Takeovers of Foreign Banks: A Supervisory Perspective

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Abstract

This paper investigates the determinants of the takeover of a foreign bank by a domestic bank, whereby the former becomes a branch of the latter, and its welfare e¤ects for both the domestic and the foreign country. The analysis is based on a model of a bank that is supervised by an agency that cares about closure costs plus deposit insurance payouts. The agency uses supervisory information to decide on the early closure of the bank. Under the principle of home country control, the takeover moves responsibility for both supervision of the foreign branch and insurance of the foreign deposits to the domestic country. It is shown that the takeover is more likely to happen if the foreign bank is small (relative to the foreign market) and if its investments are riskier than those of the domestic bank. Moreover, the takeover (whenever it happens) is in general welfare improving for both countries.

Keywords: international banks, takeovers in banking, cross-border bank mergers, bank supervision, bank closure, deposit insurance, home country control.

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1 Introduction

During the 1990's a very large process of banking consolidation has taken place in both Europe and the United States. Although most of the action so far has occurred within the domestic markets, there have been a significant number of cross-border mergers. This process is expected to accelerate in the near future. In particular, many analysts seem to believe that (especially in Europe) large banks have no choice but to pursue cross-border merger strategies.

The purpose of this paper is to investigate the determinants of the takeover of a foreign bank by a domestic bank, and its welfare effects for both the domestic and the foreign country. The main result of the paper is that the takeover is more likely to happen if the foreign bank is small (relative to the foreign market) and if its investments are riskier than those of the domestic bank. In addition, the takeover (whenever it happens) is in general welfare improving for both countries.

The theoretical literature on this area is very small. In the case of domestic bank mergers, the three main motives discussed in the literature are economies of scale and scope (including "too big to fail" economies of scale), increases in market power, and risk diversification. Of these reasons, the first two are probably not very relevant for cross-border mergers. Economies of scale and scope have been empirically difficult to find for large domestic banks, and the synergies are likely to be much smaller in the case of cross-border deals. On the other hand, the takeover of a foreign bank does not increase marker power in either the domestic or the foreign market. So it seems that in order to explain international takeovers in banking one should focus on the risk diversification motive.

In order to assess the importance of this motive one should note that banks are no ordinary firms. In particular, they have to be licensed by a competent authority, they are subject to strict capital requirements, and some of their liabilities are insured. Moreover, they are supervised by some government agency (which may or may not be the central bank). In this paper we argue that a proper understanding of the risk diversification motive for international takeovers in banking requires taking into account the regulatory and supervisory framework that characterizes the activity of banks.

International banks have two modes of operation in host countries. They can operate via branches (which form a legally dependent part of the home institution) or via subsidiaries (which are separate foreign banks owned by the home institution). According to the Core Principles for Effective Banking Supervision (Basle Committee on Banking Supervision, 1997) the home supervisor should be in charge of the consolidated supervision of their international banks, including overseas branches and subsidiaries. However, the host supervisor is also involved in the case of subsidiaries, since a subsidiary is a registered bank in the host country.

When the international bank owns a subsidiary in a host country, its deposits in this country are insured according to the host country regulation. The situation with regard to deposit insurance is less clear when the international bank opens a branch in a host country. Usually, host authorities require the international bank's deposits in the host country to be covered by the same guarantees as the deposits of domestic banks. For instance, the 1994 European Directive on deposit-guarantee schemes establishes that "each Member State shall ensure that within its territory one or more deposit-guarantee schemes are introduced and officially recognized" (art. 3), and that "deposit-guarantee schemes... shall cover the deposits at branches set up by credit institutions in other Member States" (art.4).

In this paper we restrict attention to takeovers of a foreign bank by a domestic bank in which the former becomes a branch of the latter whose deposits (like in the European context) are insured by the domestic deposit insurance agency. The analysis is based on a model of a bank that is supervised by an agency that cares about closure costs plus deposit insurance payouts. The agency uses supervisory information (which provides a signal of the future return of the bank's assets) to decide on the early closure of the bank. Under the principle of home country control, the takeover moves responsibility for supervision of the foreign branch to the domestic country.

In deciding whether to close the bank (i.e. revoke its license to operate) the supervisor compares the current costs of closing the bank with the expected future costs of a bank failure. Since the returns of the domestic and the foreign assets are not perfectly correlated, the takeover increases the current costs by more than the expected future costs. Hence diversification makes the domestic supervisor softer with the international bank than with the original domestic bank. This effect leads to a more than proportional increase in the market value of the domestic bank (which depends on the probability that the bank will remain open). A takeover will then take place if this increase in the market value of the domestic bank is greater than the market value of the foreign bank. This will be the case when the foreign bank is a small bank in the foreign country (so it is not "too big to fail"), and/or its investments are riskier than those of the domestic bank (so the takeover effectively increases the probability that these riskier returns will be realized).

Since depositors are assumed to be fully insured, it follows that domestic (foreign) social welfare prior to the takeover is simply the sum of the market value of the domestic (foreign) bank and the expected utility of the domestic (foreign) supervisor. In the case of the foreign country, the owners of the foreign bank are compensated by the owners of the domestic bank (otherwise they would not be willing to sell), so a sufficient condition for the takeover to be welfare improving is that it increases the expected utility of the foreign supervisor. This will obtain whenever the foreign deposit insurance premium is below its fair level (in particular, for large and/or risky foreign banks). As for the domestic country, it is also the case that a sufficient condition for a welfare gain is that it increases the expected utility of the domestic supervisor, which will typically happen as a result of the diversification of the returns of the bank.

The paper is organized as follows. Section 2 presents the model of the domestic and the foreign bank and characterizes the closure policies of domestic and the foreign supervisor. Section 3 assumes that the domestic bank buys the foreign bank, and characterizes the closure policy of the domestic supervisor with regard to the international bank. Section 4 discusses the effects of the takeover on the probability of bank failures. Section 5 analyzes the determinants of international takeovers (in particular under what conditions the market value of the international bank will be greater than the sum of the market values of the domestic and the foreign bank). Section 6 looks at the welfare effects of the takeover for the domestic and the foreign country. Finally, Section 7 offers a few concluding remarks.

