses high capital requirements to mitigate their risk. Summarizing, Lemma 6.1 shows that the regulators would optimize social welfare by selecting different capital requirements in banking systems of different strengths.

Now I analyze whether opening up banking systems harmonizes regulation of those banking systems. I compare optimal regulation in two different cases. First, banks enter through cross-border lending; that is, they extend loans abroad using their home-based monitoring technology (see Section 6.2.1). Second, banks enter through de novo entry; that is, they build a new, country-specific monitoring technology (see Section 6.2.2).

Proposition 6.3. *In case of cross-border lending, capital regulation becomes less harmonized across countries if banking systems open up their borders. In the case of de novo entry, capital regulation becomes more harmonized if banking systems open up.*

For cross-border lending, the following situation applies. If a weak country opens up its borders, domestic low-quality banks must compete with strong foreign competitors. Losing market share makes them even weaker and less responsive to capital regulation. Consequently, the regulator of a weak banking system is inclined to loosen capital regulation even further. The opposite holds for the regulator of a strong banking system. Opening banking systems up allows strong banks to take additional market share from weak banks. They grow larger and become more responsive to capital regulation. Correspondingly, the regulator of a strong banking system further increases the level of capital regulation.

This is different with de novo entry if entering foreign banks are regulated by the domestic regulator. The regulator of a weak banking system now regulates not only weak domestic banks but also strong de novo entrants. Due to higher average quality, banks become more responsive to capital regulation. Hence, the regulator of a weak domestic banking system increases capital requirements and capital regulation across countries becomes more harmonized.

Proposition 6.3 shows that opening up banking systems for cross-border competition may lead to less harmonization between the regulatory standards in countries with banks of different qualities. In contrast, opening up banking systems for de novo entry in which the foreign bank is regulated by the domestic regulator results in greater harmonization of capital regulation.

Proposition 6.3 triggers some thoughts regarding initiatives on harmonization of capital regulation; namely, the Basel I and Basel II accords. It shows that harmonization of capital regulation may not occur endogenously if banking systems are opened up. In addition, complete harmonization may not be socially optimal. This argument would promote a certain level of discretion of national regulators in the calibration of capital regulation. However, this is not to say that the level of harmonization of capital regulation is unimportant. Harmonization of capital regulation prevents potential favoritism of domestic banks by the domestic regulation. This is the focus of the next section.

6.3 Expropriation

Although Section 6.2.3 assumes that the regulator acts in the best interest of all participants in the lending markets (i.e., banks, borrowers, and depositors), this may not always be the case. Regulators may act in the interest of voters that may favor domestic over foreign banks.[7] The action of the regulator by which it favors certain (usually domestic) banks is called expropriation. I assume throughout this section that foreign and domestic banks are initially on an identical footing; that is, they have identical intrinsic monitoring technology, $\underline{\nu}_F = \underline{\nu}_D = 0$. What distinguishes them is that the regulator imposes different requirements on them.

Whereas Section 6.2.1 analyzes cross-border entry and Section 6.2.2 late entry, this section could represent the mode of entry in which a foreign bank acquires a domestic bank and, by doing this, obtains a market share in the entering country.

I analyze two cases. First, I allow the regulator to limit the size of the market share that the foreign bank can grab. Second, the regulator may demand higher capital requirements from foreign banks.

6.3.1 Limited market share

I first analyze the situation in which the regulator expropriates foreign banks by limiting their size. In particular, at $t = 0$ the market is divided between banks unevenly, such that domestic banks obtain a higher market share than foreign banks. In particular, at $t = 0$ each foreign bank obtains m_F incumbent borrowers, and each domestic bank obtains m_D incumbent borrowers, where $m_D > m_F$. The proportion of domestic banks is γ and the proportion of foreign banks is $[1 - \gamma]$. I show that the lower market share might put foreign banks at a substantial competitive disadvantage.

There exist several regulatory tools that may allow the regulator to limit the size of foreign banks. First, the regulator may object to a takeover of a large domestic bank by a foreign bank. A foreign bank may then enter only through an acquisition of a small domestic bank or by building its branch network from scratch. Second, and related, when a foreign bank decides to enter, the domestic market might already be divided between domestic banks.

I can now prove the following proposition.

Proposition 6.4. *For intermediate S (i.e., $\frac{q_D^2 X^2}{2c\rho} < S < \frac{q_D^2 X^2}{c\rho}$), there exists $\hat{m}_F$ such that for $m_F < \hat{m}_F$ foreign banks lose their market share in competition with domestic banks. I*

[7] Kroszner and Strahan (1999) show that deregulation in the U.S. was largely driven by the interest of large U.S. banks.

have

$$\nu_F^* = m_F[1 - q\gamma]\frac{X}{c\rho}, \quad (6.3)$$

$$\nu_D^* = \{m_D + m_F q[1 - \gamma]\}\frac{X}{c\rho}. \quad (6.4)$$

Proposition 6.4 shows that foreign banks are hampered twice because the regulator limits their size. First, this directly hampers their profits. Second, size limit puts foreign banks at a competitive disadvantage. That is, foreign banks invest less in monitoring technology. Consequently, they lose borrowers in competition with domestic banks. They become even smaller and riskier. In contrast, a size advantage allows domestic banks to gain additional market share in competition with foreign banks. This induces them to invest more in monitoring technology. Domestic banks become larger and safer.

