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Dominik Egli, Steven Ongena, and David C. Smith

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Abstract

We study the decision an entrepreneur faces in financing multiple projects and show that relationship financing will arise endogenously in an environment where strategic defaults are likely, even when firms have access to arm's-length financing. Relationship financing allows an entrepreneur to build a private reputation for repayment that reduces the cost of financing. However, in an environment where the risk of strategic default is low, the benefits from reputation building are outweighed by holdup rents extractable by the incumbent lender. Entrepreneurs then choose to finance projects from single or multiple, arm's-length lenders.

Keywords: relationship financing, reputation building, staged financing, contract enforcement, judicial efficiency

* The authors are from the Swiss Ministry of Finance and University of Bern (dominik.egli@intergga.ch), Tilburg University (steven.ongena@kub.nl), and Board of Governors of the Federal Reserve System (david.c.smith@frb.gov), respectively. The views in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Swiss Ministry of Finance, Board of Governors of the Federal Reserve System or of any other person associated with the Federal Reserve System. We thank Hans Degryse, Mariassunta Giannetti, Ralf Elsas, Jan Pieter Krahnen, Rafael Repullo, Joao Santos, Bas Werker, and seminar participants at the 2001 European (Barcelona) and German (Vienna) Finance Association Meetings, 2001 SSSE Meetings (Geneva), 2000 Tor Vergata Conference (Rome), the Swiss National Bank, and Tilburg University for providing helpful comments. Egli thanks the Department of Economics at UC Santa Cruz for their hospitality and the Swiss Science Foundation for their financial support. Ongena received partial support from the Netherlands Organization for Scientific Research (NWO).

1. Introduction

Previous theory teaches us that close relationship-based financing, such as that provided by banks and venture capitalists, is most important to so-called "informationally-opaque" borrowers. These borrowers – typically small, young firms with no public track record – value relationship lending because they are unable to credibly communicate their repayment ability to a wider set of "arm's-length" lenders. In reality, many informationally-transparent firms also rely on some form of relationship-based financing. For instance, firms in Europe and Asia rely heavily on bank financing, even when well-functioning capital markets exist within the countries they operate (Allen and Gale, 2000). In the U.S., Houston and James (2001) report that relatively large, publicly-traded firms obtain an average of 67% of their debt from banks and only 16% from public issues. In this paper, we provide a rationale for why all types of firms may at times prefer relationship-based financing to arm's-length financing. In particular, we study the decision firms face in financing multiple independent investment projects.

In our model, an entrepreneur determines the sequencing for investment in two projects according to the availability and cost of funds. The entrepreneur can either try to finance both projects up front or sequence the financing and investment over two periods, and can choose to finance the projects through one or multiple lenders. A lender bases its financing decision on the perceived likelihood that an entrepreneur will strategically default on a loan, and on its ability to extract "holdup" rents. We assume that some entrepreneurs are good, in that they never default on a loan, while others are bad in the sense that they will always default when it pays to do so. Lenders cannot observe an entrepreneur's default type, but know the unconditional likelihood of facing a bad borrower. We show that firms operating in an environment where strategic defaults are likely choose to have their projects sequentially financed by the same lender. We term this behavior "relationship financing". The intuition for this result is straightforward. The relationship lender observes individual loan repayments in the first period, which increases the ex-ante likelihood of repayment in both periods. The resulting decrease in the interest rate charged to the entrepreneur seeking to finance the sequenced projects more than offsets holdup rents accruing to the incumbent lender.

Our model illustrates that even in cases where banks gain all of the bargaining power, relationship financing may still be preferable to arm's-length financing if the assessed likelihood of repayment is sufficiently low. However, relationship financing is not always optimal. If the ex-ante risk of strategic default in the economy is low, then the benefits of building a reputation are outweighed by the rents extractable by the relationship lender. In this environment, firms choose to finance both projects up front either from a single lender or from multiple lenders. We term this, as well as the opportunity to sequence projects using multiple lenders, "arm's-length financing".

The main contributions of our paper are three-fold. First, we demonstrate that relationship financing can arise endogenously, even when firms have equal access to arm's-length financing and banks are able to extract holdup rents. In our model, all entrepreneurs start with the opportunity for financing their projects with arm's-length securities and then choose whether or not to invest in a relationship. Second, our model provides a rationale for why entrepreneurs may optimally choose to delay the financing of a project even when there is no uncertainty about project payoffs or discount rates (Dixit and Pindyk, 1994; Berk, 1999), nor a need to monitor progress through stages of financing (Gompers, 1995). Firms delay projects to gain a good repayment reputation, which reduces future lending costs. Because a reputation for repayment can only be gained by borrowing from the same lender, when firms choose to sequence projects, they do so through relationship financing. Third, by assigning more meaning to our strategic default parameter, we gain insight into cross-country differences in financing behavior. For instance, if a country's legal system can reduce the incentive for firms to strategically default, then our model suggests that relationship financing will be more prevalent in countries with weaker contract enforcement and less efficient judicial systems.

The rest of the paper is organized as follows. We discuss associations with the related literature in Section 2. Section 3 introduces the model. In Section 4, we explore the characteristics of arm's-length financing, while in Section 5 we focus on relationship financing. Section 6 derives the set of equilibria that exist when entrepreneurs can choose between relationship and arm's-length financing. In Section 7, we consider applications of our model and discuss robustness to weakening the model's assumptions. Section 8 concludes.

2. Related Literature

Our paper is closely related to the literature exploring the value of bank relationships. These papers are predicated on the idea that banks, as inside lenders, can observe and monitor borrowers in a way that allows them to finance firms that are otherwise unable to obtain valuable financing. Banks, it is argued, enjoy scale and scope economies in financing informationally-opaque borrowers, and can therefore improve borrower welfare.[1] However, banks' ability to privately observe information could give them the ability to extract rents by threatening to "hold up" financing to customers captured by the banks' information monopoly.[2]

We differ from this literature along several dimensions. First, although information asymmetries exist between lenders and borrowers in our model, the asymmetry itself does not influence the choice between relationship and arm's-length financing. Therefore, our model moves away from relating the value of bank financing to a firm's information problems. Instead, we relate the need for relationship financing to the ability for entrepreneurs to strategically default. Second, rather than assume that firms require repeated financing through time, we allow firms the choice between repeated lending and one-shot financing, and derive conditions under which repeated financing with one bank is optimal. Third, by assuming that entrepreneurs have multiple projects to finance, we are able to relate the

[1] See Diamond (1984), Fama (1985), Ramakrishnan and Thakor (1984), and Allen and Gale (1999). For formal reviews of this literature, see Boot (2000) and Ongena and Smith (2000a).

[2] The holdup problem is explored by Fischer (1990), Greenbaum, Kanatas, and Venezia (1989), Rajan (1992), Sharpe (1990), and von Thadden (2001).

timing and sequencing of projects to financing choice. This provides a novel approach to thinking about some common capital budgeting issues.

Because we focus on the influence of borrower reputation on financing choice, our paper shares similarities with Diamond (1991), where firms decide whether to borrow repeatedly from banks to build a track record that is publicly observable. In his model, only high-rated borrowers with a good reputation receive arm's-length financing. In our framework, an entrepreneur builds a reputation to lessen the cost of relationship financing (the repayment history is private information and cannot be reported credibly by an incumbent bank). When the cost of reputation-building is too high relative to its benefits, borrowers resort to arm's-length markets or do not borrow at all.

Like our paper, Boot and Thakor (1994) model repeated borrowing. They show that even without learning or risk aversion, bank-borrower relationships are welfare enhancing and benefit the borrower. Borrowers in their model commit to a long-term contract that requires paying an above-market borrowing rate and committing collateral until a good project outcome is realized, then paying an infinite stream of below market rates with no collateral requirements after the realization. Hence, in their model durable relationships are valuable because they allow banks and firms to subsidize financing intertemporally, which reduces the use of costly collateral. In contrast, in our model durable relationships enhance efficiency by enabling financing of sequenced projects in cases where financing of all projects at once cannot take place.