2 The Model

2.1 The Domestic Bank

Consider a discrete time, infinite horizon model of a bank that receives from a government agency a license to operate at an initial date $t = 0$. The agency supervises the bank and has the authority to withdraw the license and close the bank at any date. This will happen when either the bank is revealed to be insolvent, that is when the value of its assets is smaller than the value of its deposits, or when the agency observes some negative information about the future return of the bank's assets.

At any date $t = 0, 1, 2, \ldots$ in which it remains open, the bank raises an amount of deposits which is normalized to 1. These funds are invested in an asset that yields an iid random return $\tilde{R}$ at date $t + 1$. It is assumed that

$$\tilde{R} = \begin{cases} R, & \text{with probability } p \\ 0, & \text{with probability } 1 - p \end{cases}, \tag{1}$$

where $E(\tilde{R}) = pR > 1$. The asset can also be liquidated at the intermediate date $t + \frac{1}{2}$. The liquidation value of the asset is $L \in (0, 1)$.

Deposits pay an interest rate that is normalized to zero, and are fully insured by a deposit insurance corporation. The corporation charges a flat-rate deposit insurance premium ϕ. This premium is paid at date t by the owners of the bank. To simplify the presentation, we assume that, apart from this payment, the bank owners do not contribute any additional funds, so the investment in the risky asset is equal to the amount of deposits.

After the investment is made, the supervisory agency observes at date $t + \frac{1}{2}$ a signal $s \in [0, 1]$ that contains information about $\tilde{R}$. In particular, it is assumed that

$$\tilde{R} \mid s = \begin{cases} R, & \text{with probability } s \\ 0, & \text{with probability } 1 - s \end{cases}. \tag{2}$$

From the point of view of date t the supervisory information is a random variable $\tilde{s}$, with cumulative distribution function $F(s)$ and density function $f(s)$. Notice that for (2) to be consistent with (1) we require $E(\tilde{s}) = \int_0^1 s \, dF(s) = p$.

Following the observation of the signal s, the supervisor decides whether to close the bank or leave it open. We assume that the supervisor is risk neutral and that her objective function coincides with that of the deposit insurance corporation, namely to minimize expected total costs.[1] These costs comprise the compensation paid to depositors as well as a closure cost c that captures the negative externalities associated with a bank failure (in particular, via contagion to other banks).

According to this, if the bank is closed at date $t + \frac{1}{2}$ the supervisor incurs a total cost $1 - L + c$, where $1 - L$ is the net payment to depositors (recall that the liquidation value of the asset is L), and c is the closure cost. On the other hand, if the bank stays open it will fail with probability $1 - s$, in which case the supervisor incurs a total cost $1 + c$.[2] Hence the supervisor's policy is to close the bank if

$$1 - L + c < (1 - s)(1 + c).$$

Solving for s in this expression gives the following result.

Proposition 1 There exists a critical value

$$\hat{s} = \frac{L}{1 + c}, \tag{3}$$

such that the supervisor will close the bank at date $t + \frac{1}{2}$ if $s < \hat{s}$.

It should be noticed that the critical value $\hat{s}$ is increasing in L and decreasing in c. This means that the supervisor will be softer with banks which have lower liquidation values, and with banks whose failure entails large closure costs. Since one would expect large banks to be characterized by large c's,[3] this implies a "too big to fail" result: large banks would be treated by the supervisor with more leniency than smaller banks.

The probability that the bank will be closed by the supervisor at date $t + \frac{1}{2}$ is given by

$$z_0 = \Pr(s < \hat{s}) = F(\hat{s}). \tag{4}$$

Similarly, the probability that the bank will fail at date $t + 1$ is

$$z_1 = \Pr(s \geq \hat{s} \text{ and } \tilde{R} = 0) = \Pr(\tilde{R} = 0 \mid s \geq \hat{s}) \Pr(s \geq \hat{s}) = \int_{\hat{s}}^{1} (1 - s)\, dF(s). \tag{5}$$

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[1] This corresponds to what Mailath and Mester (1994) called a "cost-minimizing regulator."

[2] Notice that we are implicitly assuming that the supervisor is "myopic" in that she does not take into account the future costs associated with keeping the bank open. We will come back to this issue below.

[3] Recall that the volume of deposits is normalized to 1, so this is equivalent to saying that closure costs increase more than proportionately with the size of the bank's balance sheet.

From (4) and (5) it follows that the probability that the bank will be closed at date $t + \frac{1}{2}$ or fail at date $t + 1$ is

$$z_0 + z_1 = 1 - \int_{\hat{s}}^{1} s \, dF(s).$$

Using these expressions we can compute the effect on these probabilities of an increase in the critical value $\hat{s}$ that characterizes the closure policy of the supervisor.

$$\frac{dz_0}{d\hat{s}} = f(\hat{s}) > 0; \quad \frac{dz_1}{d\hat{s}} = -(1 - \hat{s}) f(\hat{s}) < 0; \quad \frac{d(z_0 + z_1)}{d\hat{s}} = \hat{s} f(\hat{s}) > 0.$$

Hence a tougher closure policy increases the probability that the bank will be closed at date $t + \frac{1}{2}$, and decreases the probability that the bank will fail at date $t + 1$. Moreover, the first effect is larger than the second, so the probability $1 - z_0 - z_1$ that the bank owners will receive the return $R - 1$ at date $t + 1$ is decreasing in $\hat{s}$.

Under risk neutrality, the market value of the bank at any date t in which it remains open, denoted by V, satisfies the equation

$$V = -\phi + (1 - z_0 - z_1)(R - 1 + V).$$

The first term in the right hand side is the deposit insurance premium paid by the bank owners at date t, and the second term is their expected return at date $t+1$: with probability $z_0 + z_1$ they will get 0 and lose the bank's license, and with probability $1 - z_0 - z_1$ they will get $R - 1$ plus the value V of the bank at date $t + 1$. Solving for V in this equation then gives

$$V = \frac{(1 - z_0 - z_1)(R - 1) - \phi}{z_0 + z_1}. \tag{6}$$

Notice that V is the value of the bank's charter (the net present value of the rents that the bank owners will obtained as long as the bank stays open), which in this model is endogenous.[4]

Similarly, the discounted expected utility of the supervisor at any date t in which the bank remains open, denoted by U, satisfies the equation

$$U = \phi - z_0(1 - L + c) - z_1(1 + c) + (1 - z_0 - z_1)U.$$

[4] This approach to endogenizing charter values is taken from Suarez (1994). On the role of charter values in banking see also Keeley (1990).