The implications of Proposition 6.4 must be confronted with Proposition 6.1. If monitoring technology can be transfered across borders (Proposition 6.1), large foreign banks may easily take additional market share from domestic banks. The stability of domestic institutions might be at stake. However, if monitoring technology is country-specific and the size of foreign banks is limited (Proposition 6.4), the market share of foreign banks in the domestic country might be depleted by large domestic banks that use their scale advantage. In this case, small foreign banks may become risky and, if many foreign banks exist, they may even pose a threat to the stability of the domestic banking system.

6.3.2 Biased capital regulation

The other possibility for expropriation is the asymmetric application of prudential regulation. In particular, the regulator may use capital regulation to expropriate foreign banks. Even though capital regulation has been quantified up to a certain extent (see the Basel I and Basel II agreements), regulators still possess some discretionary power in setting the level of capital requirements for a specific bank. It is not my intention to argue that discretion must be eliminated. In particular, in Proposition 6.3 I even argue that certain discretion is valuable. Now I highlight its potential dark side.[8] More specifically, the regulator may abuse its power to expropriate foreign banks.

In particular, the regulator may impose tighter capital requirements on foreign banks k_F and looser capital requirements on domestic banks k_D, such that $k_F > k_D$. I define $X_F \equiv Y - [1 - k_F]r_D$ and $X_D \equiv Y - [1 - k_D]$, where Y is a return of the borrower and r_D is a cost of debt. I can now show the following result.

Proposition 6.5. *For intermediate S (i.e., $\frac{Y^2}{2c\rho N} < S < \frac{[Y - r_D]^2}{c\rho N}$), there exists $\hat{k}_F$ such that*

[8] Discretionary power might be advantageous because it is hard to quantify all the risk that banks are exposed to.

for $k_F > \hat{k}_F$ foreign banks lose their market share in competition with domestic banks. Thus

$$\nu_F^* = [1 - q\gamma]\frac{X_F}{c\rho N}, \tag{6.5}$$

$$\nu_D^* = \{1 + q[1-\gamma]\}\frac{X_D}{c\rho N}, \tag{6.6}$$

where $\nu_F^* < \nu_D^*$.

The intuition for Proposition 6.5 is the following. If higher capital requirements are imposed only on foreign banks, this hampers their competitive ability. Even though foreign banks are otherwise identical to domestic banks, higher capital requirements increase their funding costs (because capital is costlier than deposits). Consequently, foreign banks may lose borrowers in competition with domestic banks. Foreign banks may become smaller, invest less in monitoring, and become riskier.

The key result of Proposition 6.5 is that raising capital requirements for one group of banks (for foreign banks) but not for the other (domestic banks) puts the first group at a competitive disadvantage. If differences in imposed capital requirements are substantial ($k_F > \hat{k}_F$), foreign banks are hampered so much that they lose market share and consequently they invest less in monitoring and become riskier. Hence, foreign banks become riskier because of higher capital requirements. In contrast, domestic banks gain market share and invest more in monitoring technology. Consequently, domestic banks become safer despite lower capital requirements.

Next, I show that higher competition exacerbates the distortions created by the differences in capital requirements.

Corollary 6.6. *Increasing competition augments the region in which imposing higher capital requirements on foreign banks increases their risk (i.e., $\frac{\partial \hat{k}_F}{\partial q} < 0$).*

Corollary 6.6 shows that differences in capital requirements across banks have the biggest effect if competition is high. If competition is high (high q), domestic banks can use the advantage of lower capital requirements over the larger market share. Hence, even a small difference in capital requirements between foreign and domestic banks ($\hat{k}_F$ is smaller if q is high) puts foreign banks at such a competitive disadvantage that they lose market share and become riskier.

Proposition 6.5 and Corollary 6.6 shed some light on a related problem. Banks may use several mechanisms of "regulatory arbitrage" to circumvent capital requirements (see Jones (2000)). By doing this, some banks may lower the *effective* capital requirements. Proposition 6.5 then shows such banks may gain an unfair competitive advantage. Consequently, they could take additional market share, increase their investment in monitoring technology, and become safer.

I have analyzed expropriation of foreign banks by the domestic regulator. Now I turn to a more dynamic setting in which the staying power of a bank becomes important.

6.4 Staying Power of a Bank

The above analysis has focused on entry into banking markets. Now I extend this by allowing banks to exit the market. This brings new dynamics into the model. This affects banks' investments in monitoring and also their entry decision.

In particular, at $t = 1$ banks are subjected to a shock h with probability p. With probability $[1 - p]$ there is no shock. If the shock occurs, its size h is uniformly distributed at the interval $[0, H]$. If the shock occurs, a bank may still avoid the loss h by exiting the market. Hence, the bank weights the loss h of a shock with the expected profit if it continues with its operations. If the shock exceeds the bank's expected profit, the bank exits from the market. In this case, the bank avoids the shock h, but also does not obtain any profits.

I assume for simplicity that the conditions for borrowers do not change if their bank exits the market. That is, the borrowers' success probability continues to correspond to the monitoring technology of the initial bank. The borrower is simply transfered to another bank and it receives financing at the same conditions as agreed with its incumbent bank. I also assume that there is no competition for borrowers and that the market share of foreign banks m_F is lower than the market share of domestic banks m_D; that is, $m_F < m_D$ (similarly to in Section 6.3.1).