Our modeling is also related to the papers exploring the choice between relationship and arm's-length lending. Rajan (1992) argues that relationship lending is beneficial because a bank's threat to hold up repeated financing can induce firm managers to accept positive net present value projects. Boot and Thakor (2000) allow banks to determine the allocation of their lending capacity across relationship and arm's-length "transaction" lending, and study the impact of bank competition on relationship lending. In contrast to Rajan (1992) and Boot and Thakor (2000), we allow relationship financing to arise endogenously and show that relationship financing can expand financing opportunities for entrepreneurs and will, in some cases, be preferable to arm's-length financing.

Because we link project timing to financing method, our setup is also related to work focusing on the option value of waiting to invest and optimal contracting under uncertainty. For example, entrepreneurs may optimally choose to delay financing a project when there is uncertainty about investment returns or discount rates (Dixit and Pindyk, 1994; Berk, 1999). Moreover, "staging" – or breaking into multiple rounds – the financing of an entrepreneurial venture may be optimal if there is a need to monitor its progress (Sahlman, 1990; Gompers, 1995; Admati and Pfleiderer, 1994; Bergemann and Hege, 1998; Neher, 1999; Cornelli and Yosha, 2001; and Kaplan and Stromberg, 2001). Complementing these papers, our model considers multiple projects and provides an additional rationale for why entrepreneurs may optimally choose to delay financing a project or stage financing. Entrepreneurs sequence projects when reputational gains from paying off early projects reduce future lending costs.

3. The Model

An entrepreneur has access to two independent projects A and B. Both projects require an initial investment k and yield certain payoffs π_{A} and π_{B}, which exceed k. Subject to financial constraints, the entrepreneur can choose to either invest in both projects jointly or delay one project and pursue the projects sequentially. Without loss of generality, assume that $\pi_{\mathsf{A}} > \pi_{\mathsf{B}}$, and define $\Delta \equiv 2k/(\pi_{\mathsf{B}} + \pi_{\mathsf{B}})$ and $\Delta_{\mathsf{j}} \equiv k/\pi_{\mathsf{j}}$, $j = A, B$, to be the inverse profitability measures for the joint and sequential projects, respectively. Note that by definition $\Delta_{\mathsf{A}} < \Delta < \Delta_{\mathsf{B}}$.

We assume that the entrepreneur has no initial wealth and that projects are nondivisible. Therefore, the entrepreneur must borrow the entire amount for each project from one lender. The entrepreneur has no mechanism for storing excess cash from period to period, so if she chooses to sequence the projects, she must also sequence her financing. Moreover, the entrepreneur consumes all surplus earnings from a project at the end of period 1, so that any period-2 project must be completely financed using outside sources. As will be discussed later, neither the non-divisibility nor the consumption-of-surplus assumption is restrictive.

As part of the financing decision, the entrepreneur must also choose whether to borrow from one lender or two. We label the financing of sequential projects by one lender as "relationship financing" because the lender can learn from the entrepreneur's first-period behavior. We label as "arm's-length financing" the funding of sequential projects by two different lenders, or the one-shot financing of joint projects by either one or two lenders.

Entrepreneurs have full bargaining power in the first period of a relationship, but bargaining power transfers to lenders in the second period when financing is repeated, allowing the relationship lender to accrue all information-related rents.[3] Defaults are only observed by the incumbent lender and the entrepreneur cannot credibly communicate her repayment history to a new lender.[4]

We assume that a certain set of entrepreneurs will default on a loan even when they have the funds to repay. With probability $1 - p_0$, $p_0 \in (0, 1]$, the lender faces a "bad" entrepreneur who will strategically default on her contracted payment, r_t $(t = 1, 2)$, if it pays her to do so. With probability p_0, the borrower is a "good" entrepreneur who always makes her contracted interest payment. Each entrepreneur knows her type, while lenders only know p_0. In case projects are sequenced, the incumbent lender that finances the first-period project also knows whether the entrepreneur pays the contracted amount, r_1. Let $\beta \in [0, 1]$ be the (endogenously determined) probability that a bad entrepreneur pays r_1. Given β, the lender can deduce the total probability of receiving payment r_1, $q = p_0 + \beta(1 - p_0)$. Given that r_1 is paid, the incumbent lender updates its prior belief, p_0, that the entrepreneur is

[3] Competition from partially informed outside banks may limit such "holdup" rents. Von Thadden (2001), for example, shows that an inside lender can earn positive profits on good risks by pricing slightly above the pooling interest rate most of the time, but charging occasionnally up to the break-even rate for loans to unsuccessful firms. Reputational concerns about future lending, market driven information leaks, or moral hazard problems associated with asset substitution may further constrain the lender's ability to extract rents.

[4] Similarly, Fisher (1990), Rajan (1992), Sharpe (1990), and von Thadden (2001) assume that outside lenders observe only a noisy signal of project outcome and loan repayment. While in some countries lenders share repayment information through 'black' credit registers, such registers do not exist in many developing countries, do not cover cross-border transactions, and do not guarantee accurate and complete reporting (Jappelli and Pagano, 1999).

good using Bayes' rule, $p_1 = p_0/q$.

In fixing p_0, we presume that an entrepreneur's temptation to default on a loan will depend on exogenous factors that influence debtor costs of bankruptcy. Such factors could include a country's choice of bankruptcy procedures, the degree of protection given to creditors, the efficiency of the judicial system, the legal tradition of the country, and other cultural traditions. For simplicity, we assume that lenders cannot recuperate any positive payment when a bad entrepreneur decides to default and a bad entrepreneur cannot precommit to a positive level of repayment.

Both the entrepreneur and the lenders are risk neutral and maximize the expected present value of their payoffs. The parameter ρ is the entrepreneur's subjective discount factor. In order to facilitate the formal exposition, we assume that $\rho > \sqrt{\Delta_B}$. This assumption requires either that project B be quite profitable or that the entrepreneur not discount the future by very much.

This completes the description of the game setup. We proceed as follows. We first derive equilibrium contracts assuming that entrepreneurs have access to arm's-length or relationship financing, but not both. We then analyze the optimal contracts assuming that entrepreneurs have access to both types of financing.

4. Arm's-Length Financing

To derive conditions under which projects are financed with arm's-length contracts, we start with joint projects. The entrepreneur seeking to finance joint projects proposes a contract specifying the investment amount $2k$ and the repayment level r. A bad entrepreneur never repays r as she is always better off repudiating. The good entrepreneur pays $\min\{r, \pi_\mathsf{A} + \pi_\mathsf{B}\}$ by assumption. The risk of repudiation influences negotiations at the beginning of the game. A lender anticipates a breach of contract with probability $1 - p_\mathtt{0}$. Hence the lender is only willing to sign a contract when its expected repayment $p_\mathtt{0} r$ at least covers investment $2k$, i.e. $r \geq 2k/p_\mathtt{0}$. On the other hand, any repayment r that exceeds $\pi_\mathsf{A} + \pi_\mathsf{B}$ is impossible since the entrepreneur has no initial wealth, i.e. $r \leq \pi_\mathsf{A} + \pi_\mathsf{B}$. These two constraints are compatible if and only if $p_\mathtt{0} \geq 2k/(\pi_\mathsf{A} + \pi_\mathsf{B}) = \Delta$. When this condition holds, the good entrepreneur can offer a repayment $r = 2k/p_\mathtt{0}$ which makes the lender indifferent between signing and rejecting and maximizes the entrepreneur's profit $\pi_\mathsf{A} + \pi_\mathsf{B} - r$. To conceal her intentions, a bad entrepreneur imitates the behavior of a good entrepreneur.