The first term in the right hand side is the deposit insurance premium paid by the bank owners at date t, the second term is the expected total cost incurred by the supervisor if she closes the bank at date $t+\frac{1}{2}$, the third term is her expected total cost if the bank fails at date $t+1$, and the last term takes into account that fact that with probability $1-z_0-z_1$ the bank will stay open and the supervisor will get the discounted expected utility U. Solving for U in this equation then gives

$$U=\frac{\varphi-z_0(1-L+c)-z_1(1+c)}{z_0+z_1}=\frac{\varphi-z_0(1-L)-z_1}{z_0+z_1}-c. \qquad (7)$$

The deposit insurance premium φ is said to be "fair" if it is equal to the expected compensation paid to depositors, that is if

$$\varphi=z_0(1-L)+z_1.$$

Notice that, by (7), in the case of fair premia the discounted expected utility of the supervisor is simply $-c$.

However, in the real world deposit insurance premia are not typically fair. Rather, they are set with reference to the average riskiness of the banks in the country, so riskier banks will in fact be subsidized by safer banks. For this reason, in the analysis that will be carried out below we will assume that φ is a constant.

So far we have implicitly assumed that the supervisor is "myopic" in that she does not take into account the future costs associated with keeping the bank open. If the supervisor were non-myopic, its discounted expected utility would be

$$U'=\varphi-E[\min\{1-L+c,(1-s)(1+c)-sU'\}].$$

From here it follows that the critical value below which the supervisor closes the bank would become

$$\hat{s}'=\frac{L}{1+c+U'}.$$

Let z_0' and z_1' denote the corresponding probabilities that the bank will be closed by the supervisor at date $t+\frac{1}{2}$ and fail at date $t+1$, respectively. Then it is immediate to show that

$$U'=\frac{\varphi-z_0'(1-L)-z_1'}{z_0'+z_1'}-c.$$

Hence in the case of fair premia we would have $U'=-c$ and $\hat{s}'=L$. On the other hand, if the deposit insurance premium is set to cover also the closure costs, so $U'=0$, we would have $\hat{b}' = \hat{b}$. At any rate, in what follows we will continue to assume that the supervisor is myopic.

Since the depositors are fully insured, they always get 0 in net terms, so in our model social welfare, denoted by W, is simply the sum of the expected utilities of the bank owners and the supervisor, that is

$$W = V + U. \tag{8}$$

We will use this expression in Section 6 in order to assess the welfare effects for the domestic country of a takeover of a foreign bank by the domestic bank.

2.2 The Foreign Bank

Consider now a foreign bank that at any date $t = 0, 1, 2, \ldots$ in which it remains open raises an amount λ of deposits. We assume that $\lambda < 1$, so the foreign bank is smaller than the domestic bank. These funds are invested in a foreign asset that yields an iid random return $\lambda \tilde{R}^*$ at date $t+1$. As before, it is assumed that

$$\tilde{R}^* = \begin{cases} R^*, & \text{with probability } p^* \\ 0, & \text{with probability } 1 - p^* \end{cases}, \tag{9}$$

where $E(\tilde{R}^*) = p^* R^* > 1$. Moreover, $\tilde{R}^*$ and $\tilde{R}$ are independent. The foreign asset can be liquidated at date $t + \frac{1}{2}$, and its liquidation value is $\lambda L^* \in (0, \lambda)$.

Foreign deposits pay an interest rate that is normalized to zero, and are fully insured by a foreign deposit insurance corporation. The corporation charges a flat-rate deposit insurance premium ϕ^* per unit of deposits. As in the case of the domestic bank, we assume that the premium $\lambda \phi^*$ is paid at date t by the owners of the foreign bank.

There is a foreign supervisor that observes at date $t + \frac{1}{2}$ a signal $s^* \in [0, 1]$ that contains information about $\tilde{R}^*$. In particular, it is assumed that

$$\tilde{R}^* \mid s^* = \begin{cases} R^*, & \text{with probability } s^* \\ 0, & \text{with probability } 1 - s^* \end{cases}. \tag{10}$$

From the point of view of date t the supervisory information is a random variable $\tilde{s}^*$, with cumulative distribution function $F^*(s^*)$ and density function $f^*(s^*)$.[5]

[5] Notice that since $\tilde{R}^*$ and $\tilde{R}$ are independent, it must be the case that $\tilde{s}^*$ and $\tilde{s}$ are also independent.

After observing the signal s^*, the foreign supervisor decides whether to close the bank or leave it open. Assuming, as before, that the supervisor is risk neutral and that her objective function coincides with that of the deposit insurance corporation, we could follow the same steps as in the previous section to prove the analogue of Proposition 1, which defines a critical value

$$\hat{s}^* = \frac{L^*}{1 + c^*} \tag{11}$$

below which the foreign supervisor would close the bank.

As in the case of the domestic bank, we can compute the probability that the foreign bank will be closed at date $t + \frac{1}{2}$

$$z_0^* = \Pr(s^* < \hat{s}^*) = F^*(\hat{s}^*), \tag{12}$$

and the probability that the bank will fail at date $t + 1$

$$z_1^* = \Pr(s^* \geq \hat{s}^* \text{ and } \tilde{R}^* = 0) = \int_{\hat{s}^*}^{1} (1 - s^*)\, dF^*(s^*). \tag{13}$$

The market value of the foreign bank at any date t in which it remains open, denoted by V^*, is then given by

$$V^* = \frac{\lambda[(1 - z_0^* - z_1^*)(R^* - 1) - \varphi^*]}{z_0^* + z_1^*}, \tag{14}$$

Similarly, the discounted expected utility of the foreign supervisor, denoted by U^*, is

$$U^* = \frac{\lambda[\varphi^* - z_0^*(1 - L^*) - z_1^*]}{z_0^* + z_1^*} - \lambda c^*. \tag{15}$$

Hence foreign social welfare, denoted by W^*, is given by

$$W^* = V^* + U^*. \tag{16}$$

This expression will be used in Section 6 to assess the welfare effects for the foreign country of a takeover of the foreign bank by the domestic bank.