I can now prove the following lemma.

Lemma 6.2. *Smaller foreign banks exit more often than larger domestic banks.*

Lemma 6.2 stems from the fact that foreign banks expect lower profits than domestic banks because of their smaller market share. Consequently, a relatively small shock that has no influence on large domestic banks might force foreign banks to pull back from their investments abroad.

What Lemma 6.2 shows is that foreign banks are more affected by the exit possibility. In particular, small foreign banks face an additional disadvantage. Due to their small size, they are more prone to exit the banking system more often than large domestic banks. To gain staying power they must become sufficiently large.

The following proposition analyzes what impact the probability of exit has on the level of investment in monitoring.

Proposition 6.6. *A higher probability of a shock p raises the investment in monitoring technology if a shock is small ($H > \bar{H}$) but lowers the investment in monitoring technology if a shock is large ($H \leq \bar{H}$).*

This proposition stems from the following effect. If a small shock is expected, banks increase investments in monitoring technology and bank stability improves. That is, a small shock increases the value of monitoring; namely, banks with higher monitoring technology better defend against potential shock. In contrast, if a large shock occurs, banks are forced to exit regardless of their monitoring technology. If the bank exits, its investment in monitoring is useless. Hence, a higher probability of a large shock lowers bank monitoring.

Proposition 6.6 shows that the response of the bank to an increased probability of a shock crucially depends on the size of the shock. Leaning on Proposition 6.6, the regulators need not pay excessive attention to potential small shocks that may hamper bank assets. Even though a small shock might lower a bank's profitability, it increases investment in monitoring and bank stability. However, regulators should be more concerned if an expected shock is large. A large expected shock has two effects. First, if it occurs, it forces banks to exit. Second, banks that anticipate such a shock invest less in monitoring technology ex-ante. Hence, they become less stable even in the case of no shock.

I can now show the following result.

Proposition 6.7. *Increasing capital requirements augments the investment in monitoring technology if a shock is large ($H > \hat{H}$) and cost of monitoring is low ($c < \bar{c}$), but lowers the investment in monitoring if a shock is small ($H \leq \hat{H}$) and the cost of monitoring is high ($c \geq \bar{c}$).*

Increasing capital requirements has two opposite effects on monitoring incentives. The familiar effect is that higher capital requirements force banks to correctly price their risks and limit their reliance on deposit insurance. This effect increases the level of investment in monitoring technology. Yet, in the presence of the bank's exit option, an opposite effect of capital requirements is at work. Higher capital requirements hamper banks' profits, which in turn elevate the probability of exit. Banks expecting a higher probability of exit invest less in monitoring.

Two parameters determine whether the positive or negative effect of capital requirements on monitoring incentives prevails. First, if the expected shock to the bank's value is small ($H \leq \hat{H}$), the bank's decision to exit depends substantially on its expected profits. In this case, increasing capital requirements lowers banks' profits, augments exit, and also hampers investment in monitoring. Yet, if the expected shock to a bank's value is high ($H > \hat{H}$), a shock typically forces a bank to exit. Even though higher capital requirements hamper expected profits, this does not mainly influence the bank's exit decision. Hence, the negative effect of higher capital requirements on monitoring technology is limited and the positive effect prevails.

Second, if the cost of monitoring is low ($c < \bar{c}$), the positive effect of capital requirements on monitoring becomes more pronounced. Namely, banks respond more to higher capital requirements by increasing their monitoring levels. In contrast, if the cost of monitoring is high ($c \geq \bar{c}$), the bank's expected profit is low and the negative effect of capital requirements is at work. In particular, increasing capital requirements significantly lowers the value of the bank, which leads to more exit. A bank that anticipates a higher probability of exit invests less in monitoring. Consequently, increasing capital requirements results in less monitoring.

6.5 Conclusions

This chapter provides some key insights on the interplay between regulation and foreign entry. In particular, I show that opening up a weak banking sector leads to entry of strong foreign banks. Weak domestic banks may lose their market share, invest less in monitoring, and become riskier. Higher capital requirements induce foreign entry even further. Domestic banks may react to this. That is, they want to merge to gain scale advantages and prevent an influx of strong foreign banks.

I show also that higher capital requirements increase merger incentives. This is because higher capital requirements make investment in monitoring more valuable, which is exactly what merger brings.

I also allow for expropriation. In particular, the domestic regulator may act in favor of domestic banks and impose stricter regulation on foreign banks. I show that increasing capital requirements only for foreign banks may put them at a competitive disadvantage. They may lose market share, invest less in monitoring technology, and become riskier. However, domestic banks gain in that they face weaker competition. This helps them in preserving monitoring, and helps offset the potential adverse impact that cross border banking may have on a weak domestic banking system. As argued in Chapter 3 (see Section 3.7), just opening a domestic market to foreign competition might have severe adverse effects; acquisition of local players by foreign entrants might be preferred.

6.6 Appendix

Proof of Proposition 6.1

Note that all banks are (initially) of equal size. This implies that country O (with two banks) is twice as large as country A. In total there are 3 banks, each with $1/N = 1/3$ of total borrowers. I normalize the total borrowers (over the two countries) to one to provide symmetry with the earlier analysis.

