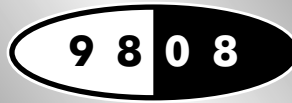


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**The Importance of Bank Seniority  
for Relationship Lending**

by Stanley D. Longhofer  
and João A.C. Santos



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## **THE IMPORTANCE OF BANK SENIORITY FOR RELATIONSHIP LENDING**

by Stanley D. Longhofer and João A. C. Santos

Stanley D. Longhofer is the Stephen L. Clark Chair of Real Estate and Finance at Wichita State University and an economist at the Federal Reserve Bank of Cleveland. João A. C. Santos is an economist at the Bank for International Settlements. The authors thank Sugato Battacharyya, Urs Birchler, Joe Bisignano, Mark Flannery, Craig Furfine, Joe Haubrich, Charlie Kahn, Ronald Mann, Mitch Petersen, John Rozycki, Bruce Smith, Kostas Tsatsaronis, two anonymous referees, and the editor, Anjan Thakor, as well as seminar participants at the Bank for International Settlements, the Federal Reserve Bank of Cleveland, the Federal Reserve Bank of New York, the Norwegian School of Management, the 1999 American Finance Association Meetings, and the 1999 Conference on Bank Structure and Competition for useful comments and suggestions.

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# **THE IMPORTANCE OF BANK SENIORITY FOR RELATIONSHIP LENDING\***

Stanley D. Longhofer

Wichita State University and Federal Reserve Bank of Cleveland  
Wichita State University  
Barton School of Business  
1845 N. Fairmount  
Wichita, KS 67260-0077  
longhofer@twsu.edu

João A. C. Santos

Research Group  
Bank for International Settlements  
Centralbahnplatz 2  
4051 Basle  
SWITZERLAND  
joao.santos@bis.org

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# **THE IMPORTANCE OF BANK SENIORITY FOR RELATIONSHIP LENDING**

Stanley D. Longhofer  
Federal Reserve Bank of Cleveland

João A. C. Santos  
Bank for International Settlements

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## Abstract

The idea that banks exist to reduce the costs of monitoring is central to modern theories of financial intermediation. The fact that banks are generally granted senior positions on their small-business loans, however, is hard to reconcile with the typical view that junior lenders have the best incentives to engage in this costly monitoring. Our paper addresses this puzzling contradiction by showing that bank seniority plays an important role in encouraging the formation of valuable bank-firm relationships.

The intuition behind our model lies in the fact that once the firm's prospects have deteriorated, junior creditors have incentives much like those of the firm's shareholders. Thus, it is the most senior claimant that benefits from helping the firm improve its quality. If banks are made junior to other creditors, they benefit little from additional investment in the firm during times of poor performance and hence will have little incentive to build relationships that enable them to determine the value of such an investment. As a result, making the bank senior improves its incentives to build a relationship with the firm, thereby fulfilling an important function of intermediated debt.

## **1. Introduction**

The idea that banks exist to reduce the monitoring costs associated with external finance is central to modern theories of financial intermediation.<sup>1</sup> Rather than having multiple lenders collect information about the firm's prospects prior to granting credit and then simultaneously monitor the borrower's actions once an investment has been undertaken, potential investors may find it more efficient to delegate these tasks to a "bank," through which they all provide funding to the firm.

This role for bank lending is particularly important for small-business borrowers, whose small size and relative opacity make funding through public markets a virtual impossibility, and leads naturally into the idea of banks as "relationship lenders." Through their ongoing monitoring efforts, banks build relationships with their customers that give them valuable information about these firms' prospects in the future.<sup>2</sup>

Of course, financial intermediaries are not without incentive problems of their own. In particular, a bank may shirk on its ongoing obligation to build monitoring relationships with the firms in which it has invested. One way of resolving this problem is to make the bank junior to the firm's other creditors; since it will be the first to suffer any losses if the firm misbehaves, the junior bank will have a better incentive to perform its ongoing monitoring function.<sup>3</sup> This "solution," however, contrasts starkly with the fact that bank loans are usually senior to those of other creditors, especially when the borrower is a small business for whom such monitoring is so important. This raises an important question: Why are bank loans senior to other debt claims?

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<sup>1</sup> Leland and Pyle (1977), Diamond (1984), Ramakrishnan and Thakor (1984) and Boyd and Prescott (1986). See Bhattacharya and Thakor (1993) and Freixas and Rochet (1997) for reviews of the contemporary banking literature.

<sup>2</sup> Berlin (1996) provides a nice expositional introduction to the notion of relationship lending we consider in this paper. Boot and Thakor (1994) show that, even without learning, a long-term bank-borrower relationship is still welfare improving because it allows the bank to reduce the use of (costly) collateral in the financing contract over time. See Ongena and Smith (1998) for a review of the literature on relationship lending.

<sup>3</sup> See, for example, Fama (1990).

In this paper, we address this question by showing that bank seniority plays an important role in encouraging the formation of ongoing bank-firm relationships, improving banks' incentives to monitor their borrowers. If banks are made junior to other creditors, they may benefit little in bad states from additional investment in the firm, and hence will have little incentive to build a relationship that might allow them to determine the value of such an investment.<sup>4</sup> As a result, the first contribution of our paper is to show that making the bank senior improves its incentives to build a relationship with the firm.

Central to our model is the idea that banks are important to small-business borrowers because they can develop ongoing relationships that help them understand a firm's true quality in bad states of nature. In good states of the world, having a relationship with a bank is not particularly important to a firm, because many lenders will be willing to provide funding even without special knowledge of the firm's prospects. In contrast, during a recession firms that have ongoing relationships with a bank are better able to obtain additional financing, allowing them to weather the recession with minimal loss. Firms that do not have bank relationships, however, may find the terms of such supplemental financing too onerous. Consequently, their prospects diminish.<sup>5</sup>

Our paper's second major contribution is to show how the bank's ability to cross-subsidize the firm over different stages of its development can play a key role in enabling it to build a relationship with the firm. The monitoring activities associated with building a relationship with the firm can be extremely costly for the bank. As a result, it will often

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<sup>4</sup> This result is somewhat different from the more typical assumption that junior creditors have a better incentive to monitor the firm. The distinction here lies in our assumption that the bank's monitoring becomes valuable only in a recession, when junior creditors may have incentives more closely aligned with those of the firm's owner. We discuss this further in Section 7.

<sup>5</sup> Slovin, Sushka, and Polonchek (1993), Petersen and Rajan (1994), and Berger and Udell (1995), among others, report results supporting the claim that a close relationship with a bank is valuable to small firms. Ongena and Smith (forthcoming) present evidence from several countries on the number of bank relationships that firms choose. Williams Stanton (1998) argues that banks reduce their lending to creditworthy firms during recessions, contributing to credit crunches. This behavior is not inconsistent with our results, which simply depend on the notion that firms with ongoing bank relationships have *better* access to credit during recessions than firms without such relationships.

be impossible for the bank to be fully compensated for these costs in its initial loan agreement with the firm. In our model, however, the bank's ability to earn super-normal returns in a future debt agreement allows it to credibly commit to performing these tasks, even though the expected return on its initial loan with the firm may be negative.

It is a generally accepted fact that bank debt is typically senior to that of other creditors, particularly for small-business borrowers. Mann (1997) and Schwartz (1997) paint pictures of banks as not only taking a senior claim over other creditors, but also collateralizing as much of their debt as possible and incorporating protective covenants that restrict the firm's ability to undertake additional debt without the bank's permission.<sup>6</sup> In addition, Carey (1995) finds that a large majority of bank-debt loan agreements with large firms contain a senior priority clause, regardless of whether or not the borrower has public debt outstanding.

Ours is not the first effort to explain the ubiquity of bank seniority. Building on Diamond (1993a), Diamond (1993b) argues that making short-term (bank) debt senior relative to long-term (public) debt improves the bank's incentives to monitor and liquidate the borrower if it gets into financial distress. Berglöf and von Thadden (1994), Park (1997), and Repullo and Suarez (1998) also focus on the liquidation problem and arrive at similar conclusions. Welch (1997) argues that banks are typically senior vis-à-vis the firm's other creditors because they are better negotiators in financial distress. In general, Welch argues, banks are better organized than other creditors, and have more to gain from developing a reputation as a tough negotiator in bankruptcy proceedings. By making the "stronger" creditor (the bank) senior, the firm is able to reduce costly conflicts among creditors that arise in financial distress.

In contrast to these papers, we focus on the problem of small-business borrowers that do not have access to public capital markets and for whom gathering information

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<sup>6</sup> Mann argues, however, that banks' use of collateral with small businesses is declining. Nevertheless, his evidence is consistent with the overall conclusion that banks overwhelmingly take senior positions in their small-business loans.

about their projects is expensive. This focus is important because such firms rely much more heavily on banks for loans and their ability to reduce monitoring costs. To our knowledge, ours is the first model to analyze the seniority question for this important subset of the loan market.

Our model is most similar to those of Diamond (1993b) and Rajan (1992). Both of these models involve a firm balancing the use of long-term (public) debt and short-term (bank) debt in order to ensure the correct liquidation/continuation decision once information about its prospects is revealed. In Diamond, the bank makes better liquidation decisions when it is senior, since the proceeds from such liquidations do not flow through to the firm's bondholders. In contrast, Rajan argues that bank debt should be junior to the firm's public debt. This difference arises because Rajan assumes that the bank's relationship with the firm gives it an informational advantage over other potential creditors: "If the bank has higher priority, it can dispossess the arm's-length creditor, giving the bank an incentive to avoid liquidation" (Rajan, 1992, p. 1387).

Like Diamond, we find that the bank and the firm have a better incentive to make Pareto-preferred decisions when the bank is senior. As in Rajan, however, the bank in our model may earn monopoly rents from its renegotiation with the firm once it learns about the firm's future prospects. Indeed, the ability to capture such rents plays a central role in encouraging the bank to build a relationship with the firm.<sup>7</sup>

A fundamental difference between our paper and these lies in our assumption that the process of building a relationship and monitoring the firm is costly for the bank. As a result, the bank's contract must provide it with the proper incentive to actually incur these costs and build a relationship with the firm. Another important distinction between our paper and Rajan is that we model firm effort as increasing the expected value of the firm's revenues to be divided in renegotiation. In contrast, firm effort in Rajan increases the likelihood that renegotiation will occur, but not the "size of the pie" to be split. It is

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<sup>7</sup> See also Peterson and Rajan (1995) and Boot and Thakor (forthcoming) for analyses of the effects of competition on relationship lending.



this difference in the effects of firm effort, as well as our incorporation of relationship-building costs, that explains the dichotomy between our results and Rajan's.

The remainder of our paper is organized as follows. The next section introduces a model of bank relationship lending. In Section 3, we define a relationship equilibrium and derive plausible conditions under which such an equilibrium exists only when the bank is senior. Section 4 discusses alternative equilibria, and demonstrates that our relationship equilibrium Pareto dominates these other alternatives. Section 5 examines the impact of the relative bargaining strengths of the bank and the firm on the outcome in our model. In Section 6, we outline the direct empirical implications that arise from our model, while Section 7 concludes. Proofs of all results are found in the Appendix.

## **2. A Model of Relationship Lending**

We consider the problem of a firm that must borrow funds in order to invest in a project. Prior to its maturity, however, outside shocks may occur that can affect the "quality" of this project. The precise impact of these shocks depends on the effort the entrepreneur has exerted prior to the onset of the shock and on whether the bank advances additional funds to the firm.

For firms whose entrepreneurs have exerted a great deal of effort, a recession leads only to a liquidity crunch. In this case, the firm must receive additional financing or its project will deteriorate. If it does receive this funding, however, its project continues as if no recession had occurred.