3 The International Bank

In this section we suppose that the domestic bank buys the foreign bank, which now becomes a branch (not a subsidiary) of the domestic bank. The resulting international bank raises 1 unit of deposits in the domestic market and λ units in the foreign market at each date t in which it remains open. These funds are invested in a portfolio of domestic and foreign assets that yields a random return $\tilde{R} + \lambda \tilde{R}^*$ at date $t + 1$. If the bank is liquidated at date $t + \frac{1}{2}$ the liquidation value of the bank's portfolio is $L + \lambda L^*$.

The final return of the international bank at date $t + 1$ can then take four values: $R + \lambda R^*$, R, λR^*, and 0. Clearly we have $R + \lambda R^* > R > 0$ and $R + \lambda R^* > \lambda R^* > 0$, but in principle we could have $R \gtrless \lambda R^*$. In what follows we will assume that λ is small enough so as to ensure that

$$R \geq 1 + \lambda > \lambda R^*. \tag{17}$$

This means that the international bank will fail at date $t + 1$ if and only if its investments in the domestic country do not succeed.

Under the assumption of home country control, the domestic authorities supervise the international bank and insure all its deposits (including the foreign deposits). Furthermore, we assume that the domestic deposit insurance corporation charges the international bank the same premium π per unit of deposits than it charged the domestic bank. The rationale for this assumption is that the takeover of the foreign bank by the domestic bank may not significantly affect the average riskiness of the banks based in the domestic country.[6] As before, the premium $(1 + \lambda)\pi$ is paid at date t by the owners of the international bank.

The domestic supervisor observes at date $t + \frac{1}{2}$ the signal s on $\tilde{R}$. However, because of geographical distance, lack of familiarity with the business, accounting, and legal practices in the foreign country, etc. this supervisor is not able to observe the signal s^* on $\tilde{R}^*$.[7] We also assume that when deciding whether to close the international bank, the domestic supervisor only takes into account the closure cost c incurred in the domestic country. To be sure, the closure cost c^* is still incurred in the foreign country, but the domestic supervisor ignores it when deciding whether to close the international bank.

[6] In addition, we do not want mergers to be driven by changes in deposit insurance premia.

[7] A less restrictive assumption would be that the domestic supervisor observes a signal on $\tilde{R}^*$ that is noisier than the signal s^* received by the foreign supervisor prior to the takeover. This would considerably complicate the analysis, but the qualitative results would be essentially unchanged.

We are now ready to characterize the closure policy of the domestic supervisor with regard to the international bank. Consider her decision problem after she has observed the signal s. If the international bank is closed at date $t + \frac{1}{2}$ she incurs a total cost $1 - L + \lambda(1 - L^*) + c$, where $1 - L$ is the net payment to domestic depositors, $\lambda(1 - L^*)$ is the net payment to foreign depositors, and c is the domestic closure cost. On the other hand, if the bank stays open it will fail at date $t + 1$ when $\tilde{R} = 0$, in which case the domestic supervisor will incur a total cost $1 + \lambda + c$, when $\tilde{R}^* = 0$, and $1 + \lambda(1 - R^*) + c$, when $\tilde{R}^* = R^*$. Since the supervisor does not observe the signal s^*, and $\Pr(\tilde{R}^* = R^*) = p^*$, in expected terms this cost is equal to $1 + \lambda(1 - p^*R^*) + c$. Hence the policy of the domestic supervisor is to close the international bank if

$$1 - L + \lambda(1 - L^*) + c < (1 - s)[1 + \lambda(1 - p^*R^*) + c], \tag{18}$$

which leads to the following result.

Proposition 2 There exists a critical value

$$\bar{s} = \frac{L - \lambda(p^*R^* - L^*)}{1 + c - \lambda(p^*R^* - 1)} \tag{19}$$

such that the domestic supervisor will close the international bank at date $t + \frac{1}{2}$ if $s < \bar{s}$. Moreover $\bar{s} < \hat{s}$.

Proof By (17) we have $1 + \lambda > \lambda R^*$, which implies $1 + \lambda(1 - p^*R^*) + c > 0$. Hence solving for s in (18) proves the first part of the proposition. Next by (19) and (3) it is immediate to check that $\bar{s} < \hat{s}$ if and only if

$$(p^*R^* - L^*)(1 + c) > (p^*R^* - 1)L.$$

But $L^* < 1$ and $(1 + c) > L$ imply

$$(p^*R^* - L^*)(1 + c) > (p^*R^* - 1)(1 + c) > (p^*R^* - 1)L,$$

so we conclude that $\bar{s} < \hat{s}$. ∎

Hence the domestic supervisor is softer with the international bank than with the original domestic bank. The reason for this key result is the following. The takeover of the foreign bank by the domestic bank increases the costs of closing the bank at date $t+\frac{1}{2}$ by $\lambda(1-L^*)$, and reduces the expected costs of failure at date $t+1$ by $(1-s)\lambda(p^*R^*-1)$,[8] so now the supervisor is more inclined to keep the bank open. In Figure 1 we represent the equations that determine $\hat{s}$ (with dashed lines) and $\bar{s}$ (with solid lines). The takeover moves the costs of closing and the expected costs of not closing the bank at date $t+\frac{1}{2}$ in the direction of the arrows, so $\bar{s}$ moves to the left of $\hat{s}$.

[FIGURE 1]

Moreover, it is clear from (19) that as λ goes to zero, the effect of the takeover on the behavior of the domestic supervisor becomes smaller and smaller, and in the limit we have $\lim_{\lambda\to 0}\bar{s}=\hat{s}$.