Case 1: Proposition 3.1 establishes that banks do not gain market share from banks of equal type. This immediately implies that good banks in country O hold on to their market share. Banks do not change their levels of monitoring. To see this, note that, because there are only good banks in the market $\gamma = 1$, which implies that the optimal level of monitoring ν_G^* is not a function of q, see (3.9). One-sidedly opening up borders, however, increases the competition parameter in country O. This reduces the value of banks in country O; that is, observe that (3.17) is a decreasing function of competition parameter q, for $\gamma = 1$; that is,

$$\left.\frac{\partial V_G^*}{\partial q}\right|_{\gamma=1} = -\frac{1}{N}[-k + \frac{\nu_B X}{\rho}] + \frac{S}{\rho N} - \frac{1}{\rho N}[\underline{\nu}_G - \underline{\nu}_B]X - \frac{X^2}{2c[\rho N]^2}\{2[1-q]q + 2q\},$$

which is always negative (see that Assumption 3.1 guarantees that $S < [\underline{\nu}_G - \underline{\nu}_B]X$).

Case 2: Proposition 3.1 establishes that bad banks lose their market share to good banks. When the borders are closed, there are only bad banks in country O (i.e., $\gamma = 0$), and banks in country O invest $\nu_{BC}^* = X/c\rho N + \underline{\nu}_B$ (see (3.8)) in monitoring technology. After opening up borders, a bad bank in country O competes with equal probability with a good or bad bank; this means that $\gamma = 1/2$. Bad banks in country O now invest $\nu_{BO}^* = [1 - q/2]X/c\rho N + \underline{\nu}_B$. Thus, summarizing,

$$\nu_{BC}^* = X/c\rho N + \underline{\nu}_B, \quad \nu_{BO}^* = [1 - q/2]X/c\rho N + \underline{\nu}_B. \tag{6.7}$$

Observe that $\nu_{BO}^* < \nu_{BC}^*$. From (3.16) it follows that opening borders decreases the country O bank values V_B^* because V_B^* is decreasing in both q and γ; thus $V_{BO}^* < V_{BC}^*$. To compute the monitoring level of the good bank in country A before the borders of country O are opened, insert $\gamma = 1$ and $q = 0$ into (3.9) to obtain $\nu_{GC}^* = X/c\rho N + \underline{\nu}_G$. After borders are opened, the good bank has access to the borrowers from the bad banks in country O. Now $q > 0$ and $\gamma = 0$, and from (3.9) I have $\nu_{GA}^* = [1 + q]X/c\rho N + \underline{\nu}_G$. Summarizing,

$$\nu_{GC}^* = X/c\rho N + \underline{\nu}_G, \quad \nu_{GA}^* = [1 + q]X/c\rho N + \underline{\nu}_G. \tag{6.8}$$

■

Proof of Corollary 6.1

Use adapted versions of (3.7) to compute the values of the good bank in country A before (V_{GC}^*) and after (V_{GO}^*), when it gains access to country O. The adapted versions of (3.7) that take into account one-sided competition are

$$V_{GC}^* = \frac{-k + \nu_{GC}^* X/\rho}{N} - c\frac{[\nu_{GC}^* - \underline{\nu}_G]^2}{2} \tag{6.9}$$

and

$$V_{GA}^* = \frac{-k + \nu_{GA}^* X/\rho}{N} + \frac{q}{\rho N}\{-S + [\nu_{GA}^* - \nu_{BO}^*]X\} - c\frac{[\nu_{GA}^* - \underline{\nu}_G]^2}{2}. \tag{6.10}$$

Insert ν_{GA}^*, ν_{GC}^* and ν_{BO}^* from (6.7) and (6.8) into (6.9) and (6.10) to obtain

$$V_{GC}^* = \frac{-k + \underline{\nu}_G X/\rho}{N} + \frac{X^2}{2c\rho^2 N^2}, \tag{6.11}$$

and

$$V_{GA}^* = \frac{-k + \underline{\nu}_G X/\rho}{N} + \frac{[1+q]X^2}{c\rho^2 N^2} + \frac{q}{\rho N}\{-S + [\underline{\nu}_G - \underline{\nu}_B]X\} + \frac{3q^2X^2}{2c\rho^2N^2} - \frac{[1+q]^2X^2}{2c\rho^2N^2}. \tag{6.12}$$

Now compute the difference between (6.11) and (6.12) to see what the value of entering country O is to the bank in country A. This yields

$$V_{GA}^* - V_{GC}^* = \frac{q}{\rho N}\{-S + [\underline{\nu}_G - \underline{\nu}_B]X\} + \frac{q^2X^2}{c\rho^2N^2}.$$

which is always increasing in X and therefore also increasing in k. This completes the proof. ■

Proof of Corollary 6.2

Assume that the domestic banks behave in a closed domestic market as monopolists (i.e., $q = 0$). Merging then does not change the level of competition between domestic banks. Opening up the border increases q to the level $q_O > 0$. Note that allowing for competition between domestic banks has no qualitative impact; it simply elevates all values of q without changing the order. The investment in monitoring technology of a bad (B) merged (M) bank with open (O) borders is ν_{BOM}. The merged bank can defend its borrowers from an entering good bank if

$$[\nu_{GA}^* - \nu_{BOM}^*]X < S, \tag{6.13}$$

where ν_{BOM}^* follows from maximizing,

$$V_{BOM} = \frac{2[1-q]}{N}[-k + \frac{\nu_{BOM}X}{\rho}] + 2\frac{q}{\rho N}\{S + [\nu_{BOM}^* - \nu_{GC}^*]X\} - c\frac{[\nu_{BOM} - \underline{\nu}_B]^2}{2}, \tag{6.14}$$

and ν_{GA}^* and ν_{GC}^* are given in (6.8). Maximizing (6.14) w.r.t. ν_{BOM} yields

$$\nu_{BOM}^* = \frac{2X}{c\rho N} + \underline{\nu}_B. \tag{6.15}$$

Hence, the merged bank can defend its borrowers from an entering good bank if (insert (6.8) and (6.15) into (6.13))

$$[\underline{\nu}_G - \underline{\nu}_B]X - [1 - q_O]X^2/c\rho N < S. \tag{6.16}$$

