The Corporate Structure of Multinational Banks*

Gyöngyi Lóránth and Alan D. Morrison†

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Abstract

Multinational banks are increasingly subject to centralised supervision that relies upon precise aggregation and consolidation of risk data from all of their constituent parts. We present a model of organisational form for multinational bank expansion within which we can consider this trend. In our model, multinational banks design their corporate form so as to control the granularity of internal information flows. Genuine delegation to subsidiary banks is feasible because they report less precise information to home banks. Home banks can therefore use subsidiary expansion to commit ex ante to accept projects that may ex post be unattractive. That commitment comes at the cost of higher expected compensation costs; branch banks guarantee better information flows and so allow for more precise incentive contracts. Centralization of supervision mitigates the benefit of subsidiaries for the home bank and may result in credit rationing to small and medium-sized companies in host countries. Our model explains the closer engagement of subsidiaries in host countries and yields several testable implications.

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†Lóránth is at the University of Vienna and CEPR; Morrison is at the Saïd Business School, University of Oxford, CEPR and the ECGI.

1. Introduction

The information that supervisors demand from banks has become more granular, and more precisely specified, since the financial crisis of 2008–09. At the same time, large cross-border banks are increasingly subject to centralised regulation that is intended to correct for a lack of coordination between national supervisors. For example, the EU's Single Supervisory Mechanism (SSM) assigns responsibility for supervision of all Eurozone banks to the European Central Bank.[1] These initiatives require data for multinational banks to be aggregated at the holding company (home bank) level. A recent report by Deloitte (2014) argues that integration of bank reporting systems will be one of the biggest challenges in implementing the SSM. This marks a significant change from the regulatory approach taken towards multinational banks in the recent past, when regulatory and legal impediments as well as incompatible IT systems rendered incomplete the aggregation of risk from bank units operating in multiple jurisdictions.[2]

This paper examines information flows in multinational banks. We present a model that explains the choice between the branch and subsidiary structures in multinational banks as a response to contracting problems between the home bank, where decision-making authority ultimately resides, and the foreign bank, which deploys local knowledge and expertise to identify and monitor loans. In the tradition of the optimal delegation literature, we argue that, from an ex ante perspective, it is sometimes optimal for the home bank not to act upon information generated ex post by the foreign bank. The home bank accomplishes this commitment in our framework by delegating investment decisions to a foreign *subsidiary* bank. Subsidiary banks have separate balance sheets and run their own reporting and IT systems, so that the home bank receives insufficient information ex post to interfere in subsidiary bank decisions. In contrast, complete delegation to a *branch* bank is impossible. The reason is that, because they share a balance sheet with their home bank, branch banks share all relevant information with their home banks; as a result, the home bank is able to interfere ex post in the operational decisions of its branches.

The recent movement towards complete information sharing mitigates against the subsidiary delegation that we identify as optimal. We argue that, as a result, recent trends in multinational bank supervision may have the unintended consequence of rationing loans to small- and medium-sized companies

Our model considers a multinational bank that comprises a home and a foreign bank. The foreign bank has the local expertise necessary for project search and loan monitoring,

[1]Other EU countries can participate in the SSM on a voluntary basis. See Council of the European Union (2013).

[2]For example, the *Financial Times* notes that "[m]any banks [...] are plagued by computer systems that have been built up over several decades through acquisitions and new product launches to form a costly and complex patchwork of systems." See Martin Arnold and Tom Braithwaite, "Banks ageing IT systems buckle under strain," *Financial Times*, 18 June 2015.

and it must be incentivised to perform both activities by the home bank. It is impossible in our set-up for the home bank to contract on either search or monitoring effort. As a result, both must be incentivised in the constrained optimal contract, which comprises an *origination fee* that is paid when a new loan is initiated, and a *success wage* that is paid upon project success.

Under the constrained optimal contract, the foreign bank's loan monitoring is induced through its contractual success wage and, as a result, it earns an information rent that is increasing in the cost of monitoring. This rent drive a wedge between the social surplus generated by foreign investment and the income that the home bank derives from that investment. As a result, the home bank may be unwilling to invest in hard-to-monitor projects, even when those projects have a positive Net Present Value.

The foreign bank's information rent is earned after investment occurs and, hence, from an ex ante perspective, it can be defrayed against the origination fee that it receives upon investment. If the net fee remains positive, then the foreign bank's ex ante expected information rent is zero; in this case, the home bank should be willing to commit itself to make invest in hard-to-monitor loans. But project discovery is not contractible so that, while a commitment to invest in every project is desirable ex ante, the ex post monitoring rents render it incredible for hard-to-monitor loans.

When this type of credit rationing obtains, the home bank should be willing to incur an up-front cost so as to render its commitment to invest in hard-to-monitor loans credible. We demonstrate that such a commitment is achieved when information flows are restricted so that the home bank cannot distinguish between easy- and hard-to-monitor loans: in this case, the home bank must accept all or no projects, and, as it is rational to accept all, it does so.

This type of information flow restriction is achieved by selecting the appropriate institutional form for the multinational bank. When the foreign bank is a branch of the home bank, the two share a balance sheet and, hence, have consolidated reporting systems that ensure that complete information transfer occurs. In contrast, running the foreign bank as a separate subsidiary bank with its own balance sheet and reporting systems restricts information flow. In line with this statement, the Basel Committee on Banking Supervision (2013, p. 8) states that "[a] large number of banks do not have consistent processes and data terminologies across their groups because of decentralised business models and a lack of group-wide policies and procedures." The Basel Committee argues for consolidation of decentralised business models. But, in fact, our analysis demonstrates that, in restricting information flows, subsidiary bank expansion may serve a useful commitment purpose.

Subsidiary expansion enables the home bank to restrict information flows and so commit to accept every positive NPV lending opportunity. When it expands by subsidiary, the home

bank cannot identify loan types; it must therefore pay a monitoring rent for every loan if it is to ensure that hard-to-monitor projects are indeed monitored. In other words, the price of using subsidiary bank expansion to commit to an investment policy is higher average wage costs. The home bank in our model trades this cost against the benefit of committing to accept every loan. We show that commitment is valuable when the cost of loan prospecting is high enough and the cost of monitoring hard-to-monitor projects is low enough: when these conditions are satisfied, the home bank expands via subsidiaries; when they are not, it expands using a branch bank.

Our reasoning identifies an unintended consequence of supervisory demands for more complete and more granular reporting of risk data. When the home bank complies with those demands, it loses its ability to commit not to act upon information generated in its foreign subsidiaries. The consequences is a restriction of credit to marginally profitable businesses. To the extent that such businesses are small- and medium-sized firms, then, enhanced centralisation of multinational bank reporting is likely to restrict the flow of bank credit to organisations that, historically, have relied almost exclusively upon bank loans.

The trade-off that drives our results generates several implications concerning the choice between branch and subsidiary banks. The origination fee required to incentivise foreign banks to prospect for loans is higher when prospecting is difficult. This reduces the expected ex ante cost of running a subsidiary, because the higher expected wage costs can be offset against the origination fee. It follows that subsidiary expansion should be more common in markets where loan prospecting is hard. That is the case when the host country has a competitive loan market, and when it has poor legal institutions. This prediction is consistent with the fact that subsidiaries are the dominant form of entry in Eastern Europe and in Latin America (Cerutti, Dell'Ariccia, and Martinez Peria, 2007); in contrast, branches are more common that subsidiaries in Western Europe (Fiechter, Ötker-Robe, Ilyina, Hsu, Santos, and Surti, 2011). Similarly, because it is relatively easy to originate new loans with existing clients, our model predicts that branch expansion is more common when banks more overseas to follow their customers.

Subsidiaries are deployed in our model when the home bank wishes to commit to accept marginal and hard-to-monitor loans. Hence, all else equal we should expect subsidiaries to have lower average loan quality than branch banks, although this lower average quality is a consequence of efficient and welfare-enhancing lending decisions. Consistent with this hypothesis, Cerutti, Dell'Ariccia, and Martinez Peria (2007) present evidence which indicates that foreign bank subsidiaries are closely involved in small business lending in the local economy, while foreign branches operate mostly in wholesale financial markets.

When they have a choice, multinational banks frequently ignore regulatory inducements to adopt a particular mode of entry. For example, the European Union operates "single

passport" scheme (EEC, 1989), which aims to improve the competitive landscape within the E.U. by allowing any home E.U. bank to establish branches elsewhere in the E.U. Notwithstanding the ease with which they can establish branches within the European Union, many multinational banks have nevertheless elected to expand via subsidiaries (Dermine, 2002). Our analysis suggests that their expansion choice reflects the need to commit not to interfere excessively in the foreign bank's investment choices.

This observation naturally leads to the question of whether policy makers should attempt to force a particular mode of expansion. For example, one could argue that subsidiary bank expansion may enable local authorities more effectively to supervise foreign banks. Similarly, the home bank's supervisor may prefer to supervise a consolidated institution, constituted via branch banks. But both approaches require careful investigation.