The probability that the international bank will be closed at date $t+\frac{1}{2}$ is given by

$$\bar{z}_0=\Pr(s<\bar{s})=F(\bar{s}). \tag{20}$$

Similarly, the probability that the international bank will fail at date $t+1$ is

$$\bar{z}_1=\Pr(s\geq\bar{s} \text{ and } \tilde{R}=0)=\int_{\bar{s}}^{1}(1-s)\,dF(s). \tag{21}$$

Hence the probability that the international bank will be closed at date $t+\frac{1}{2}$ or fail at date $t+1$ is

$$\bar{z}_0+\bar{z}_1=1-\int_{\bar{s}}^{1}s\,dF(s).$$

To compute the market value of the international bank at any date t in which it remains open, denoted by $\bar{V}$, observe that the bank owners pay the deposit insurance premium $(1+\lambda)\phi$ at date t, and will receive a positive payoff plus the value $\bar{V}$ of the bank at date $t+1$ when $s\geq\bar{s}$ and $\tilde{R}=R$. This payoff will be $R-(1+\lambda)$, when $\tilde{R}=0$, and $R+\lambda R^*-(1+\lambda)$, when $\tilde{R}^*=R^*$. Since $\Pr(s\geq\bar{s} \text{ and } \tilde{R}=R)=1-\bar{z}_0-\bar{z}_1$ and $\Pr(\tilde{R}^*=R^*)=p^*$, we conclude that the market value of the international bank satisfies the equation

$$\bar{V}=-(1+\lambda)\phi+(1-\bar{z}_0-\bar{z}_1)[R+\lambda p^*R^*-(1+\lambda)+\bar{V}],$$

[8] Recall that we are assuming $p^*R^*>1$.

which gives

$$\overline{V} = \frac{(1 - \bar{z}_0 - \bar{z}_1)[R + \lambda p^{*}R^{*} - (1 + \lambda)] - (1 + \lambda)\phi}{\bar{z}_0 + \bar{z}_1}. \tag{22}$$

To sum up, in this section we have characterized the behavior of the domestic supervisor that is responsible for the international bank resulting from the takeover of the foreign bank by the domestic bank. In particular, we have shown that this supervisor is softer with the international bank than with the original domestic bank. Moreover, we have computed the market value of the international bank. These results will be used to discuss the determinants and the welfare effects of international takeovers in banking. As a preliminary step we first find out its effects on the probability of bank failures.

4 The Effects on the Probability of Bank Failures

In this section we compare the probabilities that the international bank will be closed at date $t + \frac{1}{2}$ or fail at date $t + 1$ with the corresponding probabilities for the domestic and the foreign bank prior to the takeover.

In the previous section we have shown that the critical value $\bar{s}$ below which the domestic supervisor will close the international bank at date $t + \frac{1}{2}$ is smaller that the critical value $\hat{s}$ below which it closed the domestic bank. Hence by (20) and (4) this implies

$$\bar{z}_0 = F(\bar{s}) < F(\hat{s}) = z_0, \tag{23}$$

so the probability that the international bank will be closed at date $t + \frac{1}{2}$ is smaller than the corresponding probability for the domestic bank. On the other hand, by (21) and (5), $\bar{s} < \hat{s}$ implies

$$\bar{z}_1 = \int_{\bar{s}}^{1} (1 - s)\, dF(s) > \int_{\hat{s}}^{1} (1 - s)\, dF(s) = z_1, \tag{24}$$

so the probability that the international bank will fail at date $t + 1$ is greater than the corresponding probability for the domestic bank. However since

$$\bar{z}_0 + \bar{z}_1 = 1 - \int_{\bar{s}}^{1} s\, dF(s) < 1 - \int_{\hat{s}}^{1} s\, dF(s) = z_0 + z_1, \tag{25}$$

the first effect is larger than the second. In particular, this means that the probability that the owners of the international bank will receive a positive payoff and keep the bank open at date $t+1$ is larger than the corresponding probability for the domestic bank.

Next we compare the closure policy of the domestic supervisor with regard to the international bank with the closure policy of the foreign supervisor prior to the takeover. The probability of closure of the international bank at date $t+\frac{1}{2}$ is smaller than the corresponding probability for the foreign bank if

$$\bar{z}_0 = F(\bar{s}) < F^*(\hat{s}^*) = z_0^*.$$

Since $\bar{s} < \hat{s}$, this condition will be satisfied if

$$\hat{s} = \frac{L}{1+c} = \frac{L^*}{1+c^*} = \hat{s}^*$$

and $F = F^*$. On the other hand, if either $\hat{s}^* < \hat{s}$, or if F is dominated by F^* in the sense of first order stochastic dominance, $\bar{z}_0$ may be larger than z_0^*. The first case happens when c^* is relatively large, that is when the foreign bank is a large bank in the foreign country, so the foreign supervisor will be less inclined to close it at date $t+\frac{1}{2}$. The second case happens when $p < p^*$, that is when the investments of the foreign bank have a higher probability of success.[9] Moreover, these two effects are more likely to make $\bar{z}_0 > z_0^*$ when $\bar{s}$ is close to $\hat{s}$, in particular when λ (the relative size of the foreign bank) is small. Hence we conclude that $\bar{z}_0$ will be smaller than z_0^* unless the foreign bank is a large bank in the foreign country that is small relative to the domestic bank, and its investments are safer than those of the domestic bank.

Similarly, we can conclude that

$$\bar{z}_1 = \int_{\bar{s}}^{1} (1-s)\, dF(s) > \int_{\hat{s}^*}^{1} (1-s^*)\, dF^*(s^*) = z_1^*,$$

and

$$\bar{z}_0 + \bar{z}_1 = 1 - \int_{\bar{s}}^{1} s\, dF(s) < 1 - \int_{\hat{s}^*}^{1} s^*\, dF^*(s^*) = z_0^* + z_1^*,$$

unless the foreign bank is large (relative to the foreign market) and safe (relative to the domestic bank), and the domestic bank is large (relative to the foreign bank).

To illustrate these results we use the following parameterization. Let

$$F(s) = s^{\frac{p}{1-p}},$$

[9] Recall that if F is dominated by F^* in the sense of first order stochastic dominance, we have $E(\tilde{s}) = p < p^* = E(\tilde{s}^*)$.

and similarly for $F^*(s^*)$. Observe that $F(0) = 0$ and $F(1) = 1$. Moreover one can easily check that $E(\tilde{s}) = p$. We take $p = .90$ and $c = .10$, and compute $\bar{z}_0 + \bar{z}_1 - (z_0^* + z_1^*)$, that is the change in the probability of failure of the foreign bank after the takeover, for $p^* = .85$, $.90$, and $.95$, $c^* = 0$, $.10$, and $.40$, and $\lambda = .10$, and $.25$.[10] Table 1 shows the results.