In contrast, if the entrepreneur does not exert effort, additional investment has no effect on the expected value of the firm's project. Instead, a low-effort firm that invests during a recession actually makes its project more risky. We think of this as a "going for broke" strategy: Since the firm did not exert any effort, there is no way for it to regain its high-return, low-risk status.

The final element of our story is the bank's decision to build a costly relationship with the firm. We assume that this relationship is important in that it allows the bank to

determine if the entrepreneur exerted effort. As a result, when the bank has a relationship with a firm, it is able to tell whether that firm is requesting additional investment because of a liquidity shock—a high-effort entrepreneur—or if it will use these added funds to go for broke—a low-effort entrepreneur. Without a relationship, however, the bank is unable to tell which type of firm is requesting additional funds and is hence less willing to advance these funds.

To this end, consider a two-period model in which an entrepreneur can invest  $I$  in a project in period 0 that will provide a random return in period 2. Since the entrepreneur has no initial endowment, he must obtain funds from outside sources in order to undertake his project. Figure 1 depicts the order of events in our model.

We assume that the entrepreneur obtains funds from two different sources. The first is a bank. In our model, banks are special in that they provide funding to meet the firm's general liquidity needs on an ongoing basis. In the process of providing such funds, banks are able to develop relationships with entrepreneurs, relationships that are valuable in a way to be specified in a moment. The second lender can be thought of as a trade creditor. We think of trade creditors as companies such as the firm's suppliers for whom lending is an ancillary activity to their primary business of producing goods. As a consequence, the trade creditor is unable to provide the firm with general cash infusions. For example, if a firm requires a working-capital loan to meet its payroll, such funds would come from its bank, not a trade creditor.<sup>8</sup> Both lenders provide the entrepreneur with funds in period 0 with the promise that they will be repaid with the revenue earned in period two. Let  $I_B$  denote the funds borrowed from a bank and  $I_T$  the funds borrowed from a trade creditor, where  $I_B + I_T = I$ .<sup>9</sup>

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<sup>8</sup> Boot and Thakor (forthcoming) distinguish between “relationship loans” and “transaction loans,” otherwise known as arms-length lending. Applying this terminology to our model, banks make relationship loans while trade creditors offer transaction loans because they do not provide relationship services to the firm.

<sup>9</sup> In this paper, we follow Diamond (1993b) and Welch (1997) and simply take it as given that the entrepreneur borrows funds from two different lenders. In another paper (in progress), we show how differences in the valuation of a firm's various assets can endogenously lead firms to borrow from multiple sources. See Berglöf and von Thadden (1994) and Bolton and Scharfstein (1996) for other models that

Immediately after these loans are made, the bank decides whether or not to invest in building a relationship with the borrower; if it does so, the bank incurs a cost  $c_B$ . We think of building a relationship as involving regular visits with the entrepreneur to learn about his business and his customers. This ongoing monitoring is particularly important for the smaller, younger firms we consider in this paper, since their prospects can change much more quickly than those of larger, more-established enterprises. Because of the ongoing nature of this process, the bank cannot build its relationship with the firm prior to its funding decision, nor can it credibly commit to actually following through with a promise to build a relationship once it provides funding to the firm.<sup>10</sup>

The “hands-on” nature of this relationship building allows entrepreneurs to observe whether a relationship is being developed. Based on this information, the entrepreneur then decides whether or not to exert effort in his firm; doing so costs him  $c_E$ .

The expected return of the firm’s project in period 2 depends on several factors. First, it is affected by exogenous market factors, the “state of the world,” which is realized in period 1 (after the bank and firm have decided whether to build a relationship and exert effort). With probability  $\theta$  the good state occurs, and the firm’s project continues with no modification; we will call the project in this state of the world project  $G$ . Note that in the good state, neither the entrepreneur’s effort nor the bank’s relationship has any effect on the project.

In contrast, in the bad state of the world, which occurs with probability  $1-\theta$ , additional investment can affect the project’s outcome. We think of this event as a “recession,” and it affects high-effort and low-effort firms differently.<sup>11</sup> If the entrepreneur exerted effort, he can retain his original project  $G$  only if he can raise an

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endogenize the use of multiple creditors.

<sup>10</sup> This is not to suggest that the bank might not also monitor the firm’s quality *prior* to making a funding decision.

<sup>11</sup> We use the term recession for expositional convenience. Our paper does not consider any aggregate implications and the use of this term is not intended to suggest otherwise.

additional  $I_1$  from the bank.<sup>12</sup> Otherwise, his project deteriorates to project  $B$ . We assume that project  $B$  has the same risk as project  $G$ , but that its expected return is lower.<sup>13</sup> If the entrepreneur did not exert effort in period 0, additional investment in the bad state has a different effect. In this case, if the entrepreneur invests an additional  $I_1$ , the project's risk *increases*, while its mean remains low, as in project  $B$ . We will denote this project as project  $R$ . In either case, if the entrepreneur requests additional funding from the bank, we assume that renegotiations proceed according to rules we will outline below.

In period 2 the project matures. We distinguish among projects  $G$ ,  $B$ , and  $R$  using two parameters,  $\mu$  and  $\sigma$ . The parameter  $\mu$  measures the difference in the expected return across projects, while  $\sigma$  is a measure of a project's risk.<sup>14</sup> A project is assumed to be successful with probability  $p(\sigma)$ , in which case it produces  $\mu(X + \sigma)$ ; with probability  $1 - p(\sigma)$  it "fails," producing  $\mu(x - \sigma)$ , where  $X \geq x$ .

We assume that increases in  $\sigma$  are mean preserving, so that for any  $\sigma_1$  and  $\sigma_2$ ,

$$\Gamma \equiv p(\sigma_1)(X + \sigma_1) + [1 - p(\sigma_1)](x - \sigma_1) = p(\sigma_2)(X + \sigma_2) + [1 - p(\sigma_2)](x - \sigma_2). \quad (1)$$

In this specification, a project with a larger  $\sigma$  has more risk; that is, we assume  $p'(\sigma) < 0$ .<sup>15</sup> Notice that an increase in the risk of a project has two effects. First, it reduces the probability that the project succeeds. Second, it increases the payoff of the project when it is successful and reduces its payoff when it fails. Figure 2 shows the impact of a change in  $\sigma$  on the probability density function of a project's return. The advantage of this specification is that it allows us to independently examine the impact of changes in the net present value of the project and its risk, while maintaining the analytical simplicity of a two-point return distribution.

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<sup>12</sup> Hart and Moore (1998) model a situation in which a borrower may wish to obtain excess financing in period 0 in order to avoid refinancing concerns in period 1. Such a strategy would be sub-optimal in our model, since the firm would never exert effort with this initial financing. As we show later, this outcome is Pareto dominated by our relationship equilibrium.

<sup>13</sup> Project  $B$  and project  $R$  that follows may have either positive or negative net present values.

<sup>14</sup> Note that  $\sigma$  is *not* the project return's standard deviation; rather, it is a parameter that is positively correlated with the firm's risk.

<sup>15</sup> This implies that the firm's probability of success,  $p(\sigma)$ , is larger than  $1/2$ .

Given this notation, our prior assumptions about the relative means and risks of projects  $G$ ,  $B$ , and  $R$  imply that<sup>16</sup>

$$\mu_G > \mu_B = \mu_R \text{ and } \sigma_G = \sigma_B < \sigma_R. \quad (2)$$

We assume that  $\min\{I_B, I_T\} \geq \mu_G(x - \sigma_G)$ , so that the project's profit when it fails is insufficient to pay off whichever lender is senior. This ensures that the senior lender's debt is never riskless, which would trivialize the role of seniority.

It is important to keep in mind that the state of the world, revealed in period 1, is distinct from the outcome of the project, realized in period 2. Notably, the state of the world only helps determine the likelihood that the project will be successful. As a result, the firm's project may fail even in the good state of the world and may succeed following a recession.

Because we want to examine the role of seniority on the outcome of our model, we will let  $\delta$  be a parameter that indicates the relative seniority of the bank. When  $\delta = 1$ , the bank is senior, and it receives all of the firm's liquidation value in default. On the other hand, when  $\delta = 0$  the bank is junior to the trade creditor, and the trade creditor receives the firm's entire revenue when its project fails. Intermediate values of  $\delta$  can be thought of as representing varying levels of proportionate priority. In other words, when the firm's project fails, the bank receives  $\delta\mu(x - \sigma)$ , while the trade creditor receives  $(1 - \delta)\mu(x - \sigma)$ .<sup>17</sup>

Many of the results that follow depend on the idea that project  $R$  is the consequence of risk-shifting behavior on the part of the entrepreneur. Consistent with this, we assume that the firm's total expected return when the project is successful is higher with project  $R$  than it is with project  $G$ :<sup>18</sup>

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<sup>16</sup> Although tedious to prove, with some additional technical assumptions all of our results continue to hold under the more general condition that  $\mu_G > \mu_B \geq \mu_R$  and  $\sigma_R > \sigma_B \geq \sigma_G$ .

<sup>17</sup> The primary purpose of this specification is to facilitate the comparative statics to be performed later. Note, however, that if  $\delta$  were equal to the proportion of the firm's bank debt relative to its total debt, the bank and the trade creditor implicitly would have equal priority.

<sup>18</sup> To reduce notational requirements, we define  $p_k \equiv p(\sigma_k)$  for all projects  $k$ .

$$p_R \mu_R (X + \sigma_R) > p_G \mu_G (X + \sigma_G). \quad (3)$$

This is a standard risk-shifting assumption and it implies that, given any fixed interest payment  $L$ , the firm will always prefer the risky project.<sup>19</sup>

Our final assumption ensures us that project  $G$  is desirable even when additional investment  $I_1$  is required in the bad state of the world:

$$(1 - \theta)[(\mu_G - \mu_B)\Gamma - I_1] \geq c_E + c_B. \quad (4)$$

Intuitively, this assumption simply tells us that the expected marginal profit from the additional investment is sufficiently large to compensate the firm for the cost of relationship building and the cost of effort necessary to make the good project attainable in the bad state of the world.

### **3. A Relationship Equilibrium**

In this section, we use the model developed above to derive an equilibrium consistent with the idea that bank relationships are valuable for firms. In the first subsection, we define a “relationship equilibrium” as one in which the bank builds a relationship with the firm and the firm’s entrepreneur exerts effort. We then calculate the firm’s expected profit in this equilibrium. In the second subsection, we derive the conditions under which this relationship equilibrium exists. We conclude the section by proving our primary result that the relationship equilibrium is more likely to exist when the bank is senior to the trade creditor.

#### ***Defining the Equilibrium***

We begin by defining what we mean by a relationship equilibrium.

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<sup>19</sup> Note that this assumption does not necessarily imply that project  $R$  has a negative net present value. This assumption is sufficient for the results that follow to hold. It is not necessary, however, and our results would still hold true with weaker, albeit less-intuitive, assumptions about the relative payoffs from projects  $G$  and  $R$ .

DEFINITION: A **Relationship Equilibrium** is a sequential equilibrium in which

- 1) *The bank develops a relationship with the firm;*
- 2) *The firm exerts effort if and only if it observes the bank building a relationship;*
- 3) *In the bad state of the world, the firm acquires additional investment from the bank;*
- 4) *On the out-of-equilibrium path in which the bank does not build a relationship with the firm, it believes with probability one that the firm did not exert effort.*

Note that the firm has complete information about whether the bank built a relationship. Instead, the only possible asymmetric information in our model arises when the bank fails to build a relationship, in which case it does not observe whether the firm exerted effort. Thus, the only out-of-equilibrium beliefs that must be specified are those of the bank for the case in which it doesn't build a relationship.<sup>20</sup>

From this definition, it is clear that in any relationship equilibrium, the firm always ends up with project  $G$ , regardless of whether the good state of the world is realized. As a result, the firm's ex ante expected profits in equilibrium are

$$\theta p_G [\mu_G(X + \sigma_G) - L_T^* - L_B^*] + (1 - \theta) p_G [\mu_G(X + \sigma_G) - L_T^* - L_B'] - c_E, \quad (5)$$

where  $L_T^*$  and  $L_B^*$  are the equilibrium face values of the debt negotiated in period 0 with the trade creditor and bank, respectively, while  $L_B'$  is the renegotiated face value of the debt owed to the bank after new investment in period 1.