Let $\gamma^* \in [0, 1]$ be the probability that a lender accepts the proposed repayment r.[5] In

[5] Existence of a sequential equilibrium in the two-period case may require that the second-period contract be randomly assigned. In general, it is possible for the entrepreneur to randomize in equilibrium between proposing a contract promising zero expected profits and one that leads to certain rejection. Alternatively, when indifferent between accepting and rejecting, a bank may randomize in equilibrium. We assume in these cases that the entrepreneur proposes a contract with certainty.

equilibrium:

$$\gamma^* \begin{cases} = 0 & \text{if } r < 2k/p_0, \\ \in [0,1] & \text{if } r = 2k/p_0 \text{ and } p_0 = \Delta, \\ = 1 & \text{if } r \geq 2k/p_0 \text{ and } p_0 > \Delta. \end{cases} \tag{4.1}$$

The lender rejects with certainty an offer of $r < 2k/p_0$ and accepts with certainty an offer of $r \geq 2k/p_0$ when $p_0 > \Delta$.[6] For $r = 2k/p_0$ and $p_0 = \Delta$, any $\gamma^* \in [0,1]$ represents a best response for the lender because the only acceptable repayment leading to nonnegative value for the entrepreneur is $r = 2k/p_0$.

The arm's-length contract for financing sequential projects is similar to the joint-projects contract. In particular, in the second period, the outside lenders cannot learn from the fact that an entrepreneur is seeking financing from them, i.e., the second-period lenders are not exposed to a Winner's Curse problem. The reason for this is that lenders are able to compute a good entrepreneur's optimal choice of financing scheme. A bad entrepreneur pursuing a different strategy than a good entrepreneur is immediately revealed. Therefore, a bad entrepreneur only chooses to switch after period 1 when it is also in the interest of a good entrepreneur to do so. Because the second-period lenders do not know the repayment history of the entrepreneur, they expect a good entrepreneur with probability p_0, i.e., $\beta = 0$. Therefore, the two periods are structurally identical, and we can directly apply

[6] For $r \geq 2k/p_0$ and $p_0 > \Delta$, there is no equilibrium profile under which the lender rejects with positive probability because the entrepreneur would then propose a repayment r slightly above $2k/p_0$, so that no best response for the lender exists.

the analysis derived above. The results are summarized in Proposition 1.

Proposition 1. Arm's-Length Financing (ALF):

(i) Joint projects: If $p_0 \geq \Delta$, the entrepreneur, either good or bad, proposes a repayment $r^* = 2k/p_0$ in exchange for an investment $2k$ in equilibrium, and the lender accepts. The bad entrepreneur defaults on r with certainty. If $p_0 < \Delta$, no contract is signed.

(ii) Sequential projects: If $p_0 \geq \Delta_j$, $j = A, B$, the entrepreneur, either good or bad, proposes repayment $r^* = k/p_0$ in exchange for investment k, and the lender accepts. A bad entrepreneur defaults with certainty. If $p_0 < \Delta_j$, no contract is signed.

The entrepreneur is able to finance both projects sequentially if and only if $p_0 \geq \Delta_B$. For $\Delta_A \leq p_0 < \Delta_B$, she can only finance the more profitable project A. The profits to a good entrepreneur from arm's-length financing are:

(i) As joint projects:

$$\Pi^{ALF} = \begin{cases} \pi_A + \pi_B - 2k/p_0 & \text{if} \quad p_0 \geq \Delta \\ 0 & \text{if} \quad p_0 < \Delta \end{cases}$$

(ii) As sequential projects:

$$\Pi^{ALF} = \begin{cases} \pi_A - k/p_0 + \rho(\pi_B - k/p_0) & \text{if} \quad p_0 \geq \Delta_B \\ \pi_A - k/p_0 & \text{if} \quad \Delta_B > p_0 \geq \Delta_A \\ 0 & \text{if} \quad p_0 < \Delta_A \end{cases}$$

Comparing profits in (i) with (ii), our setup implies that the entrepreneur will always choose to finance joint projects when possible. This result is summarized in the following corollary.

Corollary 1.1. *Under arm's-length financing, projects are financed jointly when* $p_0 \geq \Delta$. *For* $\Delta > p_0 \geq \Delta_A$, *only project A is chosen in the first period, and there is no additional financing provided in the second period. For* $p_0 < \Delta_A$, *no financing takes place.*

5. Relationship Financing

We now consider the financing of sequential projects through relationship financing by allowing the repayment behavior of the bad entrepreneur to play an important role in the setting of equilibrium contracts. We demonstrate that there are four possible equilibria associated with relationship financing: a reputational equilibrium, defined to be a sequential equilibrium in which the bad entrepreneur pays r_1 with probability $\beta \in (0, 1)$, a pooling equilibrium where the bad entrepreneur never defaults ($\beta = 1$), a separating equilibrium where the bad entrepreneur always defaults ($\beta = 0$), and a no-investment equilibrium in which no projects are financed. The existence of a particular equilibrium will depend on the proportion of bad entrepreneurs in the lending pool, the absolute and relative magnitude of the payoffs, and how the entrepreneur chooses to sequence projects.

We solve the relationship financing problem by backwards induction, starting at the beginning of the second period. The intuition from Proposition 1 can be used to obtain the second-period equilibrium conditions. However, we assume that the relationship lender has all of the bargaining power in the second period.

Corollary 1.2. *Suppose project i has been carried out in the first period. If r_1 has been repaid and $p_1 \geq \Delta_j$, the lender proposes with probability γ^* a contract with repayment $r_2^* = \pi_j$ and investment k, where γ^* is:*

$$\gamma^* \begin{cases} \in [0,1] & \text{if } r_2 = k/p_1 \text{ and } p_1 = \Delta_j, \\ = 1 & \text{if } r_2 \geq k/p_1 \text{ and } p_1 > \Delta_j. \end{cases}$$

The bad entrepreneur defaults on r_2^* with certainty. If repayment r_1 has not been paid or $p_1 < \Delta_j$, no second-period contract is signed.

We now step back to the end of period 1. Suppose project i has been financed and realized, and repayment r_1 is due. Anticipating the outcome of the second period, a bad entrepreneur knows that she collects the payoff of project j with present value $\rho\pi_j$ if she pays r_1 with probability β such that $p_1 \geq \Delta_j$. Obviously, she is better off defaulting when the cost r_1 of "reputation building" exceeds the potential gain $\rho\pi_j$ of having the reputation, i.e. in equilibrium, $\beta^* = 0$ if and only if $r_1 > \rho\pi_j$.

For $r_1 \leq \rho\pi_j$, a bad entrepreneur will choose β to maximize the probability of collecting the reputational rent $\rho\pi_j - r_1$. For $p_0 \geq \Delta_j$, she can choose $\beta = 1$ to guarantee a second-period contract. For $p_0 < \Delta_j$, she needs to choose a β^* such that $p_1 = \Delta_j$,

$$\beta^* = \overline{\beta} = \frac{p_0}{1 - p_0} \frac{1 - \Delta_j}{\Delta_j} < 1. \tag{5.1}$$

$\beta^* = \overline{\beta}$ successfully induces a second-period contract with probability $\gamma^* \in [0, 1]$. For $\beta^* = \overline{\beta}$ to be an equilibrium, the bad entrepreneur must be indifferent between β^* and any other β that increases her reputational rent based on initial beliefs β^*.[7] In other words, in equilibrium, the expected reputational rent $\gamma^* \rho \pi_j - r_1$ must equal zero, implying $\gamma^* = r_1/(\rho\pi_j)$.

Given β^*, the probability $q^* = p_0 + (1 - p_0)\beta^*$ of repayment in the first period is:

$$q^* = \begin{cases} 1 & \text{if } \ r_1 \leq \rho\pi_j \ \text{ and } \ p_0 \geq \Delta_j, \\ p_0/\Delta_j & \text{if } \ r_1 \leq \rho\pi_j \ \text{ and } \ p_0 < \Delta_j, \\ p_0 & \text{if } \ r_1 > \rho\pi_j, \end{cases} \tag{5.2}$$

and the updated equilibrium belief of the incumbent lender about the likelihood that the borrowing entrepreneur is good, given payment of r_1 is:

$$p_1^* = \frac{p_0}{q^*} = \begin{cases} p_0 & \text{if } \ r_1 \leq \rho\pi_j \ \text{ and } \ p_0 \geq \Delta_j, \\ \Delta_j & \text{if } \ r_1 \leq \rho\pi_j \ \text{ and } \ p_0 < \Delta_j, \\ 1 & \text{if } \ r_1 > \rho\pi_j. \end{cases} \tag{5.3}$$

[7] Given small non-transferable private benefits of running projects she will choose $\beta^* = \overline{\beta}$.