TABLE 1: Change in the probability of failure of the foreign bank
$(\bar{z}_0 + \bar{z}_1 - (z_0^* + z_1^*))$

Panel A: $\lambda = .10$

	$p^* = .85$	$p^* = .90$	$p^* = .95$
$c^* = 0$	$-.163$	$-.039$	$+.058$
$c^* = .10$	$-.104$	$-.008$	$+.061$
$c^* = .40$	$-.051$	$+.010$	$+.061$

Panel B: $\lambda = .25$

	$p^* = .85$	$p^* = .90$	$p^* = .95$
$c^* = 0$	$-.169$	$-.046$	$+.051$
$c^* = .10$	$-.111$	$-.015$	$+.054$
$c^* = .40$	$-.058$	$+.003$	$+.054$

All the numbers in the first column of both panels are negative, which means that if the foreign bank is riskier than the domestic bank ($p^* = .85 < .90 = p$), the probability that the bank is closed at date $t + \frac{1}{2}$ or fails at date $t + 1$ goes down. Conversely, all the numbers in the third column of both panels are positive. It can also be seen how an increase in the foreign closure cost c^*, which proxy the size of the foreign bank in the foreign market, reduces $z_0^* + z_1^*$ and hence increases the numbers in each row. Finally, comparing the numbers in Panel A with those in Panel B we conclude that an increase in the relative size of the foreign bank (an increase in λ) reduces the difference $\bar{z}_0 + \bar{z}_1 - (z_0^* + z_1^*)$.

It should also be noticed that for $p^* = .90$ and $c^* = .10$ we have $z_0^* + z_1^* = z_0 + z_1$ (since $p = .90$ and $c = 0.10$). Hence the takeover of the foreign bank reduces the

[10] The other parameter values are as follows: $L = L^* = .75$, and $R = R^* = 1.5$.

probability of failure of the domestic bank by .8% when $\lambda = .10$ and by 1.5% when $\lambda = .25$.

Since by (6), (14), and (22) the market values V, V^*, and $\overline{V}$ of the domestic, the foreign, and the international bank are decreasing in $z_0 + z_1$, $z_0^* + z_1^*$, and $\overline{z}_0 + \overline{z}_1$, respectively, the results in this section help to identify the key factors in the analysis of international takeovers in banking that will be discussed in the following section.

5 The Determinants of International Takeovers

In this section we analyze under what conditions the market value of the international bank is greater that the sum of the market values of the domestic and the foreign bank. This is a necessary (and, in the absence of regulatory constraints, also a sufficient) condition for the takeover of the foreign bank by the domestic bank.

Using (6), (14), and (22), and rearranging gives

$$\begin{aligned}
\overline{V} - (V + V^*) = {} & (R - 1 - \phi)\left(\frac{1}{\overline{z}_0 + \overline{z}_1} - \frac{1}{z_0 + z_1}\right) \\
& + \lambda(R^* - 1 - \phi)\left(\frac{1}{\overline{z}_0 + \overline{z}_1} - \frac{1}{z_0^* + z_1^*}\right) \\
& - \lambda(1 - p^*)R^*\left(\frac{1}{\overline{z}_0 + \overline{z}_1} - 1\right) \\
& - \lambda(\phi - \phi^*)\frac{1}{z_0^* + z_1^*}.
\end{aligned} \tag{26}$$

By (25) we have $\overline{z}_0 + \overline{z}_1 < z_0 + z_1$, so the first term on the right hand side is positive. The second term is also positive as long as $\overline{z}_0 + \overline{z}_1 < z_0^* + z_1^*$, which by our discussion in the previous section requires that the foreign bank be not too large (relative to the foreign market) or too safe (relative to the domestic bank), and that the domestic bank be not too large (relative to the foreign bank). The third term is always negative. Finally, the fourth term is negative (positive) if the deposit insurance premium in the domestic country, ϕ, is greater (smaller) than the premium in the foreign country, ϕ^*.

Three analytical results can be immediately derived from this expression. First, since the domestic supervisor does not care about the closure cost incurred in the foreign country, c^* only appears in $z_0^* + z_1^*$, and we can compute

$$\frac{\partial[\bar{V} - (V + V^*)]}{\partial c^*} = \lambda(R^* - 1 - \phi^*)\frac{1}{(z_0^* + z_1^*)^2}\frac{d(z_0^* + z_1^*)}{d\hat{\theta}^*}\frac{\partial \hat{\theta}^*}{\partial c^*}.$$

But we have seen in Section 2 that

$$\frac{d(z_0^* + z_1^*)}{d\hat{\theta}^*} = \hat{\theta}^* f^*(\hat{\theta}^*) > 0,$$

and by (11) we have

$$\frac{\partial \hat{\theta}^*}{\partial c^*} = -\frac{L^*}{(1 + c^*)^2} < 0,$$

so we conclude that a higher closure cost c^* reduces the difference $\bar{V} - (V + V^*)$, and hence makes the takeover less likely. Second, since the deposit insurance premium in the foreign country ϕ^* only enters in the fourth term of (26) we can also compute

$$\frac{\partial[\bar{V} - (V + V^*)]}{\partial \phi^*} = \frac{\lambda}{z_0^* + z_1^*} > 0.$$

Hence a higher foreign deposit insurance premium ϕ^* increases the likelihood of a takeover of the foreign bank by the domestic bank. Finally, we can easily compute

$$\frac{\partial[\bar{V} - (V + V^*)]}{\partial \phi} = -\left(\frac{1}{\bar{z}_0 + \bar{z}_1} - \frac{1}{z_0 + z_1}\right) - \frac{\lambda}{\bar{z}_0 + \bar{z}_1} < 0,$$

so a higher domestic deposit insurance premium ϕ makes the takeover less likely. These results are formally stated in the following proposition.

Proposition 3 The takeover of the foreign bank by the domestic bank is more likely to happen the lower the foreign closure cost c^* and the domestic deposit insurance premium ϕ, and the higher the foreign deposit insurance premium ϕ^*.

According to this result, target banks are expected to be small banks located in countries with relatively high deposit insurance premia.