In equilibrium,  $L_T^*$ ,  $L_B^*$ , and  $L_B'$  are calculated by solving the trade creditor and bank's zero-profit conditions. For the trade creditor, this is

$$p_G L_T^* + (1 - p_G)(1 - \delta)\mu_G(x - \sigma_G) = I_T, \quad (6)$$

implying that

$$L_T^* = \frac{I_T - (1 - p_G)(1 - \delta)\mu_G(x - \sigma_G)}{p_G}. \quad (7)$$

The intuition behind expression (6) is straightforward. Because the firm always ends up with project  $G$  in equilibrium, whether the good state of the world is realized is

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<sup>20</sup> As we show in Lemmas 2 and 3 below, the only set of such beliefs that are rational put probability one on the firm *not* exerting effort.

irrelevant to the trade creditor. In either state, the firm's project succeeds with probability  $p_G$ , in which case the trade creditor is repaid the full face value of its debt,  $L_T^*$ . When the firm's project fails, however, the trade creditor only receives the proportion of the firm's liquidation value,  $\mu_G(x - \sigma_G)$ , it is due given its relative priority position,  $1 - \delta$ . In equilibrium,  $L_T^*$  is set so that this total expected return just equals the trade creditor's funding costs,  $I_T$ .

The bank's zero profit condition can be written as

$$\begin{aligned} & \theta[p_G L_B^* + (1 - p_G)\delta \mu_G(x - \sigma_G)] \\ & + (1 - \theta)[p_G L_B' + (1 - p_G)\delta \mu_G(x - \sigma_G) - I_1] = I_B + c_B. \end{aligned} \quad (8)$$

In contrast to the trade creditor, the bank's expected return is affected by the state of the world, since in equilibrium the bank will provide additional financing to the firm in the bad state, thereby renegotiating the face value of its debt. When the good state is realized, which happens with probability  $\theta$ , there is no need for new funding and the firm's project succeeds with probability  $p_G$ , allowing the firm to pay  $L_B^*$  to the bank. With probability  $1 - p_G$ , however, the firm's project fails and the bank receives its contractual share of the firm's liquidation value,  $\delta \mu_G(x - \sigma_G)$ .

With probability  $1 - \theta$  the bad state of the world occurs. In this state, the firm renegotiates its bank debt, promising the bank  $L_B'$  in return for the additional funding  $I_1$ . Upon receiving this additional funding, the firm's project once again succeeds with probability  $p_G$  and fails with probability  $1 - p_G$ ; the bank's payoff in each of these cases is the same as it was in the good state.

The important question that remains is how the period-1 contract,  $L_B'$ , is negotiated. We model this renegotiation in the following manner. If the bad state of the world is realized and the firm requires additional funding, the entrepreneur initiates renegotiation by proposing a new face value of its debt to the bank in return for the added funding  $I_1$ . The bank then has the option of either accepting or rejecting this offer. If the offer is rejected, the bank and the firm play a game in which each of them has a chance of making a take-it-or-leave-it offer to the other. With probability  $q$ , the borrower makes



the offer, while with probability  $1-q$  the bank makes the offer. In either case, if the offer is rejected, the firm receives no additional investment and continues with the bad project under the terms of the original debt agreement,  $L_B^*$ .<sup>21</sup>

We begin by considering what happens if the bank rejects the firm's initial offer and they proceed to the second stage of this game. Let  $\hat{L}'_B$  denote the new face value of the debt proposed by the entrepreneur if he gets to make the final take-it-or-leave-it offer. In this case, the entrepreneur will choose  $\hat{L}'_B$  so as to drive the bank down to its reservation return:

$$p_G \hat{L}'_B + (1-p_G) \delta \mu_G (x - \sigma_G) - I_1 = p_B L_B^* + (1-p_B) \delta \mu_B (x - \sigma_B). \quad (9)$$

If the bank rejects the entrepreneur's offer, the firm will be left with the bad project and its initial contract terms,  $L_B^*$ . Thus, the right-hand side of this equation is the lowest total return the bank will be willing to accept. The entrepreneur therefore sets  $\hat{L}'_B$  so that the bank's expected return after providing additional funding for the good project is just equal to this amount:

$$\hat{L}'_B = L_B^* + \frac{I_1 - (1-p_G) \delta (\mu_G - \mu_B) (x - \sigma_G)}{p_G}. \quad (10)$$

Similarly, let  $\tilde{L}'_B$  denote the new face value of the debt proposed by the bank if it gets to make the final offer. In this case, the bank demands a loan payment such that the *entrepreneur* will be just indifferent between accepting and rejecting the offer:

$$p_G [\mu_G (X + \sigma_G) - L_T^* - \tilde{L}'_B] = p_B [\mu_B (X + \sigma_B) - L_T^* - L_B^*]. \quad (11)$$

In other words, the bank will set  $\tilde{L}'_B$  so that the firm's profit under the good state is exactly what it would be if no renegotiation occurred and the firm were forced to proceed with project *B*. This implies

$$\tilde{L}'_B = L_B^* + (\mu_G - \mu_B) (X + \sigma_G). \quad (12)$$

Given these outcomes, when the entrepreneur determines its initial offer it will set  $L'_B$  such that the bank will be just indifferent between accepting the offer and proceeding

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<sup>21</sup> Implicitly, we are assuming that the firm may not go to an outside bank for funding in this period. This assumption simplifies the analysis, but is not essential to our primary result. In Section 5, we discuss how our model would be affected by the inclusion of outside banks in this bargaining game.

to the next stage of the game

$$p_G L'_B + (1 - p_G) \delta \mu_G(x - \sigma_G) = p_G [q \hat{L}'_B + (1 - q) \tilde{L}'_B] + (1 - p_G) \delta \mu_G(x - \sigma_G), \quad (13)$$

or

$$L'_B = q \hat{L}'_B + (1 - q) \tilde{L}'_B. \quad (14)$$

In this expression, the parameter  $q$  effectively measures the relative bargaining strength of the entrepreneur. When  $q = 1$ , the borrower retains all the surplus from the renegotiation; if  $q = 0$ , the bank will make the final offer and thus extracts all rents derived from added investment in period 1. Since the bank cannot expect to do any better by rejecting this offer and proceeding to the final stage of bargaining, in the initial stage it will accept the offer of  $L'_B$  and provide an additional  $I_1$  in funding to the firm.<sup>22</sup>

This  $L'_B$  can then be substituted into the bank's zero-profit constraint (8) to solve for the initial face value of the bank debt,  $L_B^*$ :

$$L_B^* = \frac{1}{p_G} \{ I_B + c_B - \theta(1 - p_G) \delta \mu_G(x - \sigma_G) - (1 - \theta)(q(1 - p_B) \delta \mu_B(x - \sigma_G) + (1 - q)[p_G(\mu_G - \mu_B)(X + \sigma_G) + (1 - p_G) \delta \mu_G(x - \sigma_G) - I_1]) \}. \quad (15)$$

Intuitively,  $L_B^*$  is set to equal the bank's initial funding and relationship-building costs, less any expected recovery in default and any rents it extracts during renegotiation in period 1, all discounted by the probability that the firm's project will be successful.

Substituting (7), (14), and (15) into (5) shows that the firm's equilibrium expected profit is

$$\Pi_i^{r,e} = \mu_G \Gamma - [I_T + I_B + (1 - \theta)I_1 + c_B + c_E], \quad (16)$$

where  $r$ ,  $e$ , and  $i$  denote the strategies of the bank and firm: build a relationship, exert effort, and request additional investment in the bad state. Similarly, we will use  $nr$ ,  $ne$ , and  $ni$  to denote the strategies of not building a relationship, not exerting effort, and not requesting additional investment. Thus we see that the firm's expected profit in the

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<sup>22</sup> Note that  $L'_B$  would be exactly the same if we assumed that the bank were to make the initial offer during renegotiation, rather than the firm.

relationship equilibrium is simply equal to the expected return on the good project, minus the expected funding costs, and minus the relationship-building and effort costs.

***Existence of the Relationship Equilibrium***

Our goal in this subsection is to derive the conditions under which the relationship equilibrium just presented exists. We do this by developing a series of lemmas that describe the optimal out-of-equilibrium behavior of the bank and the firm.

Consider again the game tree depicted in Figure 1. At node 1, the bank decides whether to build a relationship with the firm. At nodes 2 and 3, the firm decides whether to exert effort given the bank’s choice about whether to build a relationship. Nature acts at nodes 4-7, revealing the good state with probability  $\theta$  and the bad state with probability  $1-\theta$ . Finally, at nodes 8-11, the firm decides whether to request added funding. If it does, it renegotiates its bank loan to have a new face value  $L'_b$ .

Essentially, our problem is to find the conditions under which the bank will build a relationship with the firm and, given a relationship is built, the firm’s entrepreneur will exert effort and request additional funding in the bad state of the world. We start by focusing on the firm’s problem at node 2 in Figure 1. Upon observing the bank build a relationship, the firm will be willing to follow the equilibrium strategy of exerting effort and requesting additional investment in the bad state of the world if<sup>23</sup>

$$\Pi_i^{r,e} \geq \max\{\Pi_i^{r,ne}, \Pi_{ni}^{r,ne}\}, \tag{17}$$

where, as noted before,  $\Pi_i^{r,ne}$  is the firm’s expected profit when the bank builds a relationship, the firm does *not* exert effort, and the firm requests additional investment in period 1, while  $\Pi_{ni}^{r,ne}$  is the firm’s expected profit with the relationship, no effort, no investment strategies; formal expressions for  $\Pi_i^{r,ne}$  and  $\Pi_{ni}^{r,ne}$  are derived in the Appendix.<sup>24</sup> Comparing these expected returns, we can derive the conditions under

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<sup>23</sup> In the appendix, we show that when (17) holds, the firm will always choose to request additional investment in the relationship/effort/bad state branch of the tree (node 8).

<sup>24</sup> Throughout this section, all payoffs are derived as deviations from the relationship equilibrium. That is, in their derivations,  $L_T^*$  and  $L_b^*$  are defined as in (7) and (15) above, under the expectation that the firm

which the firm is willing to exert effort.

LEMMA 1: *Conditional on observing the bank build a relationship, the firm will exert effort if and only if  $c_E \leq c_E^* \equiv \min\{\hat{c}_E, \tilde{c}_E\}$ , where*

$$\hat{c}_E \equiv (1-\theta)q[(\mu_G - \mu_B)\Gamma - (1-p_G)(1-\delta)(\mu_G - \mu_B)(x - \sigma_G) - I_1], \quad (18)$$

$$\tilde{c}_E \equiv (1-\theta)q \left[ (\mu_G - \mu_R)\Gamma - \left(1 - \frac{p_R}{p_G}\right)I_T - (1-\delta)w \right], \quad (19)$$

and  $w \equiv \frac{p_R}{p_G}(1-p_G)\mu_G(x - \sigma_G) - (1-p_R)\mu_R(x - \sigma_R)$ .