Note that p_1^*, the updated likelihood of lending to a good entrepreneur, is never less than Δ_j. Let us now turn to the contracting problem at the beginning of period 1. Anticipating q^*, the lender expects a repayment of $q^* r_1$. To cover its investment k, it only accepts a contracted repayment equal to:

$$r_1 \geq k/q^*. \tag{5.4}$$

On the other hand, it also knows that any repayment promise r_1 exceeding π_i is impossible as entrepreneurs have no initial wealth, hence:

$$r_1 \leq \pi_i. \tag{5.5}$$

We now derive conditions for a reputational equilibrium, i.e. an equilibrium in which $\beta^* \in (0,1)$. A positive repayment probability less than 1 implies $\beta^* = \overline{\beta}$ and is only possible if the reputational rent is nonnegative, hence:

$$r_1 \leq \rho \pi_j, \tag{5.6}$$

and if the choice of β^* matters, $p_0 < \Delta_j$. Taking (5.2) into account, inequalities (5.4), (5.5) and (5.6) are compatible if and only if:

$$\min\{\pi_i, \rho\pi_j\} \geq r_1 \geq \frac{k}{p_0}\Delta_j, \tag{5.7}$$

which implies,

$$p_0 \geq \max\left\{\Delta_A \Delta_B, \frac{\Delta_j^2}{\rho}\right\}.$$

Combined with $p_0 < \Delta_j$, the former condition implies $k < \rho\pi_j$.

Suppose all conditions stated thus far are fulfilled. Then, if the good entrepreneur chooses a contract promising a repayment r_1 satisfying (5.7), she will choose r_1 as low as possible. We show in the appendix that proposing:

$$r_1^* = \frac{k}{p_0}\Delta_j.$$

maximizes the good entrepreneur's profits. Hence, we arrive at the following lemma.

Lemma 1. Reputational Equilibrium: *For $\Delta_j > p_0 \geq \max\{\Delta_A \Delta_B, \Delta_j^2/\rho\}$, which implies $k < \rho\pi_j$, there exists a unique reputational equilibrium in which the entrepreneur, whether good or bad, proposes a contract promising repayment $r_1^* = k\Delta_j/p_0$ in exchange for investment k in the first period, and the lender accepts. At the end of period 1, the bad entrepreneur repays with probability $\beta^* = \overline{\beta} \in (0,1)$.*

We next turn to the conditions required for a pooling equilibrium ($\beta^* = 1$). A repayment probability $\beta^* = 1$ is only possible if the reputational rent is nonnegative, i.e. $r_1 \leq \rho\pi_j$, and if the choice of β^* does not influence the characteristics of the equilibrium contract. Proposition 1 implies that the latter occurs when $p_0 \geq \Delta_j$. Recalling inequalities (5.4)-(5.6), and taking (5.2) into account, we arrive at $\min\{\pi_i, \rho\pi_j\} \geq r_1 \geq k$, which is only possible if $k \leq \rho\pi_j$.

Given $k \leq \rho\pi_j$ and $p_0 \geq \Delta_j$, a good entrepreneur chooses r_1 as low as possible in order to maximize her profits. Hence she proposes $r_1^* = k$. Again, a bad entrepreneur is forced to mimic the good type to prevent detection. Based on this intuition, the appendix contains a formal proof of the following lemma.

Lemma 2. Pooling Equilibrium: *Suppose $k \leq \rho\pi_j$ and $p_0 \geq \Delta_j$. There exists a unique pooling equilibrium in which the entrepreneur, whether good or bad, proposes a contract promising repayment $r_1^* = k$ in exchange for investment k in the first period, and the lender accepts. At the end of period 1, the bad entrepreneur repays with certainty.*

A separating equilibrium ($\beta^* = 0$) is only possible if the reputational rent is negative ($r_1 > \rho\pi_j$). Recalling inequalities (5.4) and (5.5), and taking (5.2) into account, r_1 must also satisfy $\pi_i \geq r_1 \geq k/p_0$, implying $p_0 \geq \Delta_i$. To analyze this configuration, we must consider two cases: $k > \rho\pi_j$ and $k \leq \rho\pi_j$. Suppose $p_0 \geq \Delta_i$ and $k > \rho\pi_j$. A bad entrepreneur will never repay r_1 since $r_1 \geq k/q^* \geq k > \rho\pi_j$. The good entrepreneur chooses a contract with r_1 as low as possible, i.e., $r_1^* = k/p_0$, and the bad entrepreneur mimics. Now suppose $p_0 \geq \Delta_i$ and $k \leq \rho\pi_j$. From Lemmata 1 and 2 we know that the good entrepreneur prefers to propose a repayment $r_1^* = k \max\{\Delta_j/p_0, 1\}$ as long as $p_0 \geq \max\{\Delta_A\Delta_B, \Delta_j^2/\rho\}$. Hence a separating equilibrium only exists if $\max\{\Delta_A\Delta_B, \Delta_j^2/\rho\} > p_0 \geq \Delta_i$. This is possible for $\Delta_j^2/\rho > p_0 \geq \Delta_i$. Over this interval, the good entrepreneur once again proposes $r_1^* = k/p_0$ and the bad entrepreneur mimics.

The appendix demonstrates that proposing $r_1^* = k/p_0$ maximizes the good entrepreneur's profits in both cases. Lemma 3 follows from the proof.

Lemma 3. Separating Equilibrium: *Suppose (i)* $k > \rho\pi_j$ *and* $p_0 \geq \Delta_j$*, or (ii)* $k \leq \rho\pi_j$ *and* $\Delta_j^2/\rho > p_0 \geq \Delta_i$*. Then there exists a unique separating equilibrium in which the entrepreneur, whether good or bad, proposes a contract promising repayment* $r_1^* = k/p_0$ *in exchange for investment* k *in the first period, and the lender accepts. At the end of period 1, the bad entrepreneur defaults with certainty.*

To complete the analysis, we need to state the conditions under which a equilibrium with no investment exists. This is done by summarizing the logical counter-arguments of Lemmata 1, 2, and 3.

Lemma 4. No-Investment Equilibrium: *Suppose either* $k > \rho\pi_j$ *and* $p_0 < \Delta_i$*, or* $k \leq \rho\pi_j$ *and* $p_0 < \min\{\max\{\Delta_A\Delta_B, \Delta_j^2/\rho\}, \Delta_i\}$*. Then no contract is signed in the first period.*

Figure 1 summarizes the influence of the model parameters on the various equilibria, by varying p_0 and π_A while holding π_B constant. The dotted lines plot critical values for determining the equilibria, while the solid lines trace out the equilibrium regions. The top panel assumes that the entreprenuer chooses to sequence project A first, while the bottom panel assumes that B is chosen first.

Several interesting features of the equilibria emerge from the figure. First, an intuitive ordering exists across the equilibria. For low enough values of p_0 (i.e., high proportion of bad entrepreneurs), no contract is signed. As p_0 increases, first-period equilibrium interest rates begin to fall enough to induce bad entrepreneurs to repay; for high values of p_0 all entrepreneurs – good and bad – make their first-period payment. Second, comparing the top and bottom panels, contracts can be written for lower values of p_0 when projects are sequenced such that the higher payoff project comes later (sequence $\{B, A\}$). For a given value of r_1, bad entrepreneurs have more incentive to make the first-period repayment and get refinanced when they know the second period payoff will be relatively high. Third, when the high-valued project is chosen first (sequence $\{A, B\}$), the value of the project can be high enough to get a separating equilibrium whereby good entrepreneurs are financed over the two periods and all bad entrepreneurs default on the first-period contract.