Analytical results for other key parameters of the model, in particular the probabilities p and p^* of success of the investments of the domestic and the foreign bank and the relative size λ of the foreign bank, are more difficult to obtain. For this reason, we will present some numerical results using the parameterization introduced in the previous section. Table 2 shows the values of $\bar{V} - (V + V^*)$ for $p = .90$ and

$c = .10$; and for $p^* = .85$; $.90$; and $.95$; $c^* = 0$; $.10$; and $.40$; and $\lambda = .10$; and $.25$: The numbers are computed assuming that the deposit insurance premium ϕ is fair for the domestic bank prior to the takeover, and that $\phi^* = \phi$ (so it is also fair for the foreign bank when $p^* = .90$ and $c^* = .10$):

TABLE 2: Difference between the market value of the international bank and the sum of the market values of the domestic and the foreign bank

$(\bar{V} - (V + V^*))$

Panel A: $\lambda = .10$

	$p^* = .85$	$p^* = .90$	$p^* = .95$
$c^* = 0$	$+.257$	$+.211$	$-.208$
$c^* = .10$	$+.217$	$+.141$	$-.247$
$c^* = .40$	$+.157$	$+.082$	$-.254$

Panel B: $\lambda = .25$

	$p^* = .85$	$p^* = .90$	$p^* = .95$
$c^* = 0$	$+.566$	$+.449$	$-.601$
$c^* = .10$	$+.466$	$+.274$	$-.698$
$c^* = .40$	$+.315$	$+.126$	$-.715$

All the numbers in the first and the second column of both panels (where $p^* \leq p$) are positive, and all the numbers in the third column (where $p^* > p$) are negative, which means that the takeover of the foreign bank by the domestic bank will take place unless the investments of the former are sufficiently safer than the investments of the latter. As stated in Proposition 3, an increase in the foreign closure cost c^*; which proxy the size of the foreign bank in the foreign market, reduces the difference $\bar{V} - (V + V^*)$; and hence makes the takeover less likely. Finally, comparing the numbers in Panel A with those in Panel B we can see that an increase in λ increases the difference $\bar{V} - (V + V^*)$ in the first two columns and decreases it in the third. Hence we conclude that the effect of the relative size of the two banks on the likelihood of a takeover is ambiguous.

Summing up, in this section we have shown that the takeover of the foreign bank by the domestic bank is more likely to happen if the foreign bank is small (relative to the foreign market) and its investments are riskier than those of the domestic bank, and if deposit insurance premia are lower in the domestic country. Moreover, the numerical results suggest that the relative riskiness of the two banks is the key determinant of international takeovers in banking.

6 The Effects on Welfare

This section discusses the welfare effects for the domestic and the foreign country of the takeover of the foreign bank by the domestic bank. Obviously, this requires to restrict attention to situations in which $\overline{V} > V + V^*$, so the domestic bank will want to buy the foreign bank.

To analyze the welfare effects of the takeover for the foreign country we have to compare social welfare before and after the takeover. Following our discussion in Section 2, the former is given by $W^* = V^* + U^*$, while the latter is $\overline{W}^* = P + \overline{U}^*$, where P is the price paid by the domestic bank to the owners of the foreign bank, and $\overline{U}^*$ is the discounted expected utility of the foreign supervisor after the takeover. Taking into account the fact that after the takeover the foreign deposit insurance corporation does not charge the deposit insurance premium φ^* nor she pays any compensation to depositors, it is clear from (15) that $\overline{U}^* = -\lambda c^*$.

Since $P > V^*$ (otherwise the owners of the foreign bank would not want to sell), a sufficient condition for the takeover to be welfare improving for the foreign country is that

$$\overline{U}^* - U^* = \frac{\lambda[z_0^*(1 - L^*) + z_1^* - \varphi^*]}{z_0^* + z_1^*} \geq 0,$$

which is equivalent to

$$\varphi^* \leq z_0^*(1 - L^*) + z_1^*.$$

In other words, the foreign country will be better off if the deposit insurance premium φ^* is below its fair level. Using (12), (13), and (11) one can show that

$$\frac{\partial[z_0^*(1 - L^*) + z_1^*]}{\partial c^*} = \frac{c^*}{1 + c^*}\hat{s}^{*2} f(\hat{s}^*) > 0,$$

and we also expect $z_0^*(1 - L^*) + z_1^*$ to be higher for riskier banks, so we conclude that the takeover of a large and risky foreign bank will in general increase the welfare of the foreign country.

Table 3 illustrates these results for the parameterization introduced in Section 4. As before, we assume that the deposit insurance premium ϕ^* is fair for $p^* = .90$ and $c^* = .10$. Moreover we take $\lambda = .25$.

TABLE 3: Change in the discounted expected utility of the foreign supervisor $(\overline{U}^* - U^*)$

	$p^* = .85$	$p^* = .90$	$p^* = .95$
$c^* = 0$	$+.029$	$-.002$	$-.216$
$c^* = .10$	$+.040$	0	$-.227$
$c^* = .40$	$+.070$	$+.008$	$-.228$

From Table 2 we know that the domestic bank will take over the foreign bank for $p^* = .85$ and $p^* = .90$, in which case the price P paid by the domestic bank to the owners of the foreign bank will be greater than the market value V^* of the foreign bank prior to the takeover. Since all the numbers in the first column of Table 3 are positive, and the numbers in the second column are either positive or, in the case of the value corresponding to $c^* = 0$, very small compared to the corresponding value in Table 2, we conclude that the takeover increases the welfare of the foreign country. Interestingly, the numbers in the third column of Table 3 are negative, and relatively large in absolute value, but we know that in this case the takeover will not take place.