Condition (17) above implies that the firm's effort decision depends on whether it would prefer to invest in the risky project or simply accept the bad project should the bad state of the world occur following a failure to exert effort (node 9 in Figure 1). If  $\Pi_{ni}^{r,ne} > \Pi_i^{r,ne}$ —i.e., the firm would prefer to not request additional investment at this node of the tree—the entrepreneur will choose to exert effort as long as the cost of doing so is less than  $\hat{c}_E$ , his expected marginal benefit from obtaining the good project over the bad project.

Intuitively,  $\hat{c}_E$  can be understood as follows. The first term inside the square brackets represents the added gross profit obtained from project  $G$ . From this, we subtract the added revenues that accrue to the trade creditor when the project is unsuccessful; this is the second term in the square brackets. The final term is the additional investment required in order to maintain project  $G$  in the bad state of the world. Thus, the term in square brackets represents the net surplus that can be split between the bank and the firm in the bad state of the world should the firm exert effort. How much of this will be kept by the firm depends on its relative bargaining strength,  $q$ . Finally, since effort costs must be borne in all states of the world, but their fruits are only reaped in the bad state, this whole expression is multiplied by  $1-\theta$ .

Similarly, the second bound on  $c_E$  is derived by comparing the  $\Pi_i^{r,e}$  with  $\Pi_i^{r,ne}$ .

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will exert effort and request additional funding in the bad state of the world;  $L'_b$  is set following the rules of the renegotiation process outlined above, given the case at hand.

Intuitively,  $\tilde{c}_E$  represents the upper bound of costs that can be covered by the added profit the firm earns by maintaining project  $G$  in the good state of the world, less the rents it can extract from the trade creditor by investing in the risky project.

In this expression,  $w$  represents the additional risk-shifting revenues the firm can earn when the trade creditor is junior.<sup>25</sup> In general,  $w$  may be either positive or negative, indicating that the revenue the firm is able to extract from the trade creditor may be either increasing or decreasing in  $\delta$ . On the one hand, choosing the risky project reduces the firm's total expected liquidation value below that expected by the trade creditor. On the other hand, the fact that project  $R$  fails more often than project  $G$  makes risk-shifting less attractive for the firm, since the trade creditor collects these proceeds more often. Which of these two effects is stronger determines whether the firm finds risk shifting more or less advantageous when the trade creditor is senior, i.e., whether  $w$  is positive or negative.

We assume that the former "risk-shifting" effect dominates the latter "default recovery" effect, so that  $w > 0$  and the firm can extract more revenue from the trade creditor when it is senior. This assumption is consistent with our earlier assumption that the firm finds risk-shifting desirable (condition (3) above). It is worth noting that  $w$  is increasing in the risk of the project. Indeed, when  $\sigma_R = x$ , so that project  $R$  is at its most risky,  $w$  must be positive, implying that our assumption that  $w > 0$  is tantamount to assuming that project  $R$  is sufficiently risky.

Next, we consider the conditions under which the bank will build a relationship. Obviously, whether the bank will deviate and not build a relationship depends on how the bank expects the firm to respond to this decision. To explore this reaction, we begin by noting that the only distinction between the relationship and no-relationship branches of the tree in Figure 1 is the information set comprised of nodes 10 and 11. That is, in the no-relationship branch the bank is unable to determine whether an entrepreneur requesting additional funds has exerted effort, and must therefore charge the same  $L'_B$  to

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<sup>25</sup> The total risk-shifting revenue is given by  $(1 - \frac{p_R}{p_G})I_T + (1 - \delta)w$ , where the first term in this expression gives the risk-shifting gain the firm can obtain regardless of the trade creditor's seniority position.

both types of firm.

This inability of the bank to ascertain the firm's effort when there is no relationship leads to the following lemma:

LEMMA 2: *If the bank does not build a relationship, the firm will never exert effort.*

The basic idea behind this lemma is straightforward. Although failing to exert effort has a negative impact on the total value of the firm's project ( $\mu_R < \mu_G$ ), it is still attractive to the firm as long as it can shift the downside losses to its creditors, as we assumed by (3) above. If the bank does not build a relationship with the firm in period 0, the face value of its debt following new investment in period 1 cannot depend on the firm's effort choice, and hence provides no means of forcing the firm to internalize the costs of this risk-shifting behavior. Not surprisingly, this discourages the entrepreneur from exerting effort.

It follows immediately that a bank that does not build a relationship will rationally anticipate this behavior and charge an interest rate  $L'_B$  commensurate with the belief that the firm exerted no effort.

LEMMA 3: *The only consistent out-of-equilibrium beliefs for a bank that does not build a relationship put probability 1 on the firm not exerting effort.*

Given these results, the bank's profit from deviating from our relationship equilibrium depends only on whether the firm will choose to request added investment in the bad state of the world, i.e., whether  $\Pi_i^{nr,ne}$  is larger or smaller than  $\Pi_{ni}^{nr,ne}$ . Since the bank earns zero expected profit in the relationship equilibrium, the bank will only deviate if its expected return from doing so is strictly positive.

LEMMA 4: *The bank will build a relationship with the firm if and only if  $c_B \leq c_B^* \equiv \min\{\hat{c}_B, \tilde{c}_B\}$ , where*

$$\hat{c}_B \equiv (1-\theta)(1-q)[(\mu_G - \mu_B)\Gamma - (1-p_G)(1-\delta)(\mu_G - \mu_B)(x - \sigma_G) - I_1], \quad (20)$$

$$\tilde{c}_B \equiv (1-\theta)(1-q) \left[ (\mu_G - \mu_R)\Gamma - \left(1 - \frac{p_R}{p_G}\right) I_T - (1-\delta)w \right], \quad (21)$$

and once again  $w \equiv \frac{p_R}{p_G} (1-p_G)\mu_G(x - \sigma_G) - (1-p_R)\mu_R(x - \sigma_R)$ .

Casual inspection of these conditions reveals that they are virtually identical to those on  $c_E$  that ensured that the firm would be willing to exert effort. The only differences are that these restrictions apply to  $c_B$ , the bank's cost of building a relationship, and that the bank's relative bargaining strength,  $1-q$ , is substituted for that of the firm.

Intuitively, this makes sense. Just as the entrepreneur was unwilling to exert effort unless he could capture enough of the gains from retaining the good project in the bad state of the world to offset his effort cost, so the bank will be unwilling to build a relationship unless it expects to capture sufficient rents upon renegotiation in period 1 to compensate it for the cost of doing so. Since the benefits from maintaining the good project are the same regardless of which party captures them, the only question is how they are split between the firm and the bank, as measured by the bargaining strength parameter  $q$ .

Putting together Lemmas 1-4 gives us the conditions under which a relationship equilibrium exists.

PROPOSITION 1: *A relationship equilibrium exists as long as the firm's cost of exerting effort and the bank's cost of building a relationship are not too large, i.e., if  $c_E \leq c_E^*$  and  $c_B \leq c_B^*$ .*

As one would expect, the intuition behind this proposition mirrors that behind Lemmas 1 and 4. Building a relationship is costly for the bank, as is exerting effort for the firm's entrepreneur. Unless both the bank and firm can capture sufficient rents during

renegotiation in period 1, one or both will be unwilling to fulfill its obligation and the relationship equilibrium will break down.

An interesting consequence of this proposition is that if either the bank or the firm have all the bargaining strength during renegotiation in period 1—i.e., if  $q = 0$  or  $q = 1$ —a relationship equilibrium will never exist whenever relationship building and effort costs are strictly positive. We discuss this and other implications of the bank and firm’s relative bargaining strengths in Section 5.

### ***Relationship Lending and Bank Seniority***

In the last subsection, we defined and characterized a relationship equilibrium in which the bank builds a relationship with the firm and the firm’s entrepreneur exerts effort in its project after observing the bank build this relationship. Our task now is to analyze how the bank’s relative seniority position affects the conditions under which this relationship equilibrium exists.

**PROPOSITION 2:** *A relationship equilibrium exists for a larger set of exogenous relationship-building and effort costs when the bank is senior.*

Figure 3 illustrates the effects of this proposition. In this figure, the diagonal line represents the set of  $(c_B, c_E)$  pairs for which (4) above is satisfied. Recall that, intuitively, this condition required that project  $G$ ’s expected return be sufficiently large compared to that of project  $B$  to justify the costs of building a relationship and exerting effort, as well as any additional investment that is required during a recession. Thus, the area below this diagonal line exhausts the set of  $(c_B, c_E)$  pairs for which a relationship equilibrium would be a desirable outcome.

As shown in the previous section, the bank will only be willing to build a relationship if  $c_B \leq c_B^*$  and, upon observing the bank build a relationship, the firm will only be willing to exert effort if  $c_E \leq c_E^*$ . Thus, the shaded region in Figure 3 gives the feasible  $(c_B, c_E)$  pairs for which both the bank and the firm can commit to the



relationship equilibrium. For larger relationship building or effort costs, either the bank or firm will deviate and the relationship equilibrium will fail to exist.

Proposition 2, then, is proven by demonstrating that both of these restrictions become less binding as the bank's relative seniority position increases. That is, as  $\delta$  increases, the bank and the firm can incur higher costs of building a relationship and exerting effort and still credibly commit to their respective strategies in the relationship equilibrium.

Intuitively,  $c_B^* + c_E^*$  measures the net benefit to be divided between the bank and the firm upon renegotiation in period 1 from maintaining the relationship equilibrium. If  $\Pi_{ni}^{nr,ne} > \Pi_i^{nr,ne}$ ,

$$c_B^* + c_E^* = (1 - \theta)[(\mu_G - \mu_B)\Gamma - (1 - p_G)(1 - \delta)(\mu_G - \mu_B)(x - \sigma_G) - I_1]. \quad (22)$$

As discussed in the last subsection, this represents the higher expected return associated with the good project, minus the required added investment and the fraction of this higher expected return that will accrue to the trade creditor should the project fail in period 2. When the trade creditor is junior, it retains less of the benefit from maintaining the good project in the bad state of the world. As a result, there is more left to be divided between the bank and firm, and higher relationship building and effort costs can be supported.

The intuition when  $\Pi_i^{nr,ne} > \Pi_{ni}^{nr,ne}$  is similar. In this case, the bank and firm divide

$$c_B^* + c_E^* = (1 - \theta) \left[ (\mu_G - \mu_R)\Gamma - \left(1 - \frac{p_R}{p_G}\right)I_T - (1 - \delta)w \right] \quad (23)$$

upon renegotiation in period 1. In this expression, investing in project  $R$  has the added benefit of shifting risk onto the trade creditor. The rents from this risk shifting are subtracted from the higher expected total return associated with project  $G$  to come up with the total amount to be divided between the bank and trade creditor.

Since  $w > 0$ , expression (23) is an increasing function of  $\delta$ . Intuitively, as the bank's relative seniority position increases, the trade creditor becomes less exposed to

this risk shifting. As a result, the bank and firm have a larger pie to split between themselves upon renegotiation in period 1. Once again, this allows them to incur higher relationship building and effort costs and still commit to the relationship equilibrium.

Thus we see that a relationship equilibrium is more likely to exist when the bank is made senior to the firm's other creditors. Of course, this result would be of little interest if our relationship equilibrium were dominated by other possible equilibria in our model. In the next section, we show this is not the case.

#### **4. Alternative Equilibria and Efficiency**

In the previous section, we defined and characterized an equilibrium in which the bank builds a relationship with the firm and the entrepreneur exerts effort. In addition, we demonstrated that this relationship equilibrium exists for a larger set of exogenous parameters when the bank is made senior over the firm's trade creditor.

Now, we extend the analysis to consider other potential equilibria. In particular, we demonstrate that the relationship equilibrium described above Pareto dominates the most natural alternative, a "no-relationship" equilibrium. As a result, there is a measurable welfare loss when the bank and/or firm are unable to commit to their relationship equilibrium strategies.