Consider first a policy of forced subsidiary bank expansion. A home bank might otherwise have opted for branch expansion either because commitment was unnecessary, in which case forced subsidiary bank expansion increases wage costs unnecessarily and so may undermine expansion plans; but it might equally have opted for branch banking because it was cheaper to accept that it cannot commit to invest in marginal foreign projects than to pay the higher wages that come with subsidiary expansion. In the latter case, forced subsidiary expansion could serve either to push costs up so far as to prevent expansion, or to ease credit rationing by ensuring foreign bank investment in marginal projects. Whether one or the other effect dominates requires a precise understanding of the costs generated by the internal agency problem in the multinational bank.

The effects of forced branch bank expansion are less ambiguous. Such a policy bites only when home banks would otherwise expand via subsidiaries. According to our model, they do so when subsidiary banking is the only way to guarantee investment in marginal foreign projects. Forcing branch bank expansion must then cause either (1) home bank cherry picking of strong foreign projects, thus lowering the quality of the project pool available for local banks (see, e.g., Bank for International Settlements (2001)); or (2) a complete withdrawal from the foreign market. In both cases, forced branch bank expansion reduces foreign country welfare as well as home bank profitability.

The theoretical literature on the organisational form of multinational banks is scant. Few papers examine this choice based on differences in capital regulation or in regulatory intervention. Calzolari and Lóránth (2011) present a framework where national supervisors incentives to intervene are shaped by the liability structure of the foreign unit and the home supervisors liability towards foreign depositors. Harr and Rønde (2006) and Lóránth and Morrison (2003) argue that the optimal capital regulation should account for the different liability structures of branches and subsidiaries. Dell'Ariccia and Marquez (2010) analyze the banks choice of corporate structure within a framework where banks face both political and

economic risks. In their model,while the greater limited liability protection of subsidiary structures shields home banks from economic losses, branches are better protected from property right infringements as their capital is held with the parent bank. Based on this trade-off, they show that the branch structure is preferable when political risks, such as foreign government appropriation, dominate; the subsidiary structure is preferred when the main source of uncertainty is credit risk. The main trade-off of Del'Ariccia and Marquez's paper is empirically validated by Cerutti, Dell'Ariccia, and Martinez Peria (2007).

Our work provides a complementary explanation for observed patterns of expansion choices: namely, that branches and subsidiaries are associated with different levels of involvement in the foreign market. Our theory uses a contracting problem between home and foreign banks to explain the different levels of engagement, and our results are therefore closely linked to a theory literature that examines agency and incentive problems in multidivisional firms.

2. Model description

We consider a bank that has decided to expand into a new country. We do not model the expansion decision and, hence, our formal analysis is silent on the rationale for expansion, which could occur because the bank wishes to service customers who enter that market, because it anticipates future growth opportunities in the new market, or for some other reason. Our analysis concerns the corporate structure adopted by the multinational bank.

The multinational bank's corporate structure is chosen by an agent whom we call the *home bank*. After expansion occurs, business in the new market is conducted by the *foreign bank*. The home bank works to maximise the expected value generated for its shareholders by the expansion; the foreign bank maximises its own expected income. Both agents are risk-neutral and the interest rate is normalised to zero.

2.1 *Technologies*

Expansion generates regular opportunities for the foreign bank to deploy a search technology to find projects in the new market; the decision to deploy the technology is unobservable. Every time the technology is deployed, the foreign bank experiences a private disutility of $\zeta \geq 0$ and finds a project with probability 1. If the foreign bank does not deploy its search technology, then it does not identify a project. The home and foreign bank both know whether a project has been found, but this information cannot be proved to a third party.

The search cost ζ is a measure of the difficulty of prospecting for new loans. It is therefore susceptible to a number of interpretations. One could think of ζ as capturing the importance of the foreign bank's special skills in discovering new investments, or as a

measure of competition levels in the new market. A high ζ would also reflect a significant geographical or cultural distance between the home and foreign markets.

Projects in the foreign market require an up-front investment of 1; they either succeed and return $R > 0$, or they fail and return 0. After investment has occurred, the foreign bank decides whether or not to exert a non-observable monitoring effort. Monitored projects succeed with probability Π and unmonitored projects succeed with probability $\Pi - \Delta < \Pi$.

The foreign bank's projects can be of two types, which are distinguished by their monitoring cost $\mu \in \{0, M > 0\}$. We refer to projects with high monitoring cost as *hard*, and to projects with low monitoring cost as *easy*, and we write $\tau \in \{e, h\}$ for project type. A fraction λ of all projects is hard.

The monitoring cost M represents the resources that the loan officer has to invest in the project. It could derive from the complexity of the legal environment in which the firm operates, from an institutional context that renders it harder to enforce collateral, or from the opacity of the business to which the loan is advanced. Hence, we think of easy projects as being more likely to arise amongst large blue-chip companies operating in developed markets; hard projects are more common amongst smaller firms, and in countries with lesser-developed financial markets.

In addition to the stochastic cashflow that a project returns, it may also generate an additional benefit β_μ for the home bank. That benefit is $\beta_M = 0$ for hard projects, and $\beta_0 = \beta \geq 0$ for easy projects. Subject to contracting restrictions that we outline below, β could be the expected value of a cash income from the project that requires no monitoring effort by the foreign bank, or a side benefit, such as the value of M&A advisory fees that arise when stapled financing is sold. β could also represent ongoing relationship benefits derived from lending to the large blue-chip companies that have easy projects. Introducing β allows us to study in the simplest possible fashion variation in the quality differences between easy and hard projects, but our basic intuitions survive if we set $\beta = 0$.

We assume that unmonitored projects have a negative NPV and that even hard projects have a positive NPV if they are monitored:

$$(\Pi - \Delta)R - 1 + \beta < 0 < \Pi R - M - 1. \tag{1}$$

In addition, we assume that $\Pi R - 1 - \lambda M + (1 - \lambda)\beta - \zeta \geq 0$, so that it is ex ante optimal to search for a project:

$$M \leq M^* \triangleq \frac{1}{\lambda}\left(\Pi R - 1 + (1 - \lambda)\beta - \zeta\right). \tag{2}$$

2.2 *Information*

We make four central assumptions about the relationship between the foreign and the home bank.

Assumption 1. *It is impossible to prove in court that the foreign bank has found a project.*

In practice, it is possible that the home bank can observe whether the foreign bank has located a project; it could, at least, take steps to ensure that it observed any projects found by the foreign bank. Assumption 1 guarantees that the home bank is nevertheless unable to commit to a compensation scheme that rewards the foreign bank for locating a project. Project investment is observable; hence, our assumption ensures that the foreign bank can be sure of compensation only if it finds a project in which the home bank agrees to invest.

Assumption 2. *It is impossible to write contracts that are contingent upon the realisation of* β_μ.

The additional benefit β_μ that the home bank derives from the foreign bank's project arises because of side-effects like the ability to sell stapled financing, to win M&A mandates, or to earn long-term relationship rents. It is very hard to prove that such income exists, or to associate it with specific lending projects: Assumption 2 ensures that it cannot appear in a formal contract, and so rules out contracts that distinguish between project types.

The home bank's detailed knowledge of the foreign bank's project depends upon the organisational form that it employs to expand into the foreign market. If the foreign bank is constituted as a *branch* of the home bank, then the home bank can observe the type τ of foreign projects. If the foreign bank is a *subsidiary* of the home bank then the home bank cannot observe τ.

Assumption 3. *When the foreign bank is a branch, all payoff-relevant information about project type is transmitted to the home banks. When the foreign bank is a subsidiary, the home bank does not learn the project type.*

Assumption 3 reflects real-life institutional arrangements. Subsidiary firms are separate entities, while branches are legally part of the parent institution, and share its balance sheet. Because they have their own balance sheets, subsidiary firms tend to run their own risk management systems, and to report less information to their parent firms. Some distance between the foreign bank and its home institution is therefore built into a subsidiary structure. In contrast, branches share a balance sheet with the parent and tend to use a common reporting system with the parent; strong information flows between the two institutions are therefore designed into branch structures.

Expansion is a costly and complex process and we assume that, once the representation form of the foreign bank has been decided, it cannot be changed.

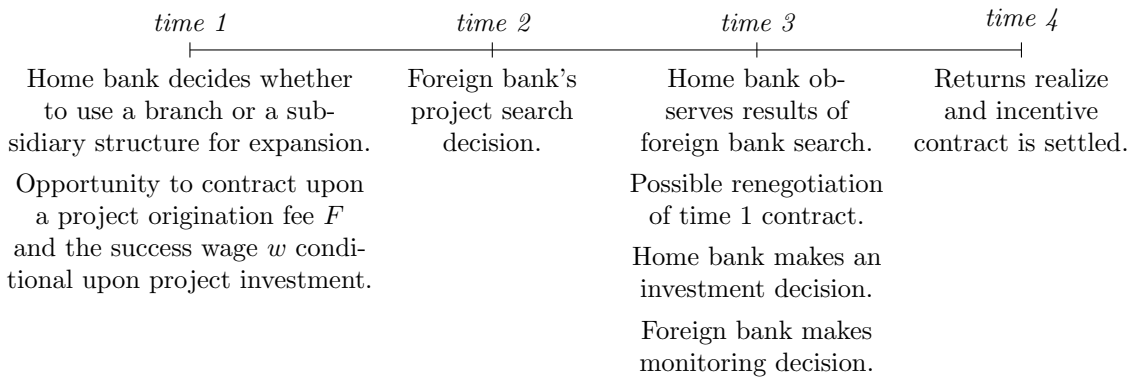


Figure 1. **Model timeline.** The home and foreign bank can contract at time 1 on the origination fee and the success wage; they may have an opportunity to renegotiate their contract at time 3.