The condition in (6.16) is satisfied for a low enough q_O because of the condition in (6.2). The left side of (6.16) is continuously increasing in q_O. Note from Assumption 3.1 that the condition in (6.16) is not satisfied for $q_O = 1$. Thus, there exists a $\hat{q}(S)$ such that the condition in (6.16) is satisfied for all q_O for which $q_O < \hat{q}(S)$. Note also that $\frac{\partial \hat{q}(S)}{\partial S} > 0$. This concludes the proof. ■

Proof of Corollary 6.3

For simplicity, it is assumed as in the proof of Corollary 6.2 that the domestic banks behave in a closed domestic market as monopolists (i.e., $q = 0$). Opening up the border increases q to the level $q_O > 0$. The value of each domestic bad bank when the border is opened and there is no merger is (see (3.7))

$$V_{BO} = \frac{1 - q_O}{N}[-k + \frac{\nu_{BO}X}{\rho}] - c\frac{[\nu_{BO} - \underline{\nu}_{BO}]^2}{2}. \tag{6.17}$$

Note that a bad bank loses its borrower to the good entering bank (this happens with probability q_O). Each bad domestic bank maximizes (6.17) by selecting the monitoring level $\nu_{BO} = \nu^*_{BO} = \frac{[1-q_O]X^2}{c\rho^2 N^2} + \underline{\nu}_B$ to obtain the value

$$V^*_{BO} = \frac{1 - q_O}{N}[-k + \frac{\underline{\nu}_B X}{\rho}] + \frac{[1 - q_O]^2}{2}\frac{X^2}{c\rho^2 N^2}. \tag{6.18}$$

Observe that the value of a merged bad bank facing $q = 0$ is

$$V_{BOM} = \frac{2}{N}[-k + \frac{\nu_{BOM}X}{\rho}] - c\frac{[\nu_{BOM} - \underline{\nu}_B]^2}{2}. \tag{6.19}$$

The situation is as follows. Assume (6.1) holds, and then a potential entrant will abstain from entering. To save on the entry cost, it will not even pose any competitive threat. Hence $q = 0$. The merged bank now maximizes (6.19) by investing $\nu_{BOM} = \nu^*_{BOM} = \frac{2X^2}{c\rho^2 N^2} + \underline{\nu}_B$. Inserting this into (6.19) yields

$$\frac{V^*_{BOM}}{2} = \frac{1}{N}[-k + \frac{\underline{\nu}_B X}{\rho}] + \frac{X^2}{c\rho^2 N^2}. \tag{6.20}$$

Compute the benefits of merging from (6.20) and (6.18) to obtain

$$MB_{BO} = \frac{V^*_{BOM}}{2} - V^*_{BO} = \frac{q_O}{N}[-k + \frac{\underline{\nu}_B X}{\rho}] + [1 - \frac{[1 - q_O]^2}{2}]\frac{X^2}{c\rho^2 N^2}. \tag{6.21}$$

If the borders are closed, the value of a bad bank is

$$V_{BC} = \frac{1}{N}[-k + \frac{\nu_{BC} X}{\rho}] - c\frac{[\nu_{BC} - \underline{\nu}_{BC}]^2}{2}. \tag{6.22}$$

The optimal monitoring is $\nu^*_{BC} = \frac{X}{c\rho N} + \underline{\nu}_B$. Insert this into (6.22) to get

$$V^*_{BC} = \frac{1}{N}[-k + \frac{\underline{\nu}_B X}{\rho}] + \frac{1}{2}\frac{X^2}{c\rho^2 N^2}. \tag{6.23}$$

The value of a merged bad bank is the same as given in (6.20). The benefits of merging are (use (6.23) and (6.20))

$$MB_{BC} = \frac{V^*_{BCM}}{2} - V^*_{BC} = \frac{1}{2}\frac{X^2}{c\rho^2 N^2}. \tag{6.24}$$

Compute the difference between (6.24) and (6.21) to obtain

$$MB_{BO} - MB_{BC} = \frac{V^*_{BCM}}{2} - V^*_{BC} = \frac{q}{N}[-k + \frac{\underline{\nu}_B X}{\rho}] + \frac{1 - [1 - q_O]^2}{2}\frac{X^2}{c\rho^2 N^2}. \tag{6.25}$$

Note that (6.25) is always positive. Thus, for bad banks merging is more beneficial when borders are opened.