To analyze the welfare effects of the takeover for the domestic country we have to compare social welfare before and after the takeover. Following our discussion in Section 2, the former is given by $W = V + U$, while the latter is $\overline{W} = (\overline{V} - P) + \overline{U}$, where $\overline{V} - P$ is the difference between the market value of the international bank and price paid to the owners of the foreign bank, and $\overline{U}$ is the discounted expected utility of the domestic supervisor after the takeover. To compute $\overline{U}$, notice that the analysis in Section 3 implies that with probability $\bar{z}_0$ the foreign supervisor will incur a cost $1 - L + \lambda(1 - L^*) + c$, and with probability $\bar{z}_1$ her expected cost will be $1 + \lambda(1 - p^*R^*) + c$, so $\overline{U}$ satisfies the equation

$$\overline{U} = (1 + \lambda)\phi - \bar{z}_0[1 - L + \lambda(1 - L^*) + c] - \bar{z}_1[1 + \lambda(1 - p^*R^*) + c] + (1 - \bar{z}_0 - \bar{z}_1)\overline{U}.$$

Solving for $\overline{U}$ and rearranging then gives

$$\overline{U} = \frac{[\phi - \bar{z}_0(1 - L) - \bar{z}_1] + \lambda[\phi - \bar{z}_0(1 - L^*) - \bar{z}_1(1 - p^*R^*)]}{\bar{z}_0 + \bar{z}_1} - c. \qquad (27)$$

Since $\overline{V} - P > V$ (otherwise the owners of the domestic bank would not want to buy), a sufficient condition for the takeover to be welfare improving for the domestic country is that $\overline{U} \geq U$. Using (7) and (27) this will hold if

$$\frac{\phi - \bar{z}_0(1 - L) - \bar{z}_1}{\bar{z}_0 + \bar{z}_1} \geq \frac{\phi - z_0(1 - L) - z_1}{z_0 + z_1}$$

and

$$\phi \geq \bar{z}_0(1 - L^*) + \bar{z}_1(1 - p^* R^*).$$

The first condition is not generally satisfied, since it is equivalent to

$$\phi \left(\frac{1}{\bar{z}_0 + \bar{z}_1} - \frac{1}{z_0 + z_1} \right) + L \left(\frac{1}{1 + \bar{z}_1/\bar{z}_0} - \frac{1}{1 + z_1/z_0} \right) \geq 0,$$

and by (23), (24) and (25) we have $\bar{z}_0 + \bar{z}_1 < z_0 + z_1$ and $\bar{z}_1/\bar{z}_0 > z_1/z_0$ (so the first term is positive and the second is negative). On the other hand, since $p^* R^* > 1$, the second condition will be satisfied if $\phi \geq \bar{z}_0(1 - L^*)$, which holds as long as the deposit insurance premium ϕ is not too small.[11]

Given this ambiguity, we will resort to a numerical illustration for the parameterization introduced in Section 4. Table 4 shows the change in the discounted expected utility of the domestic supervisor for $p = .90$ and $c = .10$, and for $p^* = .85, .90$, and $.95$, and $\lambda = .10$, and $.25$.

TABLE 4: Change in the discounted expected utility of the domestic supervisor ($\overline{U} - U$)

	$p^* = .85$	$p^* = .90$	$p^* = .95$
$\lambda = .10$	$+.095$	$+.101$	$+.107$
$\lambda = .25$	$+.262$	$+.280$	$+.298$

Since all the numbers in the first and the second column of Table 4 (which correspond to the cases where the takeover will take place) are positive, we conclude that the takeover is also welfare increasing for the domestic country.

Hence we have shown that, at least for a reasonable set of parameter values, the takeover of the foreign bank by the domestic bank will increase the welfare of both countries.

[11] In particular, if $\phi = z_0(1 - L) + z_1$ (the case of fair premia) and $L = L^*$, $z_1 > 0$ and $z_0 > \bar{z}_0$ imply $\phi > \bar{z}_0(1 - L^*)$.

7 Concluding Remarks

[To be completed]

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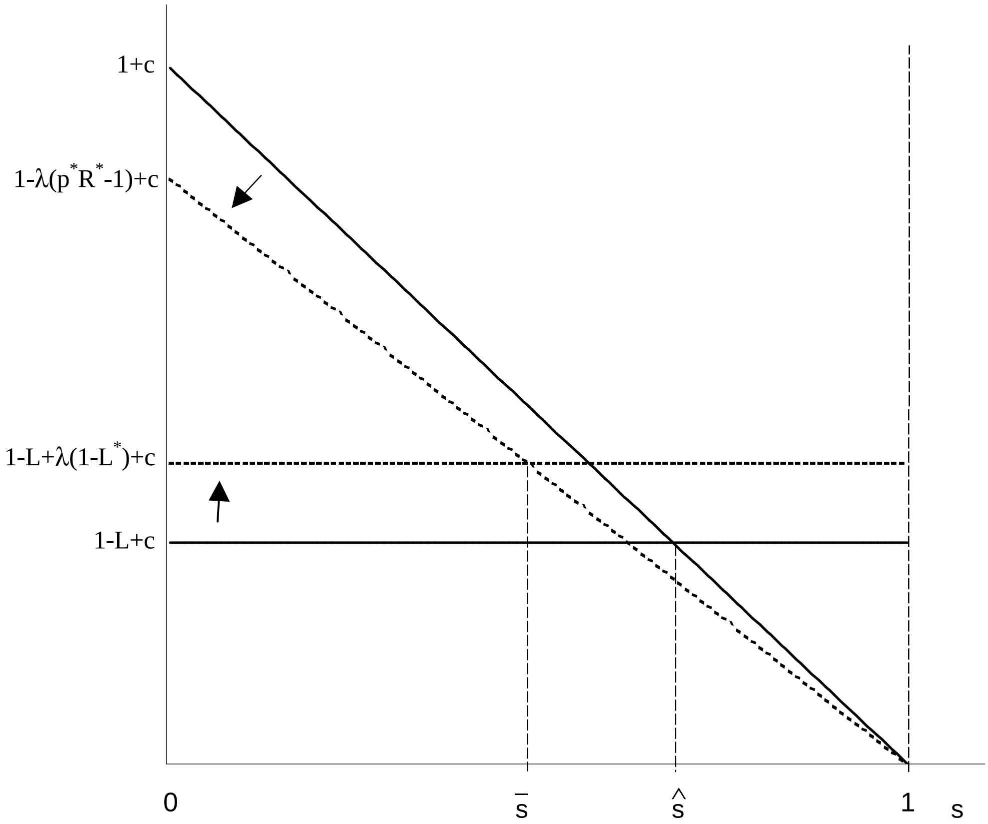

FIGURE 1. Effect of the takeover of the foreign bank on the critical value that characterizes the closure policy of the domestic supervisor.