Assumption 4. *The information transmission between the home and the foreign bank is impossible to verify in a court.*

Assumption 4 implies that it is impossible for the home bank to commit *ex ante* to an investment strategy which is contingent upon the information it receives from the foreign bank.

2.3 *Timeline and Contracts*

The relationship between the home and foreign banks is governed by a contract that is designed by the home bank. Recall that neither the foreign bank's search or monitoring effort can be observed. It is possible to observe whether project investment occurs, and whether or not an investment project succeeds. Contracts can therefore depend upon these events.

The timeline for our model, and for the contracting between home and foreign banks, is illustrated in Figure 1. The figure identifies two opportunities for contracting between the home and foreign bank.

At time 1, it is impossible by Assumption 4 to contract on any information that will be learned at time 3. Moreover, by Assumption 1, it is impossible to contract upon project discovery and, by Assumption 2, contracts cannot be contingent upon the realization of β_μ. Project investment is observable, and so is project success. Hence, the foreign bank's time 1 contract therefore comprises an *origination fee* F, which is paid when investment into a project occurs, and a *success wage* w, which is paid in case a foreign bank project succeeds.

After project discovery has occurred, the home bank will learn the project type if the foreign bank is a branch. After acquiring this information, it may attempt to renegotiate the time 1 contract by making a take-it-or-leave-it offer to the foreign bank.

We consider a variety of renegotiation assumptions. Our base case, upon which the

majority of our analysis rests, is the following. First, we assume that the home bank can commit at time 1 to an origination fee by depositing the discovery fee F with a third party that is able to promise to release the fee to the foreign bank if investment occurs, and to the home bank if it does not. The third party deviates from its instructions only if both home and foreign bank instruct it to do so; as there is never a situation in which they can agree to do so, the origination fee is effectively guaranteed at time 1. Second, we assume in our baseline analysis that the success wage payment cannot easily be administered by a third party. It will therefore be renegotiated after any time 3 information revelation.

We consider alternative contracting arrangements in Section 6.

3. Model solution

3.1 *Search and Investment*

This section presents the solution to our model. We start by considering the time 3 incentive contract between the home and foreign banks. Under the (constrained) optimal compensation contract, the foreign bank is paid a success wage w upon project success. It therefore elects to monitor a project with monitoring cost μ precisely when its expected return from doing so exceeds μ: equivalently, when $w\Pi - \mu \geq w(\Pi - \Delta)$. This requirement reduces to Condition (3):

$$w \geq w(\mu) \triangleq \frac{\mu}{\Delta}. \tag{3}$$

Equation (1) implies that the home bank wishes to invest only when Condition (3) is satisfied. When the foreign bank is a branch, the home bank can observe the type τ of the foreign bank's project at time 3. Hence, under the baseline contracting assumptions of Section 2.3, the home bank can condition the success wage upon τ. The consequence is that, although the ex ante contract does not condition upon project type, the wage contract that a branch foreign bank receives when investment occurs depends upon project type: it receives a success fee $w(M)$ for hard projects and $w(0)$ for easy projects. A subsidiary bank, whose home bank cannot distinguish at time 3 between easy and hard projects, cannot renegotiate: at time 1, it therefore establishes a success fee $w(M)$ for all projects, and this fee is not renegotiated at time 3.

The home bank's time 3 investment decision accounts for the above compensation structure. Investment occurs precisely when the home bank expects to make money from the foreign bank's project searches; that is, with success wage $w(\mu)$ and origination fee F, investment occurs if and only if Condition (4) is satisfied:

$$\mathbb{E}_H[\Pi R - 1 - w(\mu) + \beta_\mu - F] \geq 0, \tag{4}$$

where the H subscript indicates that the expectation is formed using all of the information available to the home bank. Note that the expectation operator $\mathbb{E}_H$ is only non-trivial when the foreign unit is a subsidiary. It is convenient to define the indicator function I_μ to be 1 in case Condition (4) is satisfied, and to be 0 otherwise.

We now consider the foreign bank's search decision. Suppose that at time 2 the home and foreign banks assign probability δ to the event that time 3 investment occurs:

$$\delta = \mathbb{E}[I_\mu]. \tag{5}$$

The foreign bank chooses to search for a project at time 2 if and only if the associated cost ζ is less than the expected income it derives from the project. This observation yields the following participation constraint:

$$\mathbb{E}\left[(w\Pi - \mu + F)I_\mu - \zeta\right] \geq 0. \tag{6}$$

The home bank selects the lowest origination fee F that satisfies Condition (6) and the limited liability constraint $F \geq 0$. Lemma 1 follows immediately.

Lemma 1. *The foreign bank's incentive contract stipulates the following origination fee F:*

$$F = \max\left(0, \frac{1}{\delta}(\zeta - r)\right), \tag{7}$$

where

$$r \triangleq \mathbb{E}\left[(w(\mu)\Pi - \mu)I_\mu\right]. \tag{8}$$

The foreign bank earns an expected origination fee δF; for search to be incentive compatible, this figure must exceed the foreign bank's search costs. But, if project investment occurs, the foreign bank derives an expected information rent r from its monitoring. The home bank therefore subtracts this sum from the search cost ζ when determining the origination fee. F cannot be negative, and so is given by Equation (7).

If the origination fee F is zero then the foreign bank's expected informational rent from monitoring must be more than cover the search cost ζ. It follows that the foreign bank's time 1 expected informational rent ρ is given by Equation (9):

$$\rho \triangleq \max\left(\frac{1}{\delta}(r - \zeta), 0\right). \tag{9}$$

3.2 *Choice of foreign bank form*

We now turn to an analysis of the home bank's choice between subsidiary and branch bank expansion, and of the welfare consequences of its choice. We assume that both types of bank

face the same set of investment opportunities, and we therefore base our analysis upon the representative search illustrated in Figure 1.

Recall that the home bank authorises post-search investment. If the foreign bank is a branch, then the home bank can observe the foreign bank's project type and so has two possible strategies: it can elect to be *unselective*, in which case it accepts every project, or to be *selective*, in which case it selects only easy projects. If the foreign bank is a subsidiary then the home bank cannot distinguish between projects and, hence, is compelled to be unselective.

We write V_S and V_U for the per-search expected social surplus generated by selective and unselective banks, respectively:

$$V_U \triangleq R\Pi - 1 + (1-\lambda)\beta - \zeta - \lambda M; \tag{10}$$

$$V_S \triangleq (1-\lambda)\left(R\Pi - 1 + \beta\right) - \zeta. \tag{11}$$

Recall (Equation (1)) that both easy and hard projects have a positive NPV, so that

$$V_U > V_S. \tag{12}$$

Equation (12) implies that social surplus is maximised by an unselective bank. However, the social and private optima need not coincide because the relationship between the home and foreign banks is complicated by information frictions that generate rents for the foreign bank. We now analyse the home bank's surplus-maximising strategy under the assumption that it is able to commit up-front to a selective or unselective investment strategy.

3.2.1 Foreign bank form with ex ante commitment

This Section derives the home bank's preferred expansion strategy in case it is able to make a time 1 commitment to an investment strategy. Recall that branch banks are able to condition the foreign bank's success wage $w(\mu)$ on project type, while subsidiary banks pay a success wage $w(M)$ irrespective of project type. Expected wage costs are therefore higher in subsidiary than branch banks. Hence, when the home bank can commit ex ante to an investment strategy, it is never optimal to expand via a subsidiary. The home bank's strategic choice in this Section therefore boils down to a choice between selective and unselective branch bank expansion.

Selective branch banks invest only in easy projects, which occur with probability $1-\lambda$, and they receive a success wage of 0. They therefore earn no monitoring rent and must be compensated for project search entirely through their origination fee, which is therefore equal to $F_S \triangleq \zeta/(1-\lambda)$. It follows that selective bank expansion generates a per-project

home bank surplus of S_S, where

$$S_S \triangleq (1-\lambda)(\Pi R - 1 + \beta) - \zeta. \tag{13}$$

That is, the home bank captures the expected income $(1-\lambda)(\Pi R - 1 + \beta)$ from a selective investment policy, and in expectation must also incur the per-project search cost ζ. Equation (13) yields the following participation constraint for selective branch banks:

$$\zeta \leq \zeta_{\text{SEL}} \triangleq (1-\lambda)(\Pi R - 1 + \beta). \tag{14}$$

Now suppose that the home bank adopts an unselective investment strategy. In this case, $I_\mu \equiv 1$; it follows that the probability δ_U of investment is 1, the foreign bank's expected information rent is $r_U \triangleq \lambda(\Pi w(M) - M)$ and, by Lemma 1, that the origination fee is $F_U \triangleq \max(0, (\zeta - r_U)$. The home bank therefore derives expected surplus S_U from an unselective investment, where

$$S_U \triangleq \Pi R - 1 + (1-\lambda)\beta - \lambda\Pi\frac{M}{\Delta} - F_U. \tag{15}$$

The home bank opts for unselective branch bank expansion if and only if $S_U > S_S$, and otherwise expands via a selective branch bank. We compare S_U and S_S in the respective cases where the unselective branch bank's origination fee is positive, and where it is zero.