In the case of good domestic banks, opening up borders has no impact. The entry cost together with anticipating zero market share prevents entry even without a merger, and hence there is no valuation impact. This concludes the proof. ■

Proof of Corollary 6.4

Differentiate (6.24) with respect to k to obtain

$$\frac{\partial MB_{BC}}{\partial k} = \frac{r_D X}{c\rho^2 N^2}, \tag{6.26}$$

which is positive. Note also that the derivative of (6.21) with respect to k is positive. This concludes the proof. ■

Proof of Proposition 6.2

The entering bank only knows its type once it has entered. If it is bad, it cannot win any borrowers because of the incumbency disadvantage and its value is zero. If it turns out to be good, its only possibility is to attract borrowers from bad banks. Its value is (use (3.7))

$$V_{G,\text{late}} = \frac{q[1-\gamma]}{\rho N}\{-S + [\nu_{G,\text{late}} - \nu^*_B]X\} - c\frac{[\nu_{G,\text{late}} - \underline{\nu}_G]^2}{2}. \tag{6.27}$$

The first part in (6.27) represents the profits from the borrowers that the entering bank takes in expectation from bad banks (see (3.6)). The entering bank competes with a bad bank w.p. $q[1-\gamma]$. Maximizing (6.27) yields

$$\nu^*_{G,\text{late}} = q[1-\gamma]X/c\rho N + \underline{\nu}_G. \tag{6.28}$$

Now I show that the late entrant bank conditional on being good can overcome the incumbency advantage of the existing bad banks. For this one needs $[\nu^*_{G,\text{late}} - \nu^*_B]X > S$. Use (3.8) and (6.28) to obtain

$$[\underline{\nu}_G - \underline{\nu}_B]X > S + [1-q]X^2/c\rho N. \tag{6.29}$$

Note that (6.2) assures that (6.29) is satisfied. Insert (3.8) and (6.28) into (6.27) to obtain

$$V^*_{G,\text{late}} = \frac{q[1-\gamma]}{\rho N}\{-S + [\underline{\nu}_G - \underline{\nu}_B]X\} - \frac{q[1-\gamma][2-q-q\gamma]X^2}{2c\rho^2 N^2}. \tag{6.30}$$

The expected value of the bank prior to entering is

$$V^*_{\text{late}} = \gamma \times 0 + [1-\gamma] \times V^*_{G,\text{late}}. \tag{6.31}$$

Use (6.27) to write (6.31) as

$$V^*_{\text{late}} = \frac{q\gamma[1-\gamma]}{\rho N}\left\{-S + [\underline{\nu}_G - \underline{\nu}_B]X - \frac{[2-q-q\gamma]X^2}{2c\rho N}\right\}. \tag{6.32}$$

Observe that (6.32) is zero for $q = 0$. The expression in (6.32) is continuous and increasing in q. Use Assumption 3.1 to see that the expression in curly brackets is strictly positive for $q = 1$. Thus late entry only occurs for a sufficiently high q and an entry cost sufficiently small. In addition, it readily follows that (6.32) is maximized at an interior γ, and that for a sufficiently small entry cost and sufficiently high q, late entry is observed for $\gamma \in [\underline{\gamma}, \bar{\gamma}]$. ■

Proof of Corollary 6.5

Differentiate (6.32) w.r.t. k to obtain

$$\frac{\partial V^*_{\text{late}}}{\partial k} = \frac{q\gamma[1-\gamma]r_D}{\rho N}\left\{\underline{\nu}_G - \underline{\nu}_B - \frac{[2-q-q\gamma]X}{c\rho N}\right\}. \tag{6.33}$$

If late entry occurs, $V^*_{\text{late}} > 0$. Observe from (6.32) that this implies that

$$[\underline{\nu}_G - \underline{\nu}_B]X - \frac{[2-q-q\gamma]X^2}{2c\rho N} > 0. \tag{6.34}$$

The expression (6.34) guarantees that, if late entry occurs, (6.33) is positive. Because late entry is more profitable, the value of late entry (6.32) surpasses the entry cost for a larger range of parameter values, thus, $\frac{\partial \underline{\gamma}}{\partial k} < 0$ and $\frac{\partial \bar{\gamma}}{\partial k} > 0$. ■

Proof of Lemma 6.1

This proof follows the proof of Proposition 3.6 in Chapter 3 and is omitted. ■

Proof of Proposition 6.3

This proof follows the proof of Proposition 3.6 in Chapter 3 and is omitted. ■

Proof of Proposition 6.4

I first conjecture that domestic banks take borrowers from foreign banks but neither domestic nor foreign banks can take borrowers from banks of the same type. Conditional on the fact that foreign banks obtain borrowers from foreign banks but not from domestic banks, their profits are

$$V_F = m_F[1-q][-k+\frac{\nu_F X}{\rho}] + m_F\frac{q}{\rho}[1-\gamma]\{S+[\nu_F-\nu_F^*]X\} - c\frac{\nu_F^2}{2}. \tag{6.35}$$

Maximization with respect to ν_F yields

$$\frac{\partial V_F}{\partial \nu_F} = \{m_F[1-q]+m_F q[1-\gamma]\}\frac{X}{\rho} - c\nu_F = 0. \tag{6.36}$$

Solve (6.36) to obtain (6.3).