The two panels of Figure 1 imply that the good entrepreneur will choose project sequence $\{B, A\}$, whenever p_0 is too low to allow for sequence $\{A, B\}$ to be financed. This result is interesting by itself because it suggests that the financing environment can influence preferences on how projects with differing payoffs might be staged. As it turns out, sequencing preferences can be defined over the entire interval of p_0 by comparing the good entrepreneur's profits from each sequencing permutation. For project sequence $\{i, j\}$, the profits from relationship financing (RF) are given by

$$\begin{aligned} \Pi^{RF}(RE, \{i, j\}) &= \pi_i - \frac{k\Delta_j}{p_0} \qquad (5.8) \\ \Pi^{RF}(PE, \{i, j\}) &= \pi_i - k \end{aligned}$$

$$\Pi^{\mathsf{RF}}(SE,\{i,j\}) \;=\; \pi_{\mathsf{i}} - \frac{k}{p_{\mathtt{0}}}.$$

Let $\kappa = k/(\pi_{\mathsf{A}} - \pi_{\mathsf{B}} + k))$. Comparing the payoffs for $\{A,B\}$ and$\{B,A\}$, and combining Lemmata 1-4, allows us to fully describe the relationship financing equilibria.

Proposition 2. Relationship Financing (RF)

- $\pi_{\mathsf{A}} > \rho\pi_{\mathsf{B}}^2/k$: *There is a no-investment equilibrium for* $p_{\mathtt{0}} < \Delta_{\mathsf{A}}\Delta_{\mathsf{B}}$; *there is a reputational equilibrium with project sequence* $\{B,A\}$ *for* $\Delta_{\mathsf{A}}\Delta_{\mathsf{B}} \leq p_{\mathtt{0}} < \Delta_{\mathsf{A}}$; *there is a pooling equilibrium with project sequence* $\{B,A\}$ *for* $\Delta_{\mathsf{A}} \leq p_{\mathtt{0}} < \kappa$; *there is a separating equilibrium with project sequence* $\{A,B\}$ *for* $\kappa \leq p_{\mathtt{0}} < \Delta_{\mathsf{B}}^2/\rho$; *there is a reputational equilibrium with project sequence* $\{A,B\}$ *for* $\Delta_{\mathsf{B}}^2/\rho < p_{\mathtt{0}} < \Delta_{\mathsf{B}}$; *and there is a pooling equilibrium with project sequence* $\{A,B\}$ *for* $p_{\mathtt{0}} \geq \Delta_{\mathsf{B}}$.

- $\rho\pi_{\mathsf{B}}^2/k \geq \pi_{\mathsf{A}} > \pi_{\mathsf{B}}/\rho$: *There is a no-investment equilibrium for* $p_{\mathtt{0}} < \Delta_{\mathsf{A}}\Delta_{\mathsf{B}}$; *there is a reputational equilibrium with project sequence* $\{B,A\}$ *for* $\Delta_{\mathsf{A}}\Delta_{\mathsf{B}} \leq p_{\mathtt{0}} < \Delta_{\mathsf{B}}^2/\rho$; *there is a reputational equilibrium with project sequence* $\{A,B\}$ *for* $\Delta_{\mathsf{B}}^2/\rho \leq p_{\mathtt{0}} < \Delta_{\mathsf{B}}$; *and there is a pooling equilibrium with project sequence* $\{A,B\}$ *for* $p_{\mathtt{0}} \geq \Delta_{\mathsf{B}}$.

- $\pi_{\mathsf{B}}/\rho \geq \pi_{\mathsf{A}} > \pi_{\mathsf{B}}$: *There is a no–investment equilibrium for* $p_{\mathtt{0}} < \Delta_{\mathsf{A}}^2/\rho$; *there is reputational equilibrium with project sequence* $\{B,A\}$ *for* $\Delta_{\mathsf{A}}^2/\rho \leq p_{\mathtt{0}} < \Delta_{\mathsf{B}}^2/\rho$; *there is a reputational equilibrium with project sequence* $\{A,B\}$ *for* $\Delta_{\mathsf{B}}^2/\rho \leq p_{\mathtt{0}} < \Delta_{\mathsf{B}}$; *and there is a pooling equilibrium with project sequence* $\{A,B\}$ *for* $p_{\mathtt{0}} \geq \Delta_{\mathsf{B}}$.

Figure 2 summarizes the essential features of the proposition. For relatively low values of p_0, entrepreneurs choose to finance the low-payoff project B first because lenders will not sign contracts that start with project A. However, for higher values of p_0, lenders view the risk of default to be low enough that high-valued projects can be financed first, before a reputation has been established. Because of the discount rate, the entrepreneur will always select to finance the high-valued project first when it is feasible to do so.

6. Choice of Financing Method

We now combine the results from the previous two sections to determine an entrepreneur's optimal choice of financing method. With arm's-length financing the entrepreneur retains full bargaining power in the second period, while under relationship financing the lender obtains full bargaining power in the second period. To avoid the loss of bargaining power and associated rents, the entrepreneur will always switch lenders whenever an outside lender is willing to finance a profitably second-period project.

From Proposition 1, we know that an outside lender is willing to provide arm's-length financing for one project when $p_0 \geq \Delta_i$ and for both projects when $p_0 \geq \Delta$. Moreover, Corollary 1.1 tells us that entrepreneurs that can finance both projects with arm's-length financing always find it more profitable to finance the projects jointly, rather than sequentially. This limits the analysis to choosing between arm's-length financing of joint projects and relationship financing of sequential projects.

Because lenders are unwilling to finance joint projects at arm's length when $p_0 < \Delta$, only Proposition 2 applies below that cutoff . On the other hand, no relationship-financing contract will be written when $p_0 \geq \Delta_B$ and arm's-length financing is available. This is true because any relationship contract offered over the $p_0 \geq \Delta_B$ interval – including the most profitable that sequences $\{A, B\}$ and leads to a pooling of borrowers – can be dominated by a second-period offer from a new arm's length lender (see Proposition 1).

For $\Delta \leq p_0 < \Delta_B$, we have to compare the entrepreneur's profits from relationship financing to profits from arm's-length financing with joint projects. It turns out that, over this interval, the entrepreneur always chooses relationship financing.

Lemma 5. *For $\Delta \leq p_0 < \Delta_B$, the entrepreneur sequences projects with relationship financing.*

Proof.

1. $\Pi^{RF}(SE, \{A, B\}) > \Pi^{ALF}$. *Suppose not:* $\pi_A - k/p_0 \leq \pi_A + \pi_B - 2k/p_0 \Longleftrightarrow p_0/\Delta_B \geq 1$, *a contradiction.*

2. $\Pi^{RF}(RE, \{A, B\}) > \Pi^{ALF}$. *Suppose not:* $\pi_A - k\Delta_B/p_0 \leq \pi_A + \pi_B - 2k/p_0 \Longleftrightarrow p_0 \geq \Delta_B(2 - \Delta_B)$.

From Lemma 1, it follows that a Reputational Equilibrium only exists if $p_0 < \Delta_B$. *Combining the two inequalities leads to* $\Delta_B \geq 1$, *a contradiction.* ■

Proposition 3 summarizes the main result of the section.