The origination fee is positive precisely when $r_U < \zeta$. This requirement is equivalent to Condition (16):

$$M \leq M_U^0 \triangleq \frac{\zeta\Delta}{\lambda(\Pi - \Delta)}. \tag{16}$$

When $F_U > 0$, the foreign bank earns no expected rent from an unselective investment policy and, hence, the home bank's expected surplus S_U equals the total expected surplus $\Pi R - 1 - \lambda M - \zeta$. This exceeds the surplus S_S from a selective policy by the marginal expected income $\lambda(\Pi R - 1 - M)$ from hard project investment: this expression is positive by Equation (1) so that unselective banks are strictly preferred for $M \leq M_U^0$.

In contrast when $F_U = 0$, the foreign bank earns positive time 1 expected rent equal to its expected ex post monitoring rent $\lambda M(1-\Delta)/\Delta$ less the search cost ζ. The home bank therefore prefers unselective banking when this rent figure is less than the marginal value $\lambda(\Pi R - 1 - M)$ derived from a hard project. This requirement reduces to Condition (17):

$$M \leq \overline{M} \triangleq \frac{\Delta}{\Pi}\left(\Pi R - 1 + \frac{\zeta}{\lambda}\right). \tag{17}$$

Condition (17) can be derived directly by setting $F_U = 0$ in Equation (15) and rearranging the requirement that $S_U \geq S_S$.

Note that, because the home bank extracts all of the expected surplus from unselective banks when $F_U > 0$, the time 0 participation constraint for unselective branch banks is $M \leq M^*$ when $F_U > 0$; when $F_U = 0$, the participation constraint is obtained by re-arranging Equation (15) with $F_U = 0$:

$$M \leq M_U^{\text{IR}} \triangleq \frac{\Delta}{\lambda\Pi}\left(\Pi R - 1 + (1-\lambda)\beta\right). \tag{18}$$

Figure 2 illustrates the lines M_U^0, $\overline{M}$, M^*, M_U^{IR} and $\zeta = \zeta_{\text{SEL}}$ in the respective cases where $M_U^{\text{IR}} \geq \Pi R - 1$ and $M_U^{\text{IR}} < \Pi R - 1$.

Note that, when $\overline{M}$ intersects the vertical line $\zeta = \zeta_{\text{SEL}}$ we have, first, that selective banks generate a zero surplus (because $\zeta = \zeta_{\text{SEL}}$) and, second, that the home bank is indifferent between selective and unselective branch banks (because $M = \overline{M}$). Hence, unselective banks must also generate a surplus of zero so that $\overline{M}$ and $\zeta = \zeta_{\text{SEL}}$ intersect at $M = M_U^{\text{IR}}$, as illustrated in the Figure; it is easy to check algebraically that this is the case.

At the point where the vertical $\zeta = \zeta_{\text{SEL}}$ crosses M^*, selective banks generate a social surplus of zero and so does unselective banking. It follows that, at the intersection point, hard projects generate a surplus of zero so that, as indicated in the Figure, the intersection occurs where $M = \Pi R - 1$.

Finally, as indicated in the figure, $\overline{M}$ and M_U^0 intersect at $(\zeta = \zeta^*, M = \Pi R - 1)$, where

$$\zeta^* \triangleq \frac{\lambda(\Pi - \Delta)}{\Delta}(\Pi R - 1). \tag{19}$$

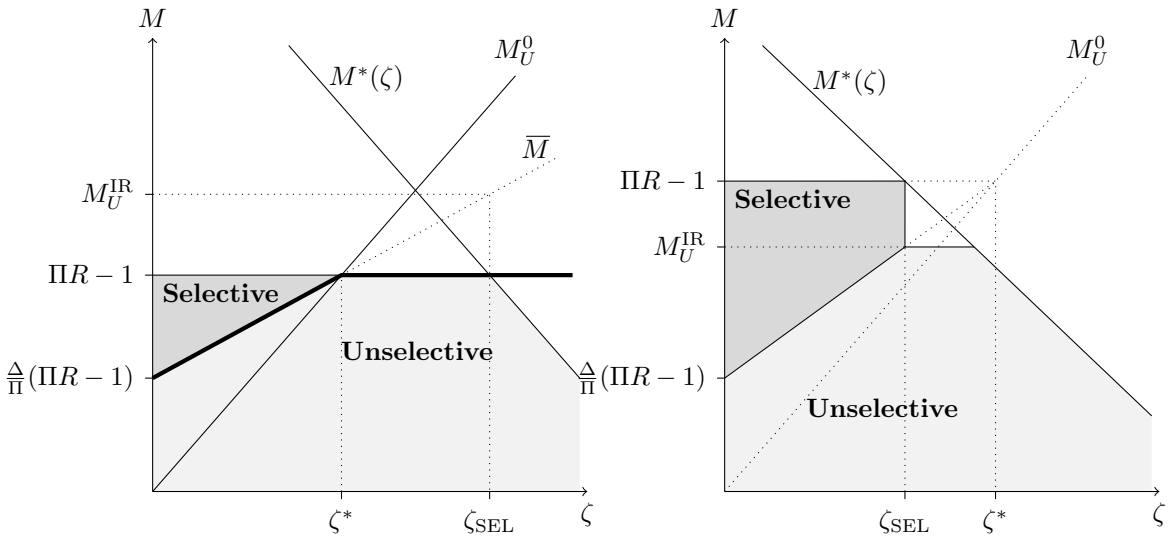
Lemma 2 summarises the results of this Section.

Lemma 2. *Let ζ^* be defined by Equation* (19) *and let $\overline{M}$ be given by Equation* (17) *when $\zeta \leq \zeta^*$ and be $\Pi R - 1$ otherwise. If the home bank can commit to an investment strategy then its surplus is maximised by branch bank expansion. It adopts a selective strategy for $M \geq \overline{M}$ and an unselective strategy otherwise.*

3.2.2 Time-consistent expansion strategy

We now derive the home bank's preferred expansion strategy in case it cannot commit at time 1 to a time 3 investment strategy. Unselective investment policies are only feasible in this case when they are time-consistent: that is, when it is incentive compatible at time 3 for the home bank to sanction investment in a hard project.

To see why an unselective investment policy may be optimal at time 1 but suboptimal when investment occurs at time 3, consider the marginal time 1 benefit that the home bank earns by switching from a selective to an unselective branch bank investment strategy. It



(a) $M_U^{\mathrm{IR}} \geq \Pi R - 1$ (b) $M_U^{\mathrm{IR}} < \Pi R - 1$

Figure 2. **Ex ante optimal home bank investment strategies.** Below the line $M = M_U^0$ the foreign bank earns no expected rent and, hence, all of the surplus accrues to the home bank. An unselective strategy is therefore ex ante optimal. Above the line, the foreign bank has positive expected rent that increases in M; when M is high enough the home bank prefers a selective strategy that wipes out the foreign bank's expected rent.

follows from the discussion after Equation (16) that this benefit can be written as follows:

$$\sigma_U \triangleq \begin{cases} \lambda(\Pi R - 1 - M), & F_U > 0; \\ \lambda(\Pi R - 1 - M) + \zeta - \lambda\frac{M}{\Delta}(\Pi - \Delta), & F_U = 0. \end{cases} \tag{20}$$

In equilibrium, the home bank commits to pay the cost ζ of project search as soon as it opens a selective branch bank at time 1. It follows that, when $F_U > 0$ so that the home bank captures all of the surplus generated by the foreign bank, σ_U does not depend upon ζ. In this case, the time 1 marginal effect of moving from selective to unselective investment is always positive. When $F_U = 0$ the home bank gives up surplus equal to the difference between the foreign bank's ex post rent and the search cost and, hence ζ features in σ_U: the home bank prefers selective branch banking for high enough M.