Given the discussion in Section 3, it should not be surprising that the relationship equilibrium described there is not unique. In particular, a no-relationship equilibrium may also exist.

DEFINITION: A *No-Relationship Equilibrium* is a sequential equilibrium in which

- 1) *The bank does not develop a relationship with the firm; and*
- 2) *The firm does not exert effort.*

Strictly speaking, two such no-relationship equilibria may exist—one in which the firm requests additional investment in the bad state of the world and one in which it does not. For the purposes of our analysis, both of these outcomes are qualitatively similar, in the

sense that the bank does not build a relationship with the firm, so we will treat them as one equilibrium.<sup>26</sup>

The key difference between this no-relationship equilibrium and the deviations from the relationship equilibrium described in the previous section is the underlying beliefs. In the no-relationship equilibrium, the bank and the trade creditor both price their initial period-0 debt contracts under the belief that no relationship will be built and that the firm will not exert effort. In contrast, the deviations in the last section were derived under the assumption that the bank would build a relationship and that the firm would exert effort. Given the differing beliefs that underlie the relationship and no-relationship equilibria, it is feasible that both may exist for the same set of exogenous parameters.<sup>27</sup> In other words, our model may exhibit multiple equilibria; we discuss the issue of equilibrium selection in a moment.

In addition to the no-relationship equilibrium, there are three other potential equilibria that one might wish to consider. The first is an autarkic equilibrium, in which no lending occurs. The second is an equilibrium in which the bank does not build a relationship with the firm, but the firm nevertheless exerts effort; Lemma 2, however, implies that this can never be an equilibrium. The final possible equilibrium is a “no-effort” equilibrium in which the bank builds a relationship with the firm, but the firm chooses to not exert effort. Although it is possible that these strategies can be supported as an equilibrium for some set of beliefs, they will always be dominated by the no-relationship equilibrium just defined.

The question we ask, then, is under which of these potential equilibria is the firm better off. That is, when the relationship equilibrium fails to exist, is there a social loss that results from the inability to commit to building a relationship and exerting effort?

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<sup>26</sup> Furthermore, the bank may have a variety of beliefs about the firm’s out-of-equilibrium effort choice, giving rise to other possible no-relationship equilibria that satisfy the above definition.

<sup>27</sup> In fact, we have been able to demonstrate the simultaneous existence of these equilibria by means of a numerical example; this example is omitted from the text for the sake of brevity.

PROPOSITION 3: *The firm's expected profit, and hence social welfare, is higher under the strategies associated with the relationship equilibrium than it is under the strategies associated with any other equilibrium.*

It is important to note that this result is not dependent on the existence of any particular equilibrium. As a result, there is a tangible welfare loss associated with the breakdown of the relationship equilibrium. In other words, for any  $(c_B, c_E)$  pair that satisfies (4) but for which the relationship equilibrium does not exist, firm profit—and hence social welfare—would be higher if the bank and the firm could commit to their relationship equilibrium strategies.

The intuition behind Proposition 3 is reasonably straightforward. When the relationship equilibrium breaks down, either because  $c_B > c_B^*$  or  $c_E > c_E^*$ , either the autarkic, the no-relationship, or the no-effort equilibrium results. In these equilibria, however, the firm ends up with either project  $B$  or project  $R$  should the bad state of the world occur. Condition (4) above thus ensures that the relationship equilibrium dominates each of these alternatives, because  $\mu_G > \mu_B = \mu_R$ . That is, the firm's expected profits are always higher under the relationship equilibrium than they are under any of the other possible outcomes.

When combined with Proposition 2, Proposition 3 provides a strong justification for giving the bank seniority over the firm's trade creditors. By making the bank senior, the bank and the firm are more readily able to commit to their relationship equilibrium strategies, thus minimizing the likelihood of less-desirable outcomes such as the no-relationship equilibrium and autarky occurring. Thus, it is clear that bank seniority can play an important role in encouraging the formation of valuable bank-firm relationships.

As mentioned above, each of the possible equilibria in our model may exist for the same set of exogenous parameters. Nevertheless, the usual problem of determining which equilibrium will obtain is not present. First, as demonstrated in Proposition 3, the relationship equilibrium Pareto dominates any other equilibrium that may exist, providing a natural focal point for selecting this equilibrium. More importantly, the specific

equilibrium to be reached is an implicit part of the initial loan contract between the bank and the firm. As a result, competition among banks will ensure that if multiple equilibria do exist, the firm will be offered a contract that affords it the highest possible profit; i.e., the relationship equilibrium.

## **5. Renegotiation and Inter-Period Subsidization**

In this section, we discuss further implications of the bargaining that occurs upon realization of the bad state in period 1. In particular, we analyze how the structure of this renegotiation game can affect the likelihood that a relationship equilibrium will exist. In addition, we consider how modifications to this bargaining process might affect our primary result that bank seniority promotes the formation of valuable bank-firm relationships.

### ***Renegotiation and Outside Banks***

Implicit in our model is the assumption that the firm is unable to approach outside banks for supplemental funding when the bad state of the world is revealed. As it turns out, relaxing this assumption would not affect our results in any qualitative manner. Most importantly, our conclusion that a relationship equilibrium is more likely to exist when the bank is senior continues to hold even when the firm can approach outside banks for supplemental funding during period 1.

To understand this fact, consider how the renegotiation game described above would be changed if the firm could approach outside banks for funding in period 1. As before, assume that the firm is given the opportunity to make an initial offer to the inside bank. If the bank rejects this initial  $L'_B$ , the firm may choose between going to an outside bank for funding or playing the second stage of the renegotiation game as described in Section 3.

Under these rules, the primary effect of allowing the firm to approach outside banks for funding in period 1 is to limit the amount of surplus the bank can extract during the negotiation by increasing the firm's relative bargaining position,  $q$ . In other words,

because the firm now has the option of paying off the original bank with the proceeds of a loan from a new bank, it will never offer an  $L'_B$  that is higher than the one it would receive from an outside bank.<sup>28</sup> As a result, the firm retains a (weakly) larger fraction of the rents from renegotiation than it would if there were no outside banks.

Although the relative bargaining positions of the firm and the bank are altered by the presence of outside lenders, the basic intuition behind Proposition 2 remains unchanged. Once again, in the bad state the bank and the firm must negotiate over the net added revenues associated with the good project less the fraction that accrues to the trade creditor when the firm defaults. While the presence of outside banks may affect how this “pie” is divided between the bank and the firm, its overall size is not. Regardless of the rules of the renegotiation game in period 1, therefore, bank seniority is the key factor in maximizing the rents that ensure the existence of a relationship equilibrium.

This is not to imply that the outside banks have no impact on outcomes in our model. In fact, the firm’s ability to approach outside lenders for funding in period 1 may so strengthen its bargaining position that the relationship equilibrium breaks down, even when the inside bank is senior to the firm’s trade creditors. To see this, consider the extreme situation in which outside banks are fully informed about the firm’s effort decision. In this case, the firm enjoys a perfectly competitive market when it renegotiates its period-1 debt. But this effectively implies that  $q = 1$  so that  $c_B^* = 0$ , and the bank will never be willing to build a relationship with the firm, even when  $\delta = 1$ .

Of course, it is unreasonable to suppose that outside lenders have the same access to information about the firm’s prospects as does the inside bank. As a result,  $q$  will likely be less than 1. Nevertheless, it is still possible that competitive pressures in period 1 may limit the bank’s ability to cover its relationship-building costs, thereby breaking

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<sup>28</sup> Our assumption that original bank’s debt is repaid is motivated by the observation that bank loan agreements commonly include covenants prohibiting the firm from obtaining additional debt without the bank’s prior approval.

down the relationship equilibrium.

The natural question, then, is how the firm and the bank might alter their relative bargaining positions so as to ensure that a relationship equilibrium will exist. It is to this question that we turn next.

### ***The Relative Bargaining Strengths of the Bank and Firm***

Casual observation of the restrictions  $c_B^*$  and  $c_E^*$  reveals that the relative bargaining strengths of the bank and the firm play a crucial role in the existence of our relationship equilibrium. Thus far, we have treated the bargaining-strength parameter,  $q$ , as if it were exogenous. Given  $q$ , we can calculate  $c_B^*$  and  $c_E^*$ ; if either the cost of building a relationship or the cost of exerting effort exceeds its respective bound, a relationship equilibrium will fail to exist.

More generally, however, we can imagine that the bank and the firm may be able to write terms into their debt agreement that can affect their relative bargaining strengths should the bad state of the world occur in period 1. For example, many bank loan agreements contain covenants that prohibit the firm from obtaining outside funding without approval from the bank. Such a covenant has the effect of strengthening the bank's bargaining position should its debt agreement be renegotiated. Similarly, early cancellation penalties, compensating balance requirements, and confidentiality agreements all act to restrict the firm's ability to act independently of the bank, and thus reduce its leverage when renegotiating the terms of the initial debt agreement.

This suggests that the bank and firm can effectively choose  $q$  so as to ensure that a relationship equilibrium will exist for a wider range of  $(c_B, c_E)$  combinations. For example, consider the situation outlined in Figure 4. In panel A, the bank's cost of building a relationship exceeds  $c_B^*$ , implying that the bank cannot credibly commit to building a relationship. As a result, the relationship equilibrium breaks down. Suppose now that the bank and firm incorporate covenants in their period-0 debt contract that effectively increase the bank's relative bargaining power in period 1; i.e., decrease  $q$ .

The end result of these covenants is to shift up  $c_B^*$  and lower  $c_E^*$  so that the given  $(c_B, c_E)$  pair support a relationship equilibrium (see panel B).

By choosing  $q$  to ensure a relationship equilibrium exists, the bank and firm are effectively transferring bank profits from the period-0 contract,  $L_B^*$ , to the period-1 contract,  $L_B'$ . In other words, the optimal debt contract in our model generally involves an element of cross-period subsidization.

This cross-period subsidization gives us an alternative interpretation of the events depicted in Figure 4. In panel A, the bank's costs of building a relationship are so large that it must set  $L_B^*$  very high to ensure it earns its required return. At this high rate of interest, however, the bank will have a strong incentive to deviate by not building a relationship with the firm; at worst, the firm will choose not to request additional funding in period 1, and the bank will keep its high-rate contract,  $L_B^*$ . If the bank can instead write covenants into its debt agreement that increase its period-1 bargaining strength, the rents it earns in  $L_B'$  can be used to offset losses from  $L_B^*$ . This inter-period subsidization allows the bank to commit to the relationship equilibrium, even in the presence of a very high  $c_B$ .

Thus, our model provides a formal rationalization for the empirical results of Berger and Udell (1992), Peterson and Rajan (1995), and Berlin and Mester (1999), who collectively find that banks smooth loan rates over the life of their relationships with firms. In short, relationship lenders in our model are able to provide young firms with below-market financing through the rents received later in the relationship.

## **6. Empirical Implications**

Our analysis provides a number of implications that may be tested empirically. As discussed in the last section, inter-period subsidization plays an important role in our model, allowing the bank to bear larger initial relationship-building costs and still credibly commit to performing this valuable service. In particular, the bank may use covenants and other contractual provisions to increase its bargaining position later in the



firm's life, thereby ensuring the existence of a relationship equilibrium.

*IMPLICATION 1: Firms that are more costly to monitor—e.g., younger firms and those with more intangible assets—will tend to include more restrictive covenants in their loan agreements and be more likely to use senior bank debt to fund their operations.*

Young firms and those with very intangible assets tend to be more informationally opaque. Similarly, firms that have very unique products or are otherwise atypical in their industry can be difficult for lenders to evaluate. As a result,  $c_B$  will tend to be higher for such firms, and more restrictive loan agreements will be necessary to ensure that a relationship equilibrium exists.