Proposition 3. *For $p_0 \geq \Delta_B$, arm's-length financing emerges and the projects are* *jointly financed in period 1. For* $\max(\Delta_A \Delta_B, \Delta_A^2/\rho) \leq p_0 < \Delta_B$, *relationship financing emerges. For* $p_0 < \max(\Delta_A \Delta_B, \Delta_A^2/\rho)$, *no financing takes place.*

The proposition, which is illustrated in Figure 3, provides an interesting and straightforward pinnacle to the analysis. The presence of too many bad entrepreneurs in a market (i.e., low values of p_0) implies that no financial contracts are written, relationship or arm's-length. However, relationship-lending does allow for financing over intervals in which the proportion of bad entrepreneurs prevents arm's-length contracts. Moreover, when the proportion of bad entrepreneurs drops to a point where arm's-length contracts are feasible, entrepreneurs can still find it optimal to choose relationship lending, even though this implies sequencing the projects and foregoing all bargaining power in the second period. The latter result stems from the fact that repayment $r = 2k/p_0$ of the arm's length contract rises faster than the present value of the repayment $r_1 + \rho r_2 = k\Delta_B/p_0 + \rho\pi_B$ under a reputational equilibrium, or $r_1 + \rho r_2 = k/p_0 + \rho\pi_B$ under a separating equilibrium. For lower values of p_0, this effect is strong and more than adequately compensates for the loss of the entire second period payoff. These results highlight the value of relationship lending.

Our stylized model shows that if the lender assesses repayment to be unlikely, an entrepreneur will defer a project and borrow repeatedly from the same lender in order to build a reputation for repayment. Such relationship financing occurs even though banks have the power to extract holdup rents from the borrowers. As the likelihood of repayment falls, the entrepreneur may even reverse project order, exacerbating holdup costs.

7. Applications and Robustness

7.1. Judicial Efficiency and Financial Development

Recent empirical work documents a strong positive correspondence between judicial efficiency, development of financial intermediation, and ultimately economic growth. For example, Levine (1999) and Levine, Loayza, and Beck (2000) show that cross-country differences in creditor rights, the quality of contract enforcement, and accounting standards help explain cross-country differences in financial intermediary development.[8] The component of financial development determined by the legal and regulatory environment in turn helps account for cross-country differences in economic growth. In particular, these studies document a strong positive association between proxies for the quality of contract enforcement in a country and the overall size of the financial intermediary sector.

Our model illustrates this positive association. In our setup, bad entrepreneurs have the option not to repay. This proportion of bad entrepreneurs may in reality directly stem from the quality of the available contract enforcement mechanism, or be a general function of the judicial efficiency. Stringent contract enforcement leaves few entrepreneurs with the strategic option to default. Lax enforcement, on the other hand, creates opportunities for many entrepreneurs never to repay. For example, an entrepreneur may know the local judge or in general have enough legal skills and resources to elude, delay, and ultimately derail

[8] See also La Porta, de Silanes, Shleifer, and Vishny (1997, 1998, 2000).

any weak attempts at judicial enforcement. Lenders may not know ex-ante whether or not an entrepreneur has access to such skills and resources. For countries with weak judicial systems, entrepreneurs may be better off delaying projects and seeking relationship-type financing.

Consequently, our stylized model not only links contract enforcement and judicial efficiency with decisions about project sequencing, but ultimately also with the development of the financial intermediary sector and the level of investment. According to our model, when the judicial system is efficient, entrepreneurs will immediately undertake all accessible projects by borrowing from arm's-length lenders. An inefficient judicial system on the other hand impels entrepreneurs to delay projects to build a reputation for repayment. If such delays are costly, then inefficient judicial systems may hamper current investment and reduce contemporaneous demand for funding. In this sense, our setup complements recent papers by Fabbri (2000) and Iacovoni and Zazzaro (2000) that posit a positive link between the quality of contract enforcement and investment. Fabbri assumes that weak contract enforcement increases the cost of repossessing collateral in case of default, while Iacovoni and Zazzaro postulate that legal inefficiencies increase banks' screening and monitoring costs.

7.2. Loan Commitments

Our model also embodies characteristics of a revolving line of credit. Lines of credit are capped, forcing firms to repay their drawn credit before financing new projects. A pattern of drawdowns and repayments enables a firm to build a reputation for repayment with its bank. Given this interpretation, our model implies that firms should opt for lines of credit financing with a low credit limit over a large term loan when operating in an environment where strategic default is likely. On the other hand, large term loans should be preferred in settings where strategic default is unlikely.

Because of the similarity between relationship lending in our model and a bank line of credit, our paper is closely related to the literature analyzing the optimality of loan commitment lending. According to this literature, loan commitments can be used to optimally balance reputational and financial capital, to forecast future loan demand, to lower regulatory taxes, or to exploit cost advantages in providing liquidity. Commitments can further mitigate investment distortions and suboptimal liquidation problems, enable borrowers to signal unobservable characteristics, and function as insurance contracts to risk-averse borrowers.[9]

Complementing this literature, our model aims to demonstrate why it may be optimal to have repeated borrowing instead of single-shot financing. We do so by formally showing that an entrepreneur may opt for project delay to allow the lender to learn from observing drawdowns and repayments. The ensuing but voluntary exposure to the lender's scrutiny renders better contract terms for the entrepreneur, even in the presence of anticipated holdup.

[9]For example, see Boot, Thakor and Udell (1987, 1991), Houston and Venkataraman (1994), Morgan (1994), and Shockley and Thakor (1997).

7.3. Robustness of the Model

Our main results are robust to various alterations and extensions. For example, as shown in the appendix, we can introduce divisibility by allowing letting entrepreneurs decide how they want to split up a project across periods. Allowing for divisibility widens the reach of both arm's-length and relationship financing versus the no-investment outcome. On the other hand, arm's-length financing may become less prevalent if borrowers face credit limits that prevent them from financing joint projects and if entrepreneurs incur a fixed cost when approaching a second lender. Similarly, introducing a fixed cost to sequencing projects, increasing the discount rate (i.e., decreasing the discount factor ρ), or introducing bank fragility may make relationship financing less attractive.

The main intuition of the model also remains intact in generalizations to multiple projects and/or multiple periods. As shown in the appendix, enabling the entrepreneur and the financiers to write long-term contracts similarly does not alter the results. Allowing entrepreneurs to finance second-period projects using retained earnings from the first period reduces the region over which a reputational equilibrium exists because the value of building a reputation decreases. However, if the initial proportion of good entrepreneurs is too low to establish a reputational equilibrium, the good entrepreneur could offer a contigent contract to a second-period lender at the beginning of the first period. The contract would contain a condition that the project will proceed only in case the first-period lender is repaid. The introduction of such a contract reestablishes the reputational equilibrium because the bad entrepreneur is once again forced to imitate the good entrepreneur by proposing a similar contract.

8. Conclusion

Our model suggests that repeated funding of sequential projects may arise as the dominant form of financing when the aggregate risk of strategic default is high, as is likely in nations with poor contract enforcement and low judicial efficiency. To build a reputation, good entrepreneurs delay projects to seek repeated financing from the same lender. Hence a low ex-ante likelihood of repayment goes hand-in-hand with delayed projects.

While our stylized framework links judicial efficiency and the prevailing type of financing, it remains silent on the precise linkage between judicial efficiency and the number of financing relationships. For example, Detragiache, Garella, and Guiso (2000) and Ongena and Smith (2000b) document a negative correspondence between different proxies for judicial efficiency and the occurrence of multiple bank-firm relationships in samples containing Italian and large European firms respectively. Their results may suggest that in regions where judicial efficiency is poor, relationship financing forces project delay, in effect reducing per period funding and worsening holdup. Multiple bank arrangements may then arise to increase per period access to funding and to abate holdup. On the other hand, in regions where judicial efficiency is high, firms can immediately finance all currently accessible projects possibly using a single lender. Such arm's-length financing is further untainted by holdup, even when firms would borrow repeatedly from the same bank. However, we leave investigating these conjectures for future research.