Conditional on the fact that domestic banks obtain borrowers from foreign banks but not from domestic banks, their profits are

$$\begin{aligned} V_D &= m_D[1-q][-k+\frac{\nu_D X}{\rho}] + m_D\frac{q}{\rho}\gamma\{S+[\nu_D-\nu_D^*]X\} + m_D\frac{q}{\rho}[1-\gamma]\{S+[\nu_D-\nu_F^*]X\} \\ &\quad + m_F\frac{q}{\rho}[1-\gamma]\{-S+[\nu_D-\nu_F^*]X\} - c\frac{\nu_D^2}{2}. \end{aligned} \tag{6.37}$$

Maximization with respect to ν_D yields

$$\frac{\partial V_D}{\partial \nu_D} = \{m_D[1-q]+m_D q\gamma + m_D q[1-\gamma] + m_F q[1-\gamma]\}\frac{X}{\rho} - c\nu_D = 0. \tag{6.38}$$

Solve (6.38) to obtain (6.4).

Now, I show that a conjecture that domestic banks cannot take borrowers in competition with another domestic bank is satisfied as long as $S > \frac{m_D^2 X^2}{2c\rho}$. To prove this, it is enough to prove that a domestic bank does not deviate to higher monitoring levels when surrounded only by domestic banks and where competition is high (i.e., $\gamma = 1$ and $q = 1$). Observe that the value of a deviating bank is

$$\hat{V}_D = \frac{m_D}{\rho}\{S+[\hat{\nu}_D-\nu_D^*]X\} + \frac{q_D}{\rho}\{-S+[\hat{\nu}_D-\nu_D^*]X\} - c\frac{\nu_D^2}{2}. \tag{6.39}$$

Maximize (6.39) with respect to $\hat{\nu}_D$ to obtain

$$\hat{\nu}_D^* = \frac{2m_D X}{c\rho}. \tag{6.40}$$

Compute the difference between value of a deviating and non-deviating domestic bank to obtain

$$\hat{V}_D(\hat{\nu}_D^*) - V_D(\nu_D^*) = \frac{m_D^2 X^2}{2c\rho^2} - S\frac{m_D}{\rho^2}. \tag{6.41}$$

If $S > \frac{m_D^2 X^2}{2c\rho}$, (6.41) is negative and a domestic bank never deviates to win a borrower in competition with another domestic bank.

Now I show that, for $S < \frac{m_D^2 X^2}{c\rho}$, there exists a $\hat{m}_F$ such that for $m_F < \hat{m}_F$ a foreign bank loses its borrower in competition with a domestic bank. I prove this by showing that deviation from (6.3) to higher monitoring levels to defend borrowers is not profitable. A foreign bank that defends its borrower in competition with domestic banks has the following profits:

$$\hat{V}_F = m_F[1-q][-k+\frac{\hat{\nu}_F X}{\rho}] + m_F[1-\gamma]\frac{q}{\rho}\{S+[\hat{\nu}_F - \nu_F^*]X\} + m_F\gamma\frac{q}{\rho}\{S+[\hat{\nu}_F - \nu_D^*]X\} - c\frac{\hat{\nu}_F^2}{2}. \tag{6.42}$$

The value of monitoring that maximizes (6.42) is given as

$$\hat{\nu}_F^* = \frac{m_F X}{c\rho}. \tag{6.43}$$

A deviating foreign bank obtains an additional return on borrowers for which it competes with domestic banks:

$$\gamma\frac{q}{\rho}\{S + [\hat{\nu}_F^* - \nu_D^*]X\}. \tag{6.44}$$

Note, however, that

$$S + [\hat{\nu}_F^* - \nu_D^*]X = S - \frac{m_D X^2}{c\rho} + \frac{[1-q]m_F X^2}{c\rho}. \tag{6.45}$$

Note that there exists a sufficiently small $\hat{m}_F$, such that for $m_F < \hat{m}_F$ the expression in (6.45) is negative. This concludes the proof. ■

Proof of Proposition 6.4

I first conjecture that domestic banks take borrowers from foreign banks but neither domestic nor foreign banks can take borrowers from banks of the same type. Later I confirm that these conjectures are true. I define $X_F = Y - [1-k_F]r_D$ and $X_D = Y - [1-k_D]r_D$. Conditional on the fact that foreign banks obtain borrowers from foreign banks but not from domestic banks, their profits are

$$V_F \quad = \quad \frac{1-q}{N}[-k + \frac{\nu_F X_F}{\rho}] + \frac{q}{\rho N}[1-\gamma]\{S + [\nu_F - \nu_F^*]X_F\} - c\frac{\nu_F^2}{2}. \tag{6.46}$$

Maximization with respect to ν_F yields

$$\frac{\partial V_F}{\partial \nu_F} = [1-q\gamma]\frac{X_F}{\rho N} - c\nu_F = 0. \tag{6.47}$$

Solve (6.47) to obtain (6.5).