The home bank cannot commit to its time 1 investment strategy. Hence, an unselective investment policy is only sustainable if the time 3 marginal effect of accepting a hard project is positive. The time 3 value of hard project investment is $\Pi(R - w(M)) - 1 - F_U$, which, after some easy manipulation, reduces to $\hat{\sigma}_U$, where

$$\hat{\sigma}_U - \sigma_U = (1 - \lambda)(\Pi R - 1 - M) - (1 - \lambda)M\frac{\Pi - \Delta}{\Delta} - \zeta. \tag{21}$$

The first term on the right hand side of Equation (21) is the extra value that the home bank

earns because at time 3 it has a hard project with certainty compared to time 1, when the the corresponding probability is λ. Similarly, the home bank pays rent $M(\Pi - \Delta)/\Delta$ with certainty at time 3 and with probability λ at time 1, which yields the second term on the right of Equation (21). Finally, at time 1, the search cost ζ is incurred in expectation as soon as a selective branch is opened at time 1, so that it does not feature in σ_U; at time 3, the home bank can avoid incurring ζ by refusing to accept a hard project; as indicated in the last term of Equation (21), this lowers $\hat{\sigma}_U - \sigma_U$ by ζ.

More formally, the requirement $\hat{\sigma}_U > 0$ for investment in hard projects to be sanctioned can be written as follows:

$$\Pi R - 1 - M \geq \frac{\Pi - \Delta}{\Delta} M + F_U. \tag{22}$$

That is, hard project investment is sanctioned precisely when the project's NPV is sufficient to cover both the foreign bank's monitoring rent and its origination fee.

As in Section 3.2.2, F_U is zero precisely when $M \geq M_U^0$. In this case, Condition (22) reduces to the requirement that

$$M \leq \underline{M}_0 \triangleq \frac{\Pi}{\Delta}(\Pi R - 1). \tag{23}$$

When $M < M_U^0$, the origination fee $F_U > 0$. Substituting $F_U = \zeta - \lambda M(\Pi - \Delta)/\Delta$ into Condition (22) yields the following condition for hard project investment to be sanctioned:

$$M \leq \underline{M}_1 \triangleq \frac{\Delta(\Pi R - 1 - \zeta)}{(1-\lambda)\Pi + \lambda\Delta}. \tag{24}$$

The lines $\underline{M}_0$ and $\underline{M}_1$ are plotted in Figure 3 in the respective cases where $M_U^{\mathrm{IR}} \geq \Pi R - 1$ and $M_U^{\mathrm{IR}} < \Pi R - 1$. Note that, because the time consistency requirement constrains unselective branch banks to monitoring costs below $\frac{\Delta}{\Pi}(\Pi R - 1)$, the unselective branch bank IR constraint (Equation (18)) never binds; as in Figure 2, though, the relationship between M_U^{IR} and $\Pi R - 1$ determines whether or not the selective branch bank participation constraint binds for $M > \overline{M}$.

As illustrated in the Figure, $\underline{M}_0$ and $\underline{M}_1$ intersect the line M_U^0 at the point $(\zeta = \frac{\Delta}{\Pi}\zeta^*, M = \underline{M}_0)$. We define $\underline{M}(\zeta)$ to be $\underline{M}_0$ for $\zeta \leq \frac{\Delta}{\Pi}\zeta^*$ and to be $\underline{M}_1$ otherwise. Unselective investment is time-consistent only for $M \leq \underline{M}$.

This argument establishes Proposition 1:

Proposition 1. *For every $\zeta \geq 0$ there exist $\underline{M}$ and $\overline{M}$ such that:*

1. *$\overline{M} \geq \underline{M}$ with $\underline{M} = \overline{M}$ if and only if $\zeta = 0$;*
2. *If the home bank could commit to an investment strategy, it would expand via an unse-*

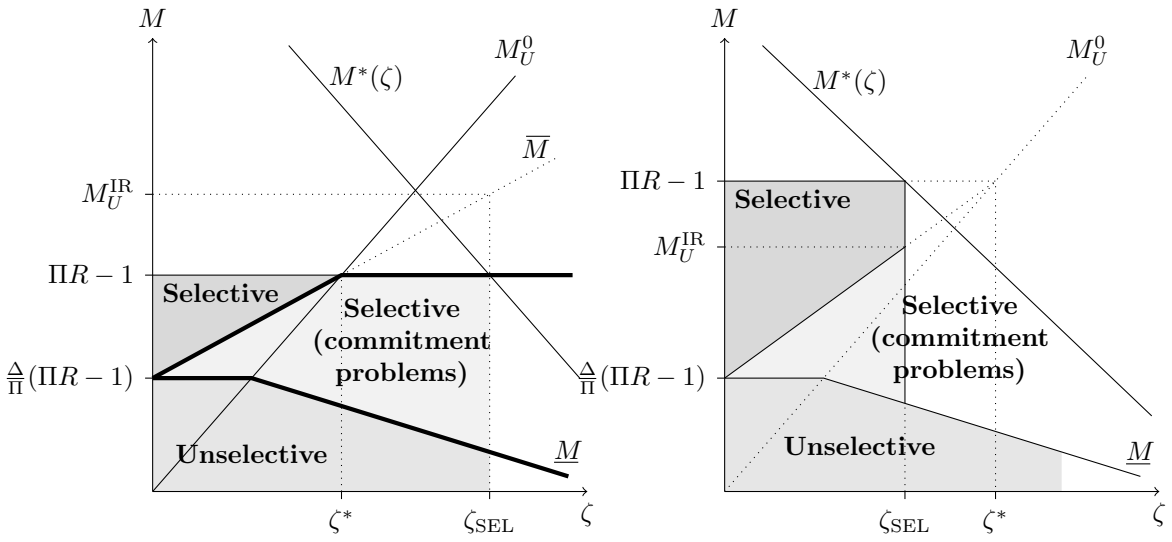


Figure 3. **Optimal time-consistent branch bank investment strategies.** When $M < \overline{M}_h$ the home bank prefers ex ante to expand using an unselective branch bank. For $\overline{M}_h > M \geq \underline{M}$ unselective branch bank investment is not time-consistent. For $M > (\Pi R - 1)\Delta/\Pi$, unselective investment would be time-consistent in the absence of ex post monitoring rent; for $M < (\Pi R - 1)\Delta/\Pi$, unselective investment would be time-consistent if the foreign bank received neither rent nor an origination fee.

lective branch bank if and only if $M \leq \overline{M}$*;*

3. *The home bank refuses to sanction investment in hard projects whenever* $M \geq \underline{M}$*.*

For $M \leq \overline{M}$, unselective branch bank investment is ex ante optimal; for $M > \underline{M}$, it is not time-consistent. Hence, for $\overline{M} \geq M > \underline{M}$, the home bank would expand via an unselective branch bank if it could commit to an investment strategy, but it cannot do so because it is unable to commit to its investment strategy.

Equation (22) indicates that time-inconsistency obtains when the project's NPV is insufficient to cover both the foreign bank's ex post information rent and its origination fee. Time-inconsistency could arise for two reasons. First, when $\overline{M} \geq M > \underline{M}_0$, time inconsistency occurs even in the absence of fees and it is therefore caused solely by information rent. Second, for $\underline{M}_0 \geq M > \underline{M}_1$, time inconsistency would not occur were it not for the foreign bank's origination fee. Within this region, then, time inconsistency is partly due to the effect identified by Rotemberg and Saloner (1994): the origination fee spreads the cost of search across easy and hard projects and, ex post, it is not worth paying for hard projects. Welfare could be increased when $\underline{M}_0 \geq M > \underline{M}_1$ if the home bank could commit to reimburse the foreign bank for its search efforts, but such commitment is ruled out by Assumptions 1 and 4.

One possible response to the home bank's commitment problem when $\overline{M} \geq M > \underline{M}$

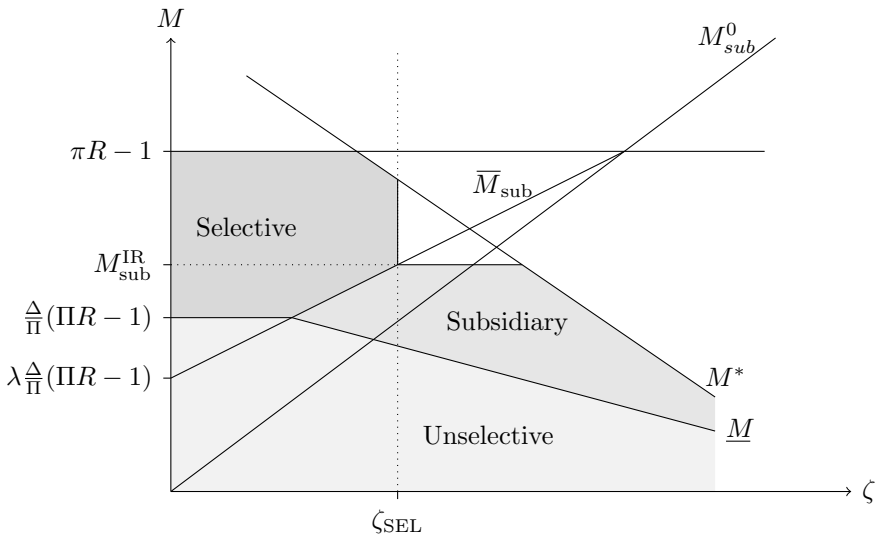


Figure 4. **Optimal time-consistent investment strategies.** When $M < \bar{M}$, unselective investment is optimal in a branch bank but is not time-consistent. Subsidiary banks achieve unselective investment without rent payment for $M \leq M^0_{sub}$ and, hence are optimal. When $M > M^0_{sub}$, subsidiary banks achieve unselective investment at the cost of an expected rent payment. That payment is smaller than the efficiency gains from unselective investment when $M \leq \bar{M}_{\text{sub}}$, in which case subsidiary banks are used; for $M > \max(\bar{M}_{\text{sub}}, \Delta(\Pi R - 1)/\Pi)$, the cost of subsidiary bank commitment exceeds its benefit, and the home bank opts for selective branch banking.

would be for the home bank to elect ex ante to restrict information flows so that, ex post, it cannot distinguish between easy and hard projects. It would therefore have the same ex post and ex ante incentives and, hence, could commit to an unselective investment policy. As noted at the start of this Section, the marginal impact of this commitment upon the home bank would exclude the cost of search, because the home bank must always pay that in equilibrium. But it would come at a cost, because the home bank would have to pay the higher incentive wage $w(M)$ to all projects. This type of informational restriction is therefore worth incurring when its marginal ex ante benefit exceeds the additional expected wage costs.