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Appendix

Proof of Lemma 1

From Proposition 2 follows that for $p_0 \geq \Delta_A$, project sequence $\{A, B\}$ results. It was shown in the text that given $\Delta_B > p_0 \geq \max\{\Delta_A \Delta_B, \Delta_B^2/\rho\}$ (implying $k < \rho\pi_B$), repayment $r_1^* = k\Delta_B/p_0$ satisfies the relevant rationality constraints (5.4), (5.5) and (5.6). To complete the proof, we show that promising repayment r_1^* maximizes the good entrepreneur's income. Recalling Corollary 1.2, the good entrepreneur's income Π^* under r_1^* over both periods is given by

$$\Pi^* = \pi_A - k\Delta_B/p_0.$$

Note that given the assumptions made on p_0, income Π^* is nonnegative.
Step 1: Consider any repayment r_1^o an lender is not willing to sign. Then, a contract over project A promising repayment $r_2^* = k/p_0$ is signed in the second period if $p_0 \geq \Delta_A$. For $p_0 < \Delta_A$, no contract is signed. Hence by promising r_1^o in the first period, the good entrepreneur achieves income $\Pi^o = \max\{0, \pi_A - k/p_0\}$ in the second period. It is straightforward to show that $\Pi^o \leq \Pi^*$.
Step 2: Any repayment promise $r_1^o < k\Delta_B/p_0$ violates the lender's rationality constraint (5.4) since in that case $q^o = p_0/\Delta_B$. Hence the lender rejects, and we are back at Step 1.

Step 3: Consider any repayment r_1^o such that $k\Delta_B/p_0 < r_1^o(\cdot) \leq \rho\pi_B$. If the lender accepts, it follows from equation (5.3) that $p_1^* = \Delta_B$, and according to Corollary 1.2, a second-period contract with $r_2 = \pi_B$ is induced. The good entrepreneur's income is then given by $\Pi^o = \pi_A - r_1^o$, which is less than Π^*
Step 4: Consider any repayment $r_1^o > \rho\pi_B$. The lender only accepts if $\beta^* = 0$. According to (5.4), this is only rational for the lender if $r_1^o \geq k/p_0$. If that is the case, the good entrepreneurs's income is given by $\Pi^o = \pi_A - r_1^o + \rho(\pi_B - k)$. This is at least as big as profit Π^* if $r_1^o \leq k\Delta_B/p_0 + \rho(\pi_B - k)$. But this is only compatible with the lender's constraint $r_1^o \geq k/p_0$ if $p_0 \geq \Delta_B$, leading to a contradiction with the assumptions made on p_0.
Summarizing Step 1 to 4, proposing to repay $r_1^* = k\Delta_B/p_0$ maximizes the good entrepreneur's income. ■

Proof of Lemma 2

The proof is analogous to the proof of Lemma 1. We showed in the text that given $k \leq \rho\pi_B$ and $p_0 \geq \Delta_B$, repayment $r_1^* = k$ satisfies the relevant rationality constraints. To complete the proof, we show that promising repayment $r_1^* = k$ maximizes the good entrepreneurs's income. Recalling Corollary 2.1, the good entrepreneur's income Π^* under repayment r_1^* over both periods is given by

$$\Pi^* = \pi_A - k + \rho(\pi_B - k/p_0).$$

Note that given the assumptions made on p_0, income Π^* is nonnegative.
Step 1: Consider any repayment r_1^0 the lenders are not willing to sign. Then, a contract promising repayment $r_2^* = k/p_0$ is signed in the second period if $p_0 \geq \Delta_A$. For $p_0 < \Delta_A$, no contract is signed. Hence by proposing r_1^0 in the first period, the good entrepreneur achieves income $\Pi^0 = \max\{0, \pi_A - k/p_0\}$ which is less than Π^*.
Step 2: Any repayment promise $r_1^0 < k$ violates the lenders' rationality constraints (5.4). Hence the lenders reject, and we are back at Step 1.
Step 3: Consider any repayment r_1^0 such that $k < r_1^0 \leq \rho\pi_B$. the lender accepts r_1^0, and from equation (5.3) it follows that $p_1^* = p_0$. According to Corollary 1.2, a second-period contract with $r_2^* = k/p_0$ is induced. The good entrepreneur's income is then given by $\Pi^0 = \pi_A - r_1^0 + \rho(\pi_B - k/p_0)$. Since $r_1^0 > r_1^* = k$, this is less than Π^*.
Step 4: Consider any repayment $r_1^0 > \rho\pi_B$. A lender only accepts if $\beta^* = 0$. According to (5.4), this is only rational for the lender if $r_1^0 \geq k/p_0$. If that is the case, the good entrepreneur's income is given by $\Pi^0 = \pi_A - r_1^0 + \rho(\pi_B - k)$. This is at least as high as profit Π^* if $r_1^0 \leq k(1-\rho) + \rho k/p_0$. Since $r_1^0 \geq k/p_0$, this implies $p_0 \geq 1$, leading to a contradiction.
Steps 1 to 4 show that choosing $r_1^* = k$ maximizes the income of the good entrepreneur. ■

Proof of Lemma 3

We showed in the text that given (i) $k > \rho\pi_B$ and $p_0 \geq \Delta_A$, or (ii) $k \leq \rho\pi_B$ and $\Delta_B^2/\rho > p_0 \geq \Delta_A$, repayment $r_1^* = k/p_0$ satisfies the relevant rationality constraints. Note that in both cases (i) and (ii), k/p_0 exceeds $\rho\pi_B$ since (i) $k/p_0 > k > \rho\pi_B$, and (ii) $k/p_0 > \rho\pi_B/\Delta_B > \rho\pi_B$. This implies that in both cases only separating equilibria exist. Recalling Corollary 2.1, the good entrepreneur's income Π^* under repayment r_1^* over both periods is given by

$$\Pi^* = \pi_A - k/p_0 + \rho(\pi_B - k).$$

It remains to show that proposing $r_1^* = k/p_0$ dominates the strategy to sign no contract in the first period and a contract with repayment $r_2^* = k/p_0$ in the second period. Following the latter strategy, the entrepreneur achieves an income with present value $\rho(\pi_A - k/p_0)$, which is less than income Π^*. ■

Project Divisibility

Let $\pi_A + \pi_B = C$, a constant, and assume that the entrepreneur fixes project size by determining the proportion α of C to be allocated to project A and the proportion $(1-\alpha)$ allocated to project B. We have to consider only the representative project sequence $\{B, A\}$. For this project sequence, $p_0 \geq \max\{\Delta_A \Delta_B, \Delta_A^2/\rho\}$ is a necessary condition for a Reputational Equilibrium to exist. In case of endogenous project split the latter condition changes to $p_0 \geq \max\{k^2/(\alpha(1-\alpha)C^2), k^2/(\rho\alpha^2 C^2)$. Obviously, $k^2/(\alpha(1-\alpha)C^2)$ is minimized for $\alpha = 1/2$, and increases in α for $\alpha > 1/2$. However for π_A close to π_B, $p_0 \geq k^2/(\rho\alpha^2 C^2)$ is the relevant condition (see Figure 1), and $k^2/(\rho\alpha^2 C^2)$ decreases in α. Hence by increasing α, that is by placing more weight on the second-period project, the entrepreneur is able to broaden the range of p_0 for which financing is feasible. The maximum she can attain is to set $\alpha = \overline{\alpha} = 1/(1+\rho)$. Increasing α beyond $\overline{\alpha}$ makes $k^2/(\alpha(1-\alpha)C^2)$ the relevant condition, which, as mentioned before, increases in α. To conclude, endogenous project split-up and an increase in total project payoffs (C) widens the reach of both arm's-length and relationship financing versus the No Investment outcome.