*IMPLICATION 2: Firms with more risk-shifting opportunities—e.g., those with more liquid assets or more growth opportunities—are more likely to use senior bank debt to fund their operations.*

Firms with very liquid assets tend to require more intensive monitoring by the bank, to ensure that these assets are not improperly diverted. Similarly, firms with relatively little current revenue but strong growth prospects will require more intensive monitoring by their banks. Because bank monitoring of such firms is so important, they will tend to use more senior bank debt to facilitate the formation of ongoing relationships.

*IMPLICATION 3: The duration of exclusive bank relationships is likely to be longer for young firms, those with more intangible assets, and those with more risk-shifting opportunities. Such firms are also more likely to exhibit cross-subsidization in their loan rates over the life of their banking relationships.*

In contrast, firms with more transparent operations or with more established reputations will find it relatively easier to obtain funding from outside lenders during times of economic stress. As a result, firms like these should exhibit less variation in their funding rates over time, the duration of their bank relationships should be shorter, and they should be less likely to incorporate subordination clauses in their non-bank debt

agreements.

*IMPLICATION 4: Firms with ongoing bank relationships will be less likely to face credit constraints during recessions and other times of bank capital decline.*

Williams Stanton (1998) shows that bank lending is subject to leveraged-induced under-investment problems, which can result in a restriction in the supply of credit during recessions and other system-wide declines in bank capital. Our model suggests that the brunt of such reductions in bank lending will be borne by firms that do not have ongoing bank relationships. In the language of Boot and Thakor (forthcoming), when banks face a weakening of their balance sheets, they respond by reducing their transaction lending, not their relationship lending.

*IMPLICATION 5: Bank seniority should be more prevalent for relationship than for transaction loans.*

When banks make transaction, or arms-length, loans, they provide no special monitoring services. As a result, there is less need for such bank loans to contain seniority covenants. In contrast, our model has shown that relationship lending is facilitated by the use of seniority. One piece of anecdotal evidence consistent with this implication is the fact that “shotgun” small-business loan offers—those that are sent out via mass mailings similar to credit card offers—do not typically contain seniority provisions.

## **7. Concluding Thoughts**

In this paper, we have shown how bank seniority facilitates the formation of ongoing relationships between banks and their small-business borrowers.<sup>29</sup> In our model, bank relationships are valuable in that they allow the bank to distinguish between good

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<sup>29</sup> More specifically, our model suggests that banks will be senior in their relationship loans with small-business borrowers, but not their transaction (arms-length) loans.

and bad firms in times of economic distress. As a result, firms with bank relationships are more willing to exert the effort necessary to ensure the quality of their projects. Our central insight is that this desirable relationship-lending equilibrium is more likely to exist when the bank is senior to the firm's other creditors.

One way of understanding this comes from recognizing that a failure to exert effort is, in essence, risk-shifting behavior by the firm. When the bank is senior, not only does it have a better incentive to build a relationship with the firm, it also forces the firm to internalize more of the effects of its risk-shifting behavior when it asks for additional financing during a recession. In contrast, the junior bank has less incentive to control the firm, because it is less affected by this behavior.

In an ideal world, the bank and firm would write a long-term contract fully specifying the actions of each and the terms of any supplemental funding to be provided in period 1. In essence, bank seniority provides a means of committing to the actions outlined in this first-best contract when such a contract cannot be written and enforced.

Our conclusion that banks should be senior stands in contrast to the typical view that *junior* lenders have a better incentive to control firm risk-shifting, since they are the first to suffer when the firm's prospects diminish. Although this is a common view, our model demonstrates that it is not always correct.

More generally, the proper priority for a "monitoring" lender depends on how the monitoring will affect that lender's payoff given the firm's underlying financial condition.<sup>30</sup> In our model, it is the senior lender that benefits from maintaining the good project in the bad state of the world. By making its loan senior to those of the firm's other creditors, the bank is able to reap the benefits of its relationship building, and thus is willing to incur the incumbent costs of this action.

This role for bank seniority in our model is similar in some respects to that of secured debt in Stulz and Johnson (1985). In that paper, secured debt is used to mitigate

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<sup>30</sup> Rajan and Winton (1995) make a similar point.

the under-investment problem that can arise when the firm cannot renegotiate its existing debt in the face of new investment opportunities.<sup>31</sup> Like the secured debt in Stulz and Johnson, bank seniority in our model guarantees that future investment decisions are not distorted by the presence of existing creditors. Unlike this earlier work, however, bank seniority serves as a commitment device to ensure that the firm will exert effort, thereby creating a low-risk marginal investment should the bad state of the world occur.

Another important characteristic often ascribed to relationship lenders is the ability to cross-subsidize the firm early in its life with rents the bank earns on later contracts with the firm. Such inter-period subsidization plays an important role in our model, allowing the bank to bear larger initial relationship-building costs and still credibly commit to performing this valuable service. In particular, the bank may use covenants and other contractual provisions to increase its bargaining position later in the firm's life, thereby ensuring the existence of a relationship equilibrium.

Like all theoretical models, our analysis must be considered with certain caveats. As discussed in Section 3, the maximum costs of building a relationship and exerting effort that can support a relationship equilibrium depend on the additional risk-shifting revenues the firm can extract from the trade creditor when it is junior. These revenues are measured by the term  $w$ , which we assumed to be positive. Intuitively, by assuming that  $w > 0$ , we assume that additional investment in the no-effort firm makes its follow-up project substantially more risky. Although we believe this is the most natural assumption to make, if  $w$  were negative, the impact of seniority on the existence of a relationship equilibrium could become non-monotonic. In other words, if by failing to exert effort the firm has little impact on the riskiness of its project, then in some cases a relationship equilibrium may be facilitated by making the bank *junior* to the firm's other creditors.<sup>32</sup>

This consideration of the role of risk shifting points out another central

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<sup>31</sup> James (1988) uses a similar idea to motivate bank loan sales and standby letters of credit.

<sup>32</sup> This idea was suggested by empirical implication 2 in the last section.

assumption underlying our analysis. Recall that additional investment in the firm during a recession has a different impact in our model, depending on whether the entrepreneur exerted effort. If the entrepreneur exerted effort, then additional investment merely serves to preserve the firm's high-return, low-risk status. On the other hand, if the entrepreneur did not exert effort, then additional investment acts to increase the risk of the firm's project, without raising its expected return. Clearly, if this assumption were altered, our conclusions about the optimality of bank seniority would be affected.

Rather than being a weakness, however, we believe this fact serves to highlight the importance of risk shifting for relationship lending; if the firm's entrepreneur does not continuously work to improve his firm's business prospects, then added funding is unlikely to revive the firm during a recession. It is exactly this type of risk-shifting behavior that banks monitor on their relationship loans, and it is this type of behavior that makes bank seniority optimal in our model.

Finally, note that we have assumed that building a relationship with the firm is a costly endeavor for the bank. If this were not the case, the relative seniority of the bank would have no impact on the existence of our relationship equilibrium; because doing so is costless and beneficial to the firm, the bank would *always* build a relationship. Nevertheless, we believe the more natural case is the one in which initiating and maintaining an ongoing relationship with the firm is costly for the bank.

## **8. Appendix**

Proof of Lemma 1:  $\Pi_i^{r,e}$  is given by (16) in the text. As discussed in the text, there are two cases to consider.

*Case A: Firm Does Not Request Added Investment* – Upon observing the bank build a relationship, if the firm chooses to not exert effort and not request added investment in the bad state of the world, its expected return is

$$\begin{aligned}\Pi_{ni}^{r,ne} &\equiv \theta p_G[\mu_G(X + \sigma_G) - L_B^* - L_T^*] + (1 - \theta)p_B[\mu_B(X + \sigma_B) - L_B^* - L_T^*] \\ &= \mu_G\Gamma - (1 - \theta)q(\mu_G - \mu_B)[p_G(X + \sigma_G) + (1 - p_G)\delta(x - \sigma_G)] \\ &\quad - I_T - I_B - c_B - (1 - \theta)(1 - q)I_1.\end{aligned}\quad (24)$$

Direct comparison shows that  $\Pi_i^{r,e} \geq \Pi_{ni}^{r,ne}$  iff

$$c_E \leq (1 - \theta)q[p_G(\mu_G - \mu_B)(X + \sigma_G) + (1 - p_G)\delta(\mu_G - \mu_B)(x - \sigma_G) - I_1]. \quad (25)$$

Recalling that  $\Gamma = p_G(X + \sigma_G) + (1 - p_G)(x - \sigma_G)$ , this constraint can be rewritten as  $\hat{c}_E$  in the text.

*Case B: Firm Requests Added Investment* – In the same manner, we can derive

$$\Pi_i^{r,ne} \equiv \theta p_G[\mu_G(X + \sigma_G) - L_B^* - L_T^*] + (1 - \theta)p_R[\mu_R(X + \sigma_R) - L'_B - L_T^*], \quad (26)$$

where  $L'_B = q\hat{L}'_B + (1 - q)\tilde{L}'_B$  as before, but  $\hat{L}'_B$  is defined as the solution to

$$p_B L_B^* + (1 - p_B)\delta\mu_B(x - \sigma_B) = p_R \hat{L}'_B + (1 - p_R)\delta\mu_R(x - \sigma_R) - I_1, \quad (27)$$

and  $\tilde{L}'_B$  is defined as the solution to

$$p_B[\mu_B(X + \sigma_B) - L_T^* - L_B^*] = p_R[\mu_R(X + \sigma_R) - L_T^* - \tilde{L}'_B]. \quad (28)$$

These definitions for  $\hat{L}'_B$  and  $\tilde{L}'_B$  are analogous to those presented in the text, and represent the minimum renegotiation offers acceptable to the bank and firm, respectively, upon reaching the relationship, no-effort, bad-state branch of the game tree (node 9).

Using these definitions, we can rewrite

$$\begin{aligned}\Pi_i^{r,ne} &= \mu_G\Gamma - I_T - I_B - (1 - \theta)I_1 - c_B \\ &\quad + (1 - \theta)q\left[(1 - \delta)w + \left(1 - \frac{p_R}{p_G}\right)I_T - (\mu_G - \mu_R)\Gamma\right],\end{aligned}\quad (29)$$

where  $w \equiv \frac{p_R}{p_G}(1 - p_G)\mu_G(x - \sigma_G) - (1 - p_R)\mu_R(x - \sigma_R)$  as in the text. The intuition behind this expression is as follows. If the firm chooses to invest in the risky project in the bad state of the world—i.e., if  $\Pi_i^{r,ne} > \Pi_{ni}^{r,ne}$ —its profit differs from that in the relationship equilibrium in two ways. First, it does not bear the effort costs  $c_E$  borne in the relationship equilibrium. Second, by investing in project  $R$  in the bad state, the firm is able to shift risk onto the trade creditor; this effect is given by the first two terms in the square brackets. This gain, however, is offset by the lower expected return associated with the risky project, measured by the third term in the square brackets. These effects

from investing in the risky project are only realized in the bad state of the world, so this whole expression is multiplied by  $1 - \theta$ . Finally, how much of these rents the firm is able to capture depends on its relative bargaining strength,  $q$ . Direct comparison of expression (29) with  $\Pi_i^{r,e}$  gives  $\tilde{c}_E$  as defined in the text.