The home bank always prefers accurate information transmission ex post. Restrictions on information flows therefore have to be designed into the multinational bank form. If the multinational bank is sufficiently integrated with a consolidated balance sheet then its reporting systems ensure that complete information transfer occurs at time 3; branch banks achieve this information flow and, hence, cannot commit to investments that will be unattractive ex post. If, on the other bank, the foreign bank is run as a relatively independent institution with a separate balance sheet then it can maintain information systems that are deliberately distinct from those in the home bank. Restricted information flows are therefore designed into subsidiary banks, which are therefore able to achieve the desired commitment to invest in all positive NPV projects.

The expected monitoring rent that accrues to a foreign subsidiary bank is $r_{\text{sub}} \triangleq \Pi M/\Delta - \lambda M$, so that, by Lemma 1, the subsidiary bank origination fee is $F_{\text{sub}} \triangleq \max(0, \zeta - M(\Pi - \lambda\Delta)/\Delta$. The origination fee F_{sub} is positive, so that the foreign bank has no expected rent at time 1, if and only if Condition (25) is satisfied:

$$M \leq M^0_{sub} \triangleq \frac{\zeta\Delta}{\Pi - \lambda\Delta}. \tag{25}$$

We can therefore write the expected surplus that the home bank derives from subsidiary bank investment as follows:

$$S_{\text{sub}} \triangleq \begin{cases} \Pi R - 1 - \zeta - \lambda M + (1-\lambda)\beta, & M \leq M^0_{sub}; \\ \Pi R - 1 - \frac{\Pi M}{\Delta} + (1-\lambda)\beta, & M > M^0_{sub}. \end{cases} \tag{26}$$

The time 0 participation constraint for the subsidiary bank is therefore satisfied if and only if $S_{\text{sub}} \geq 0$; that is, if and only if Condition (27) is satisfied:

$$M \leq \begin{cases} M^*, & M \leq M^0_{sub}; \\ M^{\text{IR}}_{\text{sub}} \triangleq \frac{\Delta}{\Pi}(\Pi R - 1 + (1-\lambda)\beta), & M > M^0_{sub}. \end{cases} \tag{27}$$

When $M \leq M^0_{sub}$, the home bank extracts all of the project surplus so that investment is individually rational if and only if it is socially worthwhile: that is, if and only if $M \leq M^*$. For $M > M^0_{sub}$, the foreign bank extracts some rent and, hence, the participation constraint is tighter. Note that, because expected wages are higher in subsidiaries than in branches, $M^{\text{IR}}_{\text{sub}} < M^{\text{IR}}_U$.

Finally, recall that, because the home bank learns nothing about the subsidiary bank's projects, subsidiary banking is time-consistent whenever Condition (27) is satisfied.

We now compare the value of subsidiary and selective branch banking to the home bank. When $M \leq M^0_{sub}$ the foreign subsidiary bank's time 1 expected rent is zero. The ex ante cost to the home bank of using a subsidiary to commit to unselective investment is therefore zero, and the subsidiary bank is preferred to a selective branch bank. More formally, when $M \leq M^0_{sub}$ we have $S_{\text{sub}} - S_S = \lambda(\Pi R - 1 - M)$, which is non-negative by Equation (1).

When $M > M^0_{sub}$ the foreign subsidiary bank earns a positive time 1 expected rent. In this case, the home bank elects to commit via a subsidiary structure only when its expected benefit from doing so exceeds the expected rent. In this case, we have $S_{\text{sub}} - S_S > 0$ if and only if Condition (28) is satisfied:

$$M \leq \overline{M}_{\text{sub}} \triangleq \frac{\Delta}{\Pi}(\lambda(\Pi R - 1) + \zeta). \tag{28}$$

Note that $\overline{M}_{\text{sub}} = \lambda\overline{M}$.

M^0_{sub}, $\overline{M}_{\text{sub}}$, and $M^{\text{IR}}_{\text{sub}}$ are plotted on Figure 4, which identifies parameter regions within which selective branch banking, subsidiary banking, and unselective branch banking are ex ante optimal for the home bank. Note that the vertical $\zeta = \zeta_{\text{SEL}}$ must pass through the intersection of $M^{\text{IR}}_{\text{sub}}$ and $\overline{M}_{\text{sub}}$, since along $M^{\text{IR}}_{\text{sub}}$ the selective branch has expected surplus zero and this equals the expected subsidiary surplus along $\overline{M}_{\text{sub}}$.

The home bank's expansion strategy is summarised in Proposition 2 summarises the home bank's expansion strategy.

Proposition 2. *Subject to individual rationality constraints, the home bank adopts the following strategy for expansion into the new market:*

1. *If $M \leq \underline{M}$ then the headquarters expands using a foreign branch bank and adopts an unselective investment strategy;*
2. *If $\underline{M} < M \leq \overline{M}_{sub}$ then the headquarters expands using a foreign subsidiary bank and adopts an unselective investment strategy;*
3. *If $\max(\underline{M}, \overline{M}_{sub}) < M \leq \Pi R - 1$ then the headquarters expands using a foreign branch bank and adopts a selective investment strategy.*

4. Policy implications

4.1 *Mode of entry restrictions*

In the European Union, a "single passport" scheme allows any home EU bank to establish branches elsewhere in the EU without any additional licensing or other requirements from the host regulator (see (EEC, 1989)). The single passport scheme renders within-EU expansion very simple. Nevertheless, European multinational banks frequently ignore the regulatory inducements of the single passport scheme: many banks have opted to expand via subsidiaries within the European Union (Dermine, 2002).

In light of this type of evidence, it is natural to ask whether supervisors should formally constrain the corporate form that banks use to enter new countries. For example, one could argue that subsidiary expansion is more appropriate because it allows the local authorities to bring their expertise of local markets to bear on the supervision of foreign banks. An alternative argument is that, because the home regulator is better able to understand bank risk at a consolidated level, branch bank expansion is more appropriate.

Our analysis suggests that multinational banks select the constrained optimal mode of entry into new markets as the solution to an optimal contracting problem. For $M < \overline{M}_{\text{sub}}$, the multinational bank selects the welfare-maximising structure without any regulatory interference. For those M values, any attempt to impose a particular mode of entry upon a foreign bank runs the risk that it reduces welfare.

Imposing a branch structure instead of a subsidiary one when $\underline{M} < M < \overline{M}_{\text{sub}}$ guarantees the adoption of a selective investment policy and, hence, serves at the least to generate credit rationing for hard projects and so lowers foreign country welfare as well as home bank profitability. To the extent that foreign banks compete more aggressively for easy loans, imposing branch bank structure also lowers the quality of the project pool available for local banks (see, e.g., Clarke, Cull, Martinez Peria, and Sánchez (2001)).

On the other hand, a policy of forced subsidiary bank expansion bites when the home bank would otherwise have opted for branch bank expansion. That could occur for two reasons. First, when $M < \underline{M}$ commitment is unnecessary and branch bank expansion lowers expected wage costs. Forced subsidiary expansion in this case does not affect investment policies, but the associated increase in expected wage costs may undermine expansion plans. Second, if $M \geq \overline{M}_{\text{sub}}$, the home bank opts for branch banking because the cost of using subsidiary investment to invest in marginal projects is too high. Forced subsidiary bank expansion in this case would have one of two effects. Either it would force investment in all projects, and so increase welfare, or it would raise wage costs so far as to cause total withdrawal from the foreign market and, hence, would restrict the flow of credit. Which of these scenarios arises in a specific case depends upon the specifics of the situation and so requires a careful analysis of the costs and benefits of delegation.

4.2 *Increased supervisory data requirements*

Consolidated home supervision of cross-border banks requires centralisation of risk data. Until recently, regulatory and legal rules as well as information technology limitations ensured that data consolidation was incomplete. For example, financial institutions that rely upon old-fashioned information systems and upon systems that were acquired during the cross-border acquisition of subsidiaries can never achieve perfect information flows. Similarly, regulations that guarantee data security and individual privacy serve to limit the cross-border flow of information. All of these factors facilitate the subsidiary-derived commitment that we study in this paper.