Long-Term Contracts

We implicitly assumed that the entrepreneur is not able to credibly commit to stay with the incumbent financier. The threat of switching in the second period disappears if she is able to commit. Hence it is possible that the entrepreneur prefers relationship financing for $p_0 \geq \Delta_B$. In order to check for this possibility, we compare profits for a Pooling Equilibrium for $\{A, B\}$ with the profits for arm's-length financing of the joint projects. we can conclude that the writing of long-term contracts does not alter our results because $\Pi^{ALF} > \Pi^{RF}(PE, \{A, B\})$. Suppose not, then $\pi_A + \pi_B - 2k/p_0 \leq \pi_A - k \iff p_0 \leq 2k/(\pi_B + k)$. Combined with $p_0 < 1$ leads to $\pi_B < k$, a contradiction. ■

Figure 1: Comparing relationship financing equilibria for project sequencing {A,B} versus {B,A}

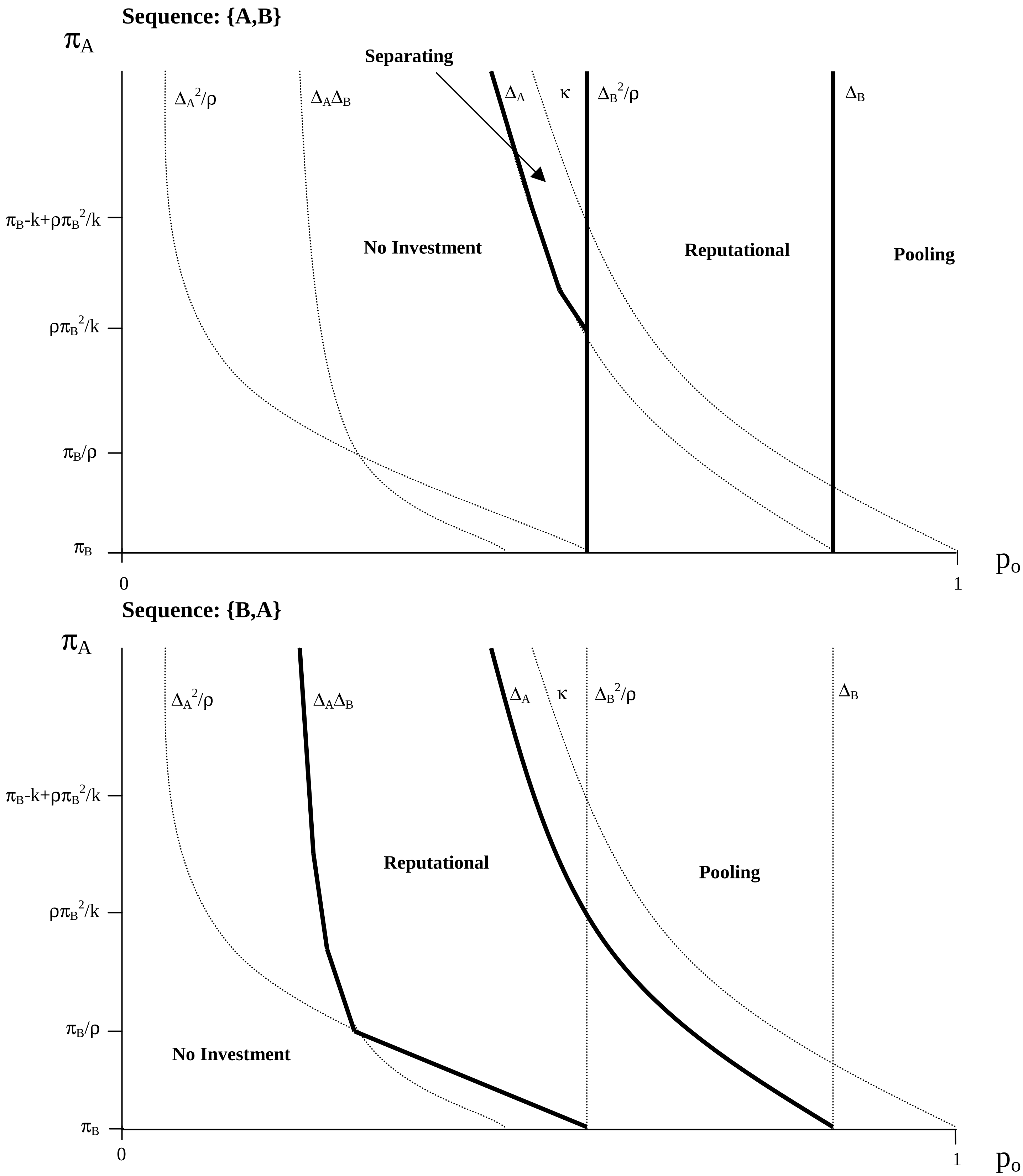

Figure 2: Summary of Proposition 8 (relationship financing)

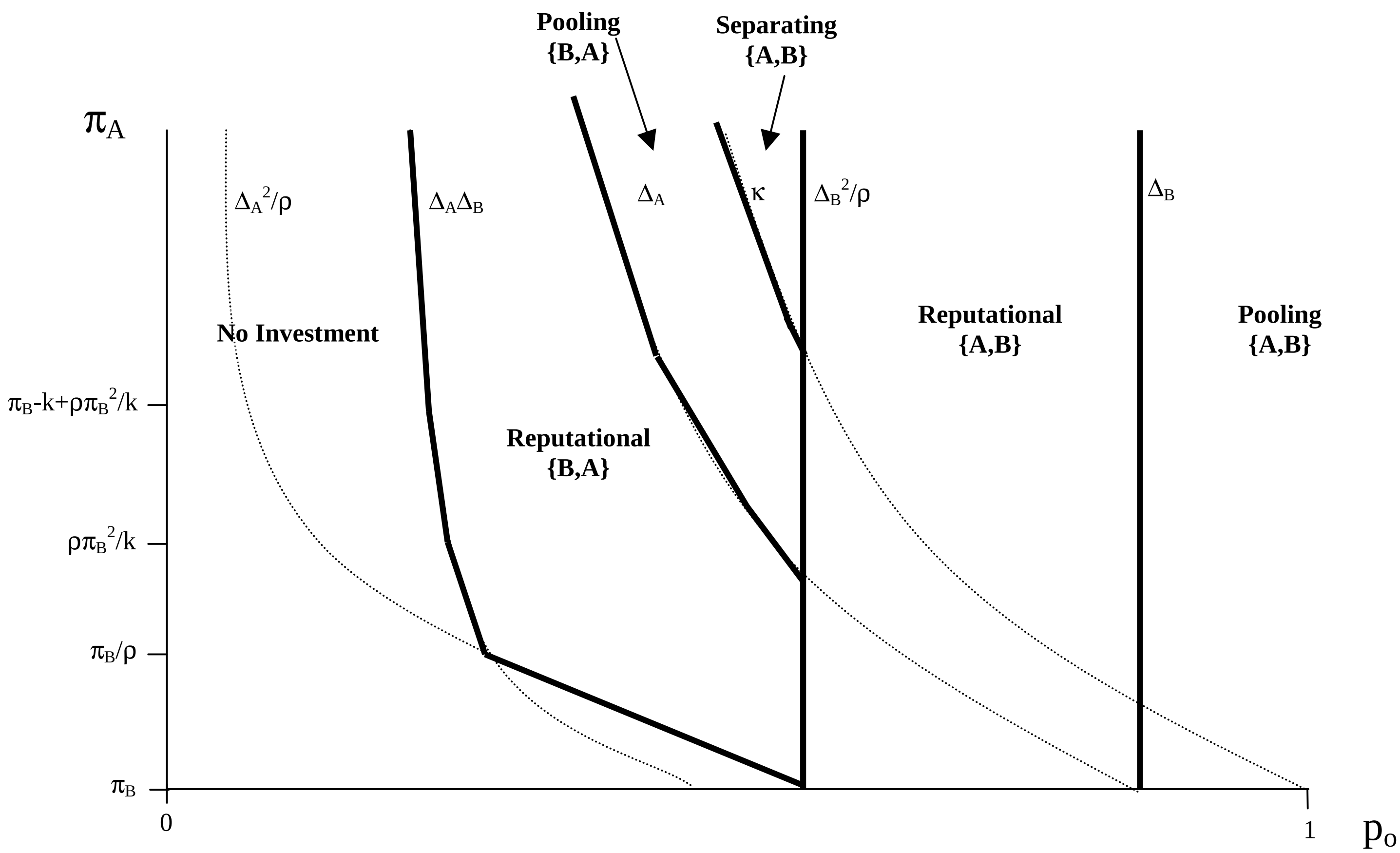

Figure 3: Summary of Proposition 10 (choice between arm's-length and relationship financing)