Next, we must show that the proper  $c_E$  restriction is binding given the firm's incentives to request or not request additional investment at node 9 of the game tree. Direct comparison of  $\hat{c}_E$  and  $\tilde{c}_E$ , however, shows that  $\hat{c}_E \leq \tilde{c}_E$  if and only if  $\Pi_{ni}^{r,ne} \geq \Pi_i^{r,ne}$ , implying that  $c_E^* = \min\{\hat{c}_E, \tilde{c}_E\}$  is the unique upper bound on the firm's effort building costs for the relationship equilibrium to exist.

Finally, note that

$$\begin{aligned} \Pi_{ni}^{r,e} &= \theta p_G [\mu_G (X + \sigma_G) - L_T^* - L_B^*] + (1 - \theta) p_B [\mu_B (X + \sigma_B) - L_T^* - L_B^*] - c_E \\ &= \mu_G \Gamma - (1 - \theta) q [(\mu_G - \mu_B) \Gamma - (1 - p_G)(1 - \delta)(\mu_G - \mu_B)(x - \sigma_G)] \\ &\quad - I_T - I_B - (1 - \theta)(1 - q)I_1 - c_B - c_E. \end{aligned} \quad (30)$$

Using this, it is straightforward to calculate

$$\Pi_i^{r,e} - \Pi_{ni}^{r,e} = (1 - \theta) q [(\mu_G - \mu_B) \Gamma - (1 - p_G)(1 - \delta)(\mu_G - \mu_B)(x - \sigma_G) - I_1]. \quad (31)$$

Note, however, that this difference is equal to  $\hat{c}_E$ . Thus, whenever the firm has an incentive to exert effort— $0 < c_E \leq \hat{c}_E$ —it will have an incentive to ask for additional funding in the relationship, effort, bad state branch of the tree (node 8 in Figure 1). ♠

Proof of Lemma 2: Let  $L_B$  and  $L_T$  denote any arbitrary initial face values of the debt owed to the bank and the trade creditor, respectively. Given this debt and the bank's decision to not build a relationship with the firm, let  $\pi_i^e$  and  $\pi_i^{ne}$  denote the firm's expected return from exerting effort and not exerting effort, respectively, when it will request additional investment in the bad state of the world, and let  $\pi_{ni}^e$  and  $\pi_{ni}^{ne}$  denote these expected returns when the firm will not request this added investment. Note that these expected returns are for any arbitrary values of  $L_B$  and  $L_T$ , and are thus distinct from the expressions  $\Pi_i^{r,e}$ , etc. When the firm does not request additional investment in the bad state of the world, it must be the case that  $\pi_{ni}^{ne} > \pi_{ni}^e$ , because exerting effort is

costly for the firm; i.e.,  $c_E > 0$ . On the other hand, if the firm does request added investment, our risk-shifting assumption (3) ensures us that  $\pi_i^{ne} > \pi_i^e$ . Combining these results gives us

$$\max\{\pi_i^{ne}, \pi_{ni}^{ne}\} > \max\{\pi_i^e, \pi_{ni}^e\}. \quad (32)$$

In other words, when the bank does not build a relationship, the firm's optimal response is to not exert effort. ♠

Proof of Lemma 3: Immediate from Lemma 2 and the discussion in the text. ♠

Proof of Lemma 4: The bank's expected return from deviating and not building a relationship with the firm depends on whether or not the firm's optimal out-of-equilibrium behavior is to request additional investment in the no-relationship, no-effort, bad-state branch of the tree (node 11 in Figure 1). We consider each of the relevant cases in turn.

*Case A: Firm Does Not Request Added Investment* – In this case, the bank's expected return from deviating and not building a relationship is

$$\theta[p_G L_B^* + \delta(1-p_G)\mu_G(x-\sigma_G)] + (1-\theta)[p_B L_B^* + \delta(1-p_B)\mu_B(x-\sigma_B)] - I_B. \quad (33)$$

Substituting in the equilibrium value of  $L_B^*$  from (15) above, this simplifies to

$$c_B - (1-\theta)(1-q)[(\mu_G - \mu_B)\Gamma + (1-p_G)(1-\delta)(\mu_G - \mu_B)(x-\sigma_G) - I_1]. \quad (34)$$

Since the bank's equilibrium expected return is zero, the bank will want to deviate and not build a relationship in this case if

$$c_B < \hat{c}_B \equiv (1-\theta)(1-q)[(\mu_G - \mu_B)\Gamma + (1-p_G)(1-\delta)(\mu_G - \mu_B)(x-\sigma_G) - I_1]. \quad (35)$$

*Case B: Firm Requests Added Investment* – Here, the bank's expected return from not building a relationship is

$$\theta[p_G L_B^* + \delta(1-p_G)\mu_G(x-\sigma_G)] + (1-\theta)[p_R L_B'' + \delta(1-p_R)\mu_R(x-\sigma_R)] - I_B, \quad (36)$$

where  $L_B''$  is the face value of the renegotiated bank debt when the firm requests additional funding to invest in the risky project; this is derived in a manner analogous to



that used to derive  $L'_B$ . Thus,

$$L''_B = q\hat{L}''_B + (1-q)\tilde{L}''_B, \quad (37)$$

where  $\hat{L}''_B$  is the solution to

$$p_R\hat{L}''_B + (1-p_R)\delta\mu_R(x-\sigma_R) - I_1 = p_B L_B^* + (1-p_B)\delta\mu_B(x-\sigma_B), \quad (38)$$

and  $\tilde{L}''_B$  is the solution to

$$p_R[\mu_R(X+\sigma_R) - L_T^* - \tilde{L}''_B] = p_B[\mu_B(X+\sigma_B) - L_T^* - L_B^*]. \quad (39)$$

Substituting (37) into (36) and noting that the bank's earns zero expected profit in the relationship equilibrium shows that the bank will only deviate by not building a relationship if

$$c_B < \tilde{c}_B \equiv (1-\theta)(1-q) \left[ (\mu_G - \mu_B)\Gamma - \left(1 - \frac{p_R}{p_G}\right)I_T - (1-\delta)w \right], \quad (40)$$

where  $w \equiv \frac{p_R}{p_G}(1-p_G)\mu_G(x-\sigma_G) - (1-p_R)\mu_R(x-\sigma_R)$ . This gives us the second condition given in the lemma. ♠

Proof of Proposition 1: Immediate from Lemmas 1–4. ♠

Proof of Proposition 2: Immediate from the differentiation of  $\hat{c}_E$ ,  $\tilde{c}_E$ ,  $\hat{c}_B$  and  $\tilde{c}_B$  with respect to  $\delta$ . ♠

Proof of Proposition 3: If the relationship equilibrium does not exist, there are only three other potential outcomes. The first is an autarkic equilibrium in which no lending occurs. The firm's expected profit in this equilibrium is 0, which is less than  $\Pi_i^{r,e}$  by assumption.

The second possible outcome is the no-relationship equilibrium. Letting “bars” denote values associated with the no-relationship equilibrium, it is straightforward to show that

$$\bar{\Pi}_{ni}^{nr,ne} = [\theta\mu_G + (1-\theta)\mu_B]\Gamma - I_B - I_T, \quad (41)$$

and

$$\bar{\Pi}_i^{nr,ne} = [\theta\mu_G + (1-\theta)\mu_R]\Gamma - I_B - I_T - (1-\theta)I_1. \quad (42)$$

In other words, the firm's profit in the no-relationship equilibrium is equal to the expected revenue from the project minus the required investment costs. Given that  $\mu_B = \mu_R$  and investing in project  $R$  in period 1 entails additional expected funding costs of  $(1-\theta)I_1$ , it is clear that the firm's expected profit in the no relationship equilibrium can be no higher than  $\bar{\Pi}_{ni}^{nr,ne}$ .

Comparing the firm's expected profit in the no-relationship equilibrium with those it earns in the relationship equilibrium ( $\Pi_i^{r,e} - \bar{\Pi}_{ni}^{nr,ne}$ ), we see that the relationship equilibrium dominates whenever

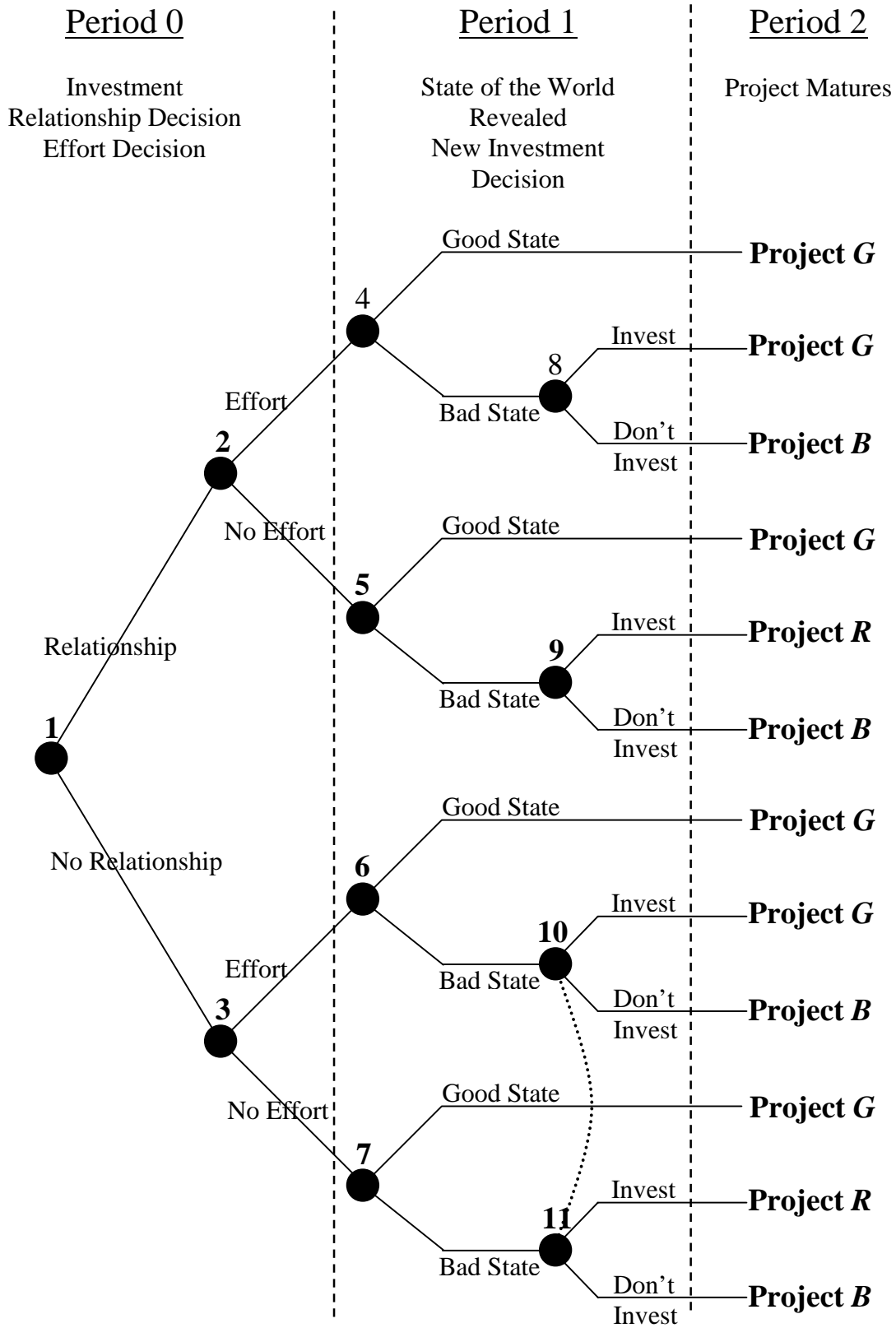
$$(1-\theta)[(\mu_G - \mu_B)\Gamma - I_1] > c_B + c_E. \quad (43)$$

This, however, is simply condition (4) in the text.