Conditional on the fact that domestic banks obtain additional borrowers from foreign banks but not from domestic banks, their profits are

$$\begin{aligned} V_D &= [1-q][-k+\frac{\nu_D X_D}{\rho N}] + \frac{q}{\rho N}\gamma\{S+[\nu_D-\nu_D^*]X_D\} + \frac{q}{\rho N}[1-\gamma]\{S-k_D+k_F \\ &\quad +\nu_D X_D - \nu_F^* X_F\} + \frac{q}{\rho N}[1-\gamma]\{-S-k_F+k_D+\nu_D X_D-\nu_F^* X_F\} - c\frac{\nu_D^2}{2}. \quad (6.48) \end{aligned}$$

Maximization with respect to ν_D yields

$$\frac{\partial V_D}{\partial \nu_D} = \{1-q+q\gamma+q[1-\gamma]+q[1-\gamma]\}\frac{X_D}{\rho N} - c\nu_D = 0. \quad (6.49)$$

Solve (6.49) to obtain (6.6). The following condition assures that ν_D is lower than 1:

$$\frac{2Y}{c\rho N} < 1. \quad (6.50)$$

A conjecture that domestic banks cannot take borrowers in competition with another domestic bank is satisfied as long as $S > \frac{Y^2}{2c\rho}$ (see the proof of Proposition 6.4). Now I show that, for $S < \frac{[Y-r_D]^2}{c\rho}$, there exists a $\hat{k}_F$ such that for $k_F > \hat{k}_F$ a foreign bank loses its borrower in competition with a domestic bank. I will prove this by showing that deviation from (6.5) to higher monitoring levels to defend borrowers is not profitable. A foreign bank that defends its borrower in competition with domestic banks has the following profits:

$$\hat{V}_F = \frac{1-q}{N}[-k+\frac{\hat{\nu}_F X}{\rho}]+[1-\gamma]\frac{q}{\rho N}\{S+[\hat{\nu}_F-\nu_F^*]X_F\}+\gamma\frac{q}{\rho N}\{S-k_F+k_D\hat{\nu}_F X_F-\nu_D^* X_D\}-c\frac{\hat{\nu}_F^2}{2}. \quad (6.51)$$

The value of monitoring that maximizes (6.51) is given as

$$\hat{\nu}_F^* = \frac{m_F X_F}{c\rho}. \quad (6.52)$$

A deviating foreign bank obtains an additional return DF on borrowers for which it competes with domestic banks:

$$DF = \gamma\frac{q}{\rho}\{S-k_F+k_D+\hat{\nu}_F^* X_F - \nu_D^* X_D\}. \quad (6.53)$$

Note that the condition in (6.50) guarantees that $\frac{\partial DF}{\partial k_F} = -1 + \frac{2X_F r_D}{N\rho} < 0$. Note that in extreme cases where $k_F = 1$ and $k_D = 0$

$$S-k_F+k_D+\hat{\nu}_F^* X_F-\nu_D^* X_D = S+\frac{Y^2}{c\rho N}-\frac{[1+q][Y-r_D]^2}{c\rho} < 0. \quad (6.54)$$

Note that there exists a sufficiently small $\hat{m}_F$, such that for $m_F < \hat{m}_F$ the expression in

(6.45) is negative. This concludes the proof. ■

Proof of Lemma 6.2
At $t = 1$ the cost of investment in monitoring is already sunk. The expected profits conditional on the absence of a shock are

$$\Pi_\tau(t = 1) = m_\tau[-k + \frac{\nu_\tau X}{\rho}] \text{ for } \tau \in \{F, D\}. \tag{6.55}$$

However, with probability $[1 - m]$ a shock f occurs. Note that for a foreign bank $\Pi_F(t = 1) = m_F[-k + \frac{\nu_F X}{\rho}]$ and for a domestic bank $\Pi_D(t = 1) = m_D[-k + \frac{\nu_D X}{\rho}]$. Both $m_D > m_F$ and $\nu_D > \nu_F$. Hence, $\Pi_D(t = 1) > \Pi_F(t = 1)$. Hence, probability that h exceeds Π_D is lower than probability that h exceeds Π_F. This concludes the proof. ■

Proof of Proposition 6.6
Conditional on a presence of a shock, bank profits are

$$\int_0^{\Pi(t=1)} \frac{[\Pi(t = 1) - h]}{H} \mathrm{d}h = \frac{\Pi(t = 1)}{2}. \tag{6.56}$$

Combine (6.56) and (6.55) to obtain the expected profit of a bank before investing in the monitoring technology (at $t = 0$):

$$\Pi_F = [1 - p]m_F[-k + \frac{\nu_F X}{\rho}] + p\frac{m_F^2[-k + \frac{\nu_F X}{\rho}]^2}{2H} - \frac{c\nu_F^2}{2}. \tag{6.57}$$

Maximize (6.57) w.r.t. ν_F to obtain

$$\frac{\partial \Pi_F}{\partial \nu_F} = [1 - p]\frac{m_F X}{\rho} + p[-k + \frac{\nu_F X}{\rho}]\frac{m_F^2 X}{\rho H} - c\nu_F = 0 \tag{6.58}$$

Solve for ν_F to obtain

$$\nu_F^* = \frac{[1 - p - \frac{m_F pk}{H}]m_F X}{\rho[c - \frac{pm_F^2 X^2}{\rho^2 H}]}. \tag{6.59}$$

Rearrange (6.59) to obtain

$$\nu_F^* = \frac{\rho k}{X} + \frac{[1 - p - \frac{ck\rho^2}{m_F X^2}]}{c - \frac{pm_F^2 X^2}{\rho^2 H}}\frac{m_F X}{\rho}. \tag{6.60}$$

Observe that for high H one has $\frac{\partial \nu_F}{\partial p} < 0$ and for low H one has $\frac{\partial \nu_F}{\partial p} > 0$. ■

Proof of Proposition 6.7
Use (6.60) to observe that $\frac{\partial \nu_F}{\partial k} < 0$ for high c and for low H. Also note that that $\frac{\partial \nu_F}{\partial k} > 0$ for low c and for high H.

■