The collection, storage and deployment of data in cross-border banks is changing in two important ways in the wake of the 2008–09 financial crisis.

First, we have seen a substantial increase in the detail of required data reporting. New prudential risk reporting requirements demand high quality, structured, complete and accurate data. Hence, supervisors require large firms to produce increasingly granular data; they also demand that it be reported more frequently. Large banks are responding to these requirements by using new technologies designed specifically to ensure compliance with regulatory demands. Collectively referred to as "regtech," the new tools aim to achieve lowest possible cost compliance with new rules. They have the side-effect of rendering it inevitable

that home banks learn information about subsidiary firms that was previously unavailable to them. Our model identifies an associated cost: a home bank that embraces regtech may be unable to achieve the commitment to invest that, we argue, is traditionally associated with subsidiary bank expansion. If so, the flow of credit to hard-to-monitor projects is likely to be harmed.

Second, as well as requiring more detailed reporting, supervisors increasingly require more centralisation. For example the largest banks in the Eurozone have been directly regulated by the European Central Bank since November 2014 (see Council of the European Union (2013)). The Basel Committee on Banking Supervision (2013) discusses progress towards "risk data aggregation;" it stresses the importance of banks' ability to provide comprehensive risk data by legal entity. When supervision is consolidated, banks that comply with regulatory standards have the data that they need to centralise decision-making. In other words, a tendency towards consolidated supervision may serve also to push banks towards branch bank expansion and centralised decision making.[3] If so, our model suggests that widespread consolidation of regulation may serve also to restrict the flow of credit to hard-to-monitor banks.

Supervisory developments in the United States suggest a template for addressing this potential problem. Foreign banks with assets exceeding $50 bn are required to place their US subsidiaries under an intermediate holding company that is regulated and supervised in the same way as any other US bank holding company. This is a form of centralisation that does not require granular information sharing with foreign home banks and, hence, enables true delegation to US bank managers. Foreign bank expansion into the US therefore occurs in a way that protects incentives to invest into US SMEs.

5. Empirical Implications

This section highlights the possible empirical implications of our work. We can relate three of our model parameters (M, ζ and λ) to the characteristics of countries, markets, and borrowers; we are therefore able to generate implications about the effect that these characteristics have upon the choices of multinational bank structure.

Dell'Ariccia and Marquez (2010) provides a theory of corporate structure choice based on country characteristics, in terms of economic and political risks. In their model, subsidiaries shield the home bank from economic shocks in the foreign market because of their limited liability. At the same time, subsidiaries are more exposed to political risk, including the risk of the expropriation of bank capital or other infringement of property rights. Our model delivers complementary predictions about the choice of corporate structure at the country

[3]Calzolari, Colliard, and Lóránth (2016) argue that banks with centralised decision-making are more likely to adopt a branch structure.

level. We explain corporate structure choice by the degree of competition/entry barriers in the foreign market ζ and by the strength of the legal and institutional environment (λ, M)that affect the bank's ability to collect payment from the borrower. In addition, we relate corporate structure to the degree of economic involvement in the foreign country, which is outside the scope of Dell'Ariccia and Marquez's (2010) model, but seems to matter. Cerutti, Dell'Ariccia, and Martinez Peria (2007) find that different organizational structures give rise to different degrees of market penetration. Furthermore, our model provide predictions about the bank's organizational structure and the shape of the incentive contracts.

5.1 *Country characteristics and choice of entry*

When the cost ζ of loan prospecting increases, the origination fee needed to incentivise search increases. To commit to invest into both types of projects the bank is more likely to select the subsidiary structure. In fact, as Lemma 3 states, the range of parameters for which subsidiary expansion occurs increases in ζ.

Lemma 3. *$\overline{M}_{sub} - \underline{M}$ is increasing in the search cost ζ.*

Proof. Immediate from the expressions for $\underline{M}$ and $\overline{M}_{\text{sub}}$.

The cost ζ of loan prospecting increases as foreign market competition increases. This observation, together with Lemma 3, yields the following hypothesis:

Hypothesis 1. *Banks are more likely to expand via subsidiaries in host countries with more competitive banking market.*

The foreign bank in our model cannot know in advance whether its loan prospecting will uncover an easy or a hard project. This assumption reflects uncertainty over the characteristics of new projects. But the likelihood that the foreign bank finds a hard project depends upon the institutional environment in which the foreign bank operates, and upon the market segment in which it searches. These factors are reflected in the probability λ that the search identifies a hard project. Lemma 4 establishes comparative statics with respect to λ.

Lemma 4. *The size of the subsidiary region of Figure 4 is increasing in λ when $M > \Delta(\Pi R - 1)/\Pi$ and is otherwise decreasing in λ.*

Lemma 4 follows immediately from Figure 4. For $M > \Delta(\Pi R - 1)/\Pi$, the subsidiary region is bounded above by the line $\overline{M}_{\text{sub}}$, which, by equation (28), is increasing in λ. For $M < \Delta(\Pi R - 1)/\Pi$, the subsidiary region is bounded below by $\underline{M}$ 1, which, by Equation (24), is increasing in λ.

It follows from Lemma 4 that, when M is high enough, subsidiary bank expansion is more likely for higher values of λ. Projects are more likely to be hard-to-monitor when legal institutions are weak and the institutions that support information disclosure are weak and, when those conditions obtain, the cost of monitoring is also likely to be higher. This argument yields the following empirical hypothesis:

Hypothesis 2. *Subsidiary bank expansion is more likely in foreign countries with poorer legal and institutional environments.*

In line with our theory, there is ample empirical evidence that subsidiaries dominate in regions such as Eastern Europe and Latin America, whose institutions appear to provide creditors with less protection than they would have in developed markets.

As illustrated in Figure 4, branches are optimal in our model for two different parameter regions. First, for a given search cost ζ, unselective branches emerge that serve easy and hard borrowers when the marginal cost M of monitoring a hard project is low. This situation is most likely to obtain in developed countries with well-established reporting systems and corporate law institutions; our analysis therefore explains evidence presented by Fiechter, Ötker-Robe, Ilyina, Hsu, Santos, and Surti (2011) in a recent IMF working paper that branches are more common than subsidiaries in Western Europe. Second, selective branches that invest only in easy projects emerge in our model when the monitoring cost M is very high. This translates into the statement that branches should emerge when legal institutions and creditor protection are weak. In line with this statement, Fiechter, Ötker-Robe, Ilyina, Hsu, Santos, and Surti (2011) report that branch banks are more frequently used for expansion into Asia and the Middle East, where creditor protection and legal institutions are relatively weaker.

Hypothesis 3. *Banks are more likely to expand via branches when expansion occurs in order to service pre-existing customers.*

We argued earlier that recent regulatory push towards more data aggregation at the holding company level and centralization of multinational bank supervision will affect branches and subsidiaries, asymmetrically. In particular, we expect the effect to be larger for subsidiaries where information flows between the subsidiary and the home bank have been designed to be less granular than between the branch and the home bank. As the benefits of subsidiaries will be reduced, we should observe a tendency of converting them into branches. Furthermore, as, according to our theory, subsidiaries are more likely to operate in countries with higher entry barriers and weaker legal and institutional environment, the effect of the new regulatory/supervisory changes are expected to be higher in these countries. This leads to the following hypothesis.

Hypothesis 4. *Following recent regulatory and supervisory changes (such as the Single Supervisory Mechanism (SSM)) we should expect a shift in corporate structure from subsidiary to branches. The impact should be larger in developing countries.*

5.2 *Organisational Form and Portfolio Quality*

Our model predicts that subsidiaries are employed so as to commit to invest in marginal projects. In contrast, some branch banks are used to cherry-pick the strongest projects. The following hypothesis is therefore immediate:

Hypothesis 5. *Ceteris paribus, subsidiaries have lower average loan quality than branch banks.*

This hypothesis is consistent with previous work by Cerutti, Dell'Ariccia, and Martinez Peria (2007) that finds that subsidiaries penetrate foreign market more deeply than branch banks, and that subsidiaries are more likely to lend to small and medium-sized local firms.

5.3 *Organisational Form and Compensation*

Branch banks in our model are paid an incentive wage only for the hard projects that require one. In contrast, subsidiary banks receive wage projects for hard and easy projects because it is impossible for the home bank to distinguish between the two. Average subsidiary bank wages are therefore higher:

Hypothesis 6. *Ceteris paribus, the average compensation per loan is higher in subsidiaries and is less sensitive to the profitability of the loan compared to branches.*

6. Robustness and Extensions

In this section we examine the robustness of our model's conclusions to some changes in its assumptions.

6.1 *Negative NPV Projects*

Our formal analysis rests upon the assumption that the home bank is able to distinguish between positive and negative NPV projects even when it operates a subsidiary abroad. We believe that this assumption is sufficiently close to reality to be reasonable. However, it is possible to extend our model to incorporate the case under which the bank has access to negative NPV projects, which are uncovered easily by the branch structure, but requires costly action under the subsidiary structure.