The last possible outcome is the no-effort equilibrium in which the bank builds a relationship with but the firm nonetheless chooses to not exert effort. Since the end project choices in each of the states of the world are the same under this equilibrium as they are under the no-relationship equilibrium, the fact that relationship building is costly means that the firm's profit is higher in the no-relationship equilibrium, and hence the relationship equilibrium, than it is in the no-effort equilibrium. ♠

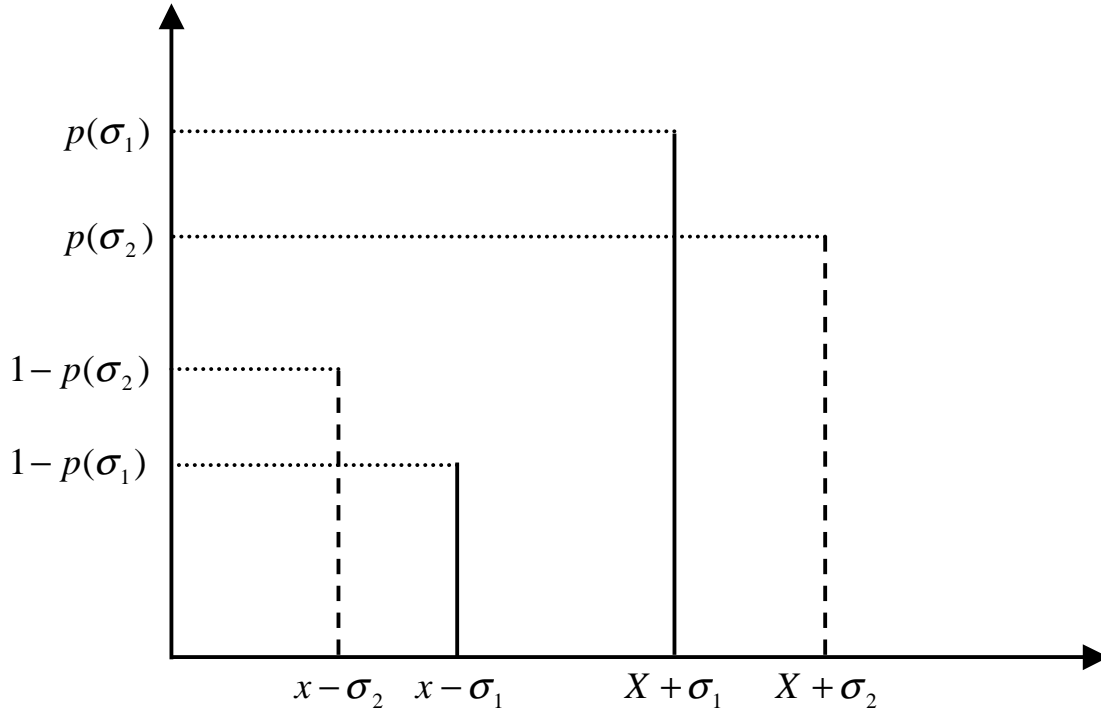
**Figure 1**

Order of events and game tree.



**Figure 2**

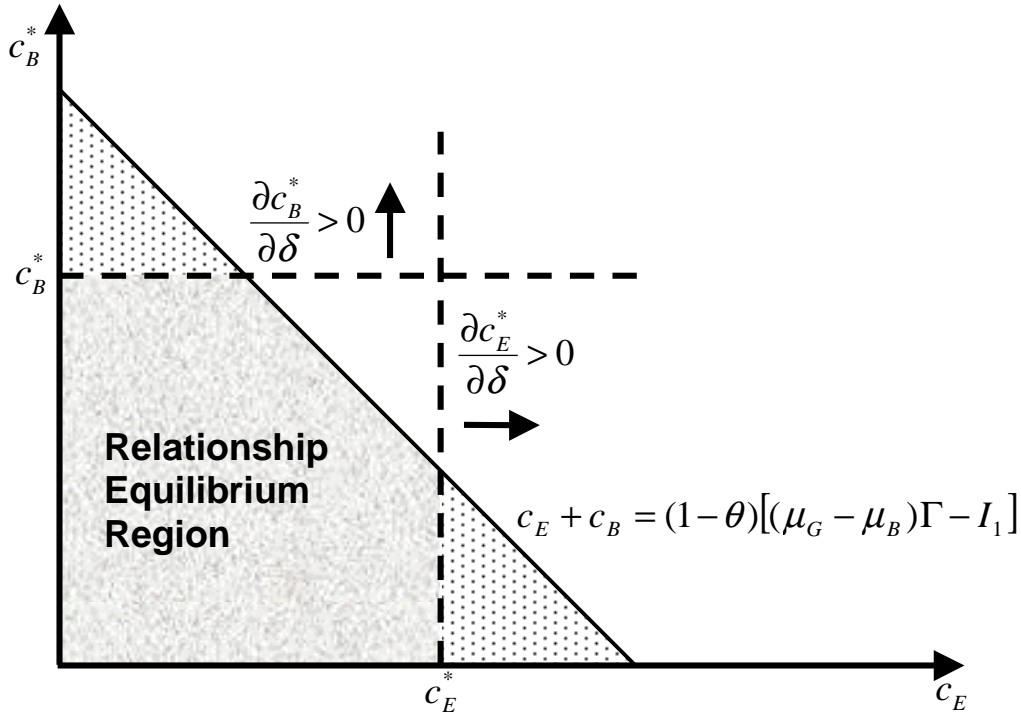
Effect of an increase in risk on the distribution of project returns.



An increase in the risk of the project from  $\sigma_1$  to  $\sigma_2$  has two effects. First, it lowers the likelihood that the project is successful, from  $p(\sigma_1)$  to  $p(\sigma_2)$ . Second, it increases the project's payoff to  $X + \sigma_2$  when successful and decreases its payoff to  $x - \sigma_2$  when unsuccessful.

**Figure 3**

Effect of an increase in bank seniority ( $\delta$ ).

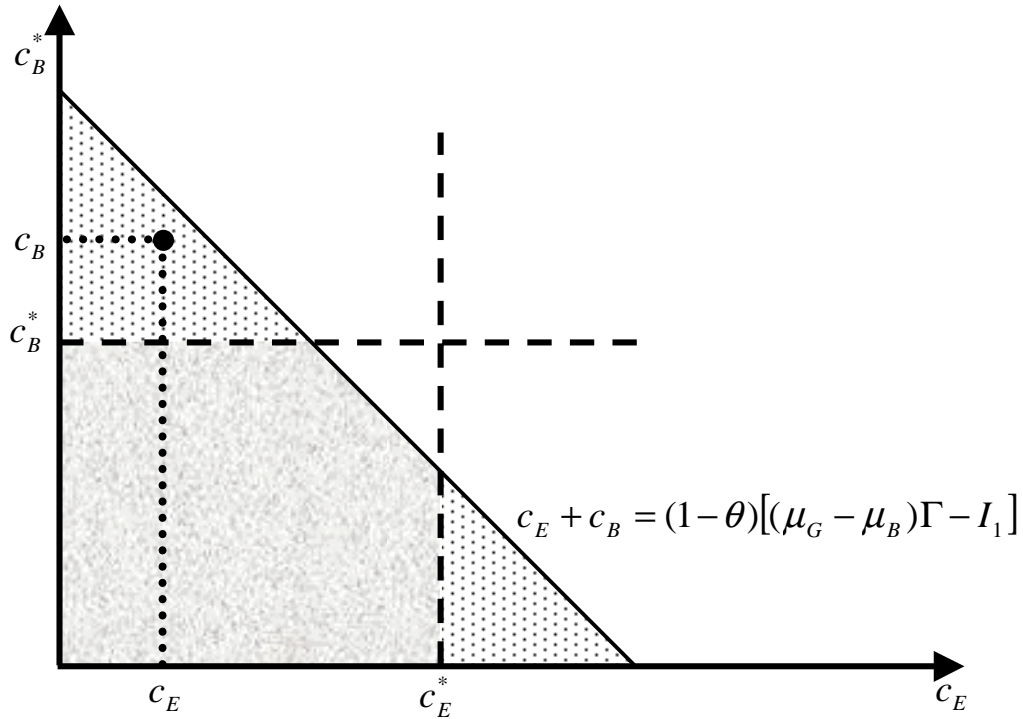


In this figure, the shaded region represents the area in which a relationship equilibrium exists. The dotted region gives the  $(c_B, c_E)$  pairs for which either the firm is unable to commit to exerting effort or the bank is unable to commit to building a relationship. In either event, the relationship equilibrium breaks down. Because  $w > 0$ , both  $c_B^*$  and  $c_E^*$  are increasing in  $\delta$ . As a result, a relationship equilibrium is more likely to exist when the bank is senior.

## Figure 4

### Panel A

Effect of a decrease in  $q$ .

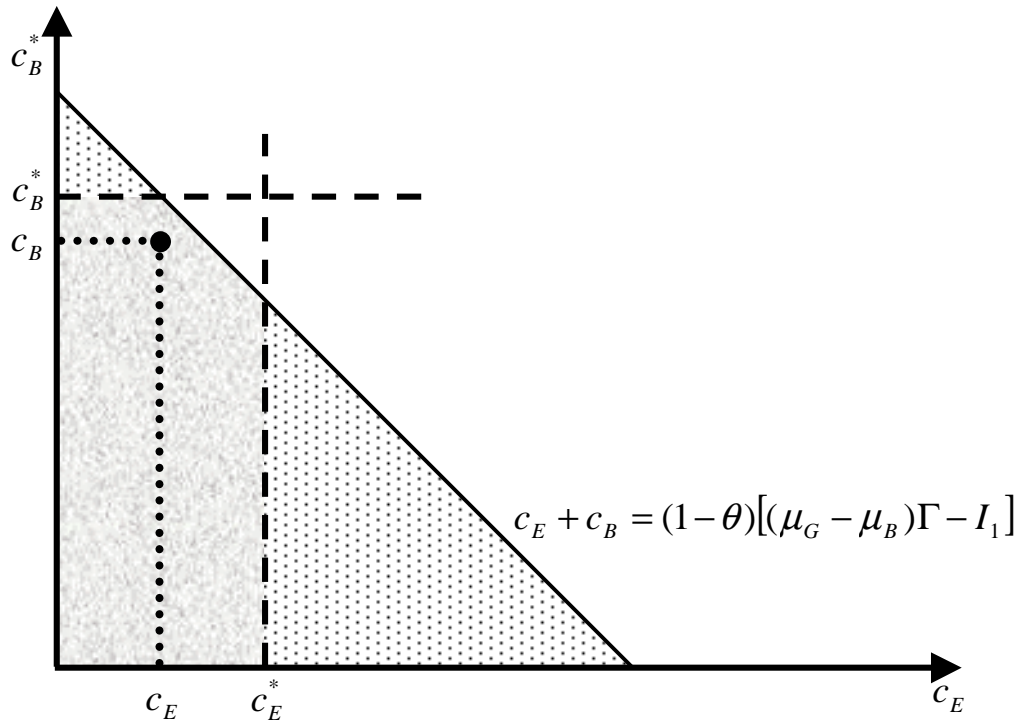


In this figure, the bank's bargaining position is sufficiently poor that it is unable to commit to building a relationship given its cost of doing so,  $c_B$ . As a result, the relationship equilibrium breaks down. If the firm and bank can write terms into their contract that increase the bank's relative bargaining strength (decrease  $q$ ), however,  $c_B^*$  will shift up and  $c_E^*$  shift down so that the given  $(c_B, c_E)$  pair does fall within the relationship equilibrium region (see Panel B).

**Figure 4**

**Panel B**

Effect of a decrease in  $q$ .



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