In a more general setting, a home bank contemplating branch bank expansion must trade off, on the one hand, the loss of commitment and a concomitant reduction in investment and, on the other hand, the possible halting of negative NPV projects. There is no compelling reason to believe that the second effect outweighs the first. Hence, we would still observe a region for moderate values of monitoring costs where subsidiaries would be chosen.

A possible interpretation of investment into negative NPV projects would be as collusion between the foreign bank and local entrepreneurs fuelled by corruption. Our prediction in this respect would be that in countries where corruption is sufficiently widespread, branches would be more likely to be chosen as a means of ensuring direct home bank control.

6.2 *Contracting Assumptions*

We assume in Section 2.3 that the home bank can renegotiate the success wage w in light of project information it receives at time 3, but that it cannot renegotiate the origination fee. We now consider a variety of alternative contracting assumptions.

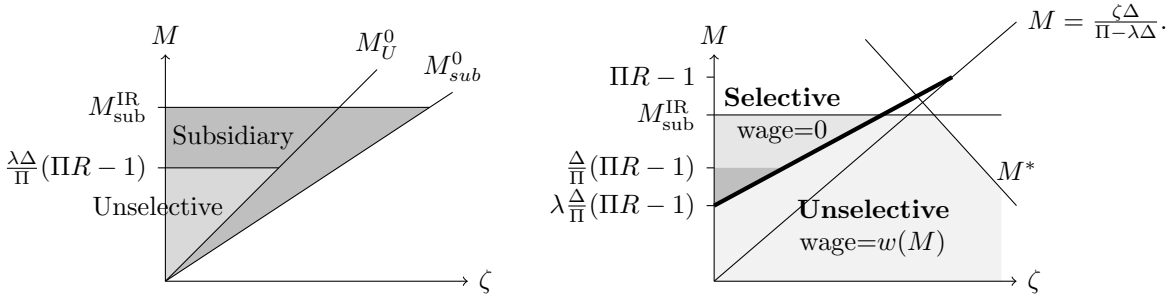
6.2.1 Renegotiation of success wage and origination fee

In this Section, we consider the consequences of allowing both the origination fee and the wage to be renegotiated at time 3.

The foreign bank's time 3 participation constraint is satisfied at time 3 whenever its monitoring incentive compatibility constraint is also satisfied. Hence, when all contractual terms are renegotiable at time 3 the home bank sets $F = 0$ and w at the lowest level consistent with monitoring: for branch banks, it sets $w = w(\mu)$, and for subsidiary banks, it sets $w = w(M)$.

It follows that a foreign branch bank will never recoup its search cost if the home bank follows a selective investment strategy. Branch bank expansion is therefore possible only if, first, unselective branch banking is time-consistent; and, second, if the foreign bank earns sufficient rent from monitoring hard projects to cover its search costs. The first of this conditions is satisfied if $\Pi(R - w(M)) > 1$; that is, if $M < \frac{\Delta}{\Pi}(\Pi R - 1)$. The second condition is true if and only if $\lambda(\Pi w(M) - M) > \zeta$; equivalently, when $M > M_U^0$. This condition is equivalent to the requirement that, when it is possible to commit to fees as in Section 3, the home bank would not need to pay a fee.

When branch banking is impossible, the home bank may attempt to run a subsidiary. A subsidiary bank's origination fee is renegotiated to 0 at time 3, but, because the home bank cannot observe the subsidiary's project type, the subsidiary's success fee at time 3 must be $w(M)$ for every project type. Investment on this basis satisfies the home bank's participation constraint provided $M \leq M_{\text{sub}}^{\text{IR}}$; the subsidiary bank is willing to search provided its expected



(a) **All payments renegotiable.** (b) **Perfect time 1 commitment.**

Figure 5. **Organisational structure with alternative contracting assumptions.** The figures illustrate regions in which banks operate with alternative contracting assumptions. In Figure (a) origination fees and success wages are renegotiable. In Figure (b) all wages are agreed using a binding time 1 contract.

monitoring rent $\Pi w(M) - \lambda M$ exceeds the search cost ζ, which is the case precisely when $M \geq M_{sub}^0$. Once again, this last condition is the one that guarantees that the fee is zero even when it is possible to commit to fees.

Regions in which branch and subsidiary banking are feasible with renegotiable success wages and origination fees are illustrated in Figure 5(a). It is instructive to compare this Figure to Figure 4, which illustrates optimal time-consistent investment strategies in the absence of renegotiation. First, the parameter space within which investment is possible is smaller in Figure 5(a) than in Figure 4: an inability to commit to wages and fees renders the set of time-consistent promises smaller, and so reduces investment. Second, the intuition that subsidiaries are important because they enable commitment survives the introduction of renegotiable wages and fees. Indeed, when hard project fees would have been renegotiated in a branch bank, the subsidiary is a better choice: hence, subsidiary banking occurs in the region below $M_{\text{sub}}^{\text{IR}}$ and left of M_U^0 in Figure 5(a), while branch banking occurs in the same region in Figure 4.

6.2.2 Commitment to success wage and origination fee

In this Section we consider an alternative model in which the headquarters commits at time 1 to both the success wage and the origination fee. As the headquarters does not know in advance what the project type will be, it must either commit to a uniform success wage $w(M)$ or to a wage 0. These payments obtain irrespective of the organisational form, which is therefore irrelevant.

A uniform success wage $w(M)$ generates exactly the same payoffs for home and foreign bank as the subsidiary of Section 3.2.2; when the success wage is always 0 the home bank will not invest in hard projects, which have a negative NPV when unmonitored, and both home and foreign therefore earn the same income as the selective branches of Section 3.2.1.

It is impossible with ex ante commitment to achieve the payoffs earned by an unselective branch in Section 3.2.1. The locus of (ζ, M) values along which the home bank is indifferent between subsidiary bank and selective branch payoffs in our baseline model is labelled $\overline{M}_{\text{sub}}$ in Figure 4.

The equilibrium contracting outcomes with perfect ex ante commitment are therefore as illustrated in Figure 5(b). Recall that, as noted above, the distinction between branch and subsidiary banks is meaningless in this case. For parameterisations identified by the dark triangle in the selective region of this Figure, an unselective branch operates in our baseline model but, because wage costs are fixed at the higher level $w(M)$ with perfect commitment, unselective expansion does not occur. Hence, in this region, preventing wage renegotiation results in credit rationing for hard projects.

6.3 *Delegation of Authority*

In our model, every investment that the foreign bank discovers has a positive net present value after the search cost ζ is sunk. Moreover, because it is rewarded only for his search efforts only if investment occurs, it will always prefer *ex post* that the investments he uncovers be accepted. Hence, in our set-up, the inefficiencies that arise because of the contracting problem between the foreign bank and the home bank could be avoided by delegating all authority for investment decisions to the foreign bank.

In practice, however, this solution would be unlikely to work. In a simple modification of our model in a foreign bank could easily locate very low quality projects from which it derived a substantial private benefit, delegation of decision-making authority to the foreign bank would result in a great many value-reductive investments. This modification would introduce additional complication to our analysis, but would have no substantive effect upon our intuitive results. Moreover, we believe that the modification would capture a realistic feature of real world banks.

7. Conclusion

This paper suggests that the choice between branch and subsidiary multinational bank expansion might be driven by contracting frictions between home and foreign banks. When the foreign bank earns information rent from its monitoring activities, the home bank may be unwilling to invest in hard-to-monitor projects, even when those projects have a positive ex ante Present Value net of all search and monitoring costs. In this situation, an organisational structure that hard-wires restrictions on information transmission between the home and foreign banks can raise welfare by preventing the home bank from acting on nuanced information about projects, and so allowing it to commit to invest in all of them. We argue

that this is the role of the subsidiary bank, which has a separate balance sheet, difference governance arrangements, and a different set of reporting systems. The cost of subsidiary bank commitment is an increase in wage payments that occurs because, when it cannot distinguish between loans that are easy- and hard-to-monitor, the home bank must compensate the foreign bank as if every project is hard-to-monitor.

The prior literature on multinational banks (Calzolari and Lóránth, 2011; Harr and Rønde, 2006; Lóránth and Morrison, 2003; Dell'Ariccia and Marquez, 2010) relies heavily upon differences in the liability structures of branches and subsidiaries. For two reasons, we deliberately abstract from those differences. First, in practice the liability differences may be blurred in reality: despite limited liability, subsidiaries are often saved by their home banks. Second, we wish to isolate the contracting problem that gives rise in our analysis to different multinational bank structures from the effects of limited liability.

Our analysis yields empirical predictions that are consistent with prior work. In particular, we can explain the larger involvement of subsidiaries in the host country's economy and their lending to small and medium-sized companies as opposed to large, blue-chip firms. We argue that multinational banks are more likely to expand via subsidiaries when their host countries have more competitive banking markets, suffer from poor legal and institutional environment, and are more distant geographically or culturally from the home country.

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