On the Sequencing of Projects, Reputation Building, and Relationship Finance

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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. We relate these findings to studies that positively associate accounting standards, creditor rights, and legal enforcement with economic growth.

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1 Introduction

Economies with advanced accounting and judicial systems appear to also have more developed financial systems. These economies, in turn, appear to enjoy the highest economic growth. Levine (1999) and Levine, Loayza, and Beck (2000), for example, show that cross-country differences in accounting standards, creditor rights, and the quality of contract enforcement help explain the differences in financial intermediary development documented in La Porta, de Silanes, Shleifer, and Vishny (1997, 1998, 2000). In turn, the components of financial development related to the regulatory and legal environment account best for the cross-country differences in economic growth.

Recent theoretical papers have started to explore the mechanisms how accounting and judicial standards may affect financing outcomes (Jappelli, Pagano, and Bianco, 2003; among others). We offer a broader theoretical explanation for the connection between key elements in the informational and judicial regime and financial-economic development. In particular we show that the ex-ante likelihood of strategic default – our proxy for transparency and enforcement – may affect both the orientation of the financial intermediary sector, in terms of whether the sector is dominated by relationship or transactional banking, and the development of the financial sector as a whole. We further highlight how project sequencing, along with "intertemporal credit rationing", may play an important and currently overlooked role in determining economic outcomes.

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 attempt 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, which is exogenously determined.

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".[1] The intuition for this result is straightforward. Financiers who attempt to finance both projects up front, i.e. "arm's length", have to charge too high rates to compensate for strategic default. Alternatively the financiers can offer their financing services in return for a relationship financing arrangement. This arrangement may be further bonded by a commitment not to disclose repayment history. As the relationship lender privately observes individual loan repayments in the first period, the incentives to repay increase in both periods. The resulting decrease in the interest rate charged to the entrepreneur seeking to finance the sequenced projects more than offsets any holdup rents accruing to the lender.

Our model illustrates that even in cases where banks gain all 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.[2] Consequently, rather than assuming that firms require repeated financing through time,[3] we allow firms the choice between repeated lending and one-shot financing, and derive conditions under which repeated financing with one bank is optimal.

The main contribution of our paper comes from assigning more meaning to our strategic default parameter. If the ability to strategically default is governed by for example accounting standards, creditor rights, and the quality of contract enforcement, then our model provides insight into how cross-country or regional differences in these

[1] 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 (Diamond, 1984; Fama, 1985). For reviews see Boot (2000) and Ongena and Smith (2000).

[2] The holdup problem is explored by Greenbaum, Kanatas, and Venezia (1989), Fisher (1990), Sharpe (1990), Rajan (1992), and von Thadden (2004).

[3] In Diamond (1991), firms borrow repeatedly from banks to build a good reputation for repayment, which is assumed to be publicly observable, before turning to financing through public debt markets. Borrowers in Boot and Thakor (1994) 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.

key features of the informational and judicial regime may determine financing behavior and economic outcomes. Our model implies that good projects could be delayed in countries or regions with low transparency, few creditor rights, and weak contract enforcement. Project delay could have negative consequences for aggregate welfare. For example, delayed projects could become obsolete or even disappear altogether due to the emergence of outside competition. Our model also ties the financial architecture of an economy – in particular the predominance of relationships versus arm's-length financing – to transparancy and enforcement. Relationship financing arises endogenously as a mechanism for building a privately-observed reputation for not defaulting.[4] But because relationship financing also implies a costly loss of control by the entrepreneur, arm's-length financing dominates in economies with a low likelihood of strategic default (i.e., high levels of transparency, rights, and enforcement).

Further, our model provides a rationale for why entrepreneurs may optimally choose to delay a project or "stage" financing. By assuming that entrepreneurs have multiple projects to finance, we are able to relate the timing and sequencing of projects to financing choice. In this sense, our setup complements works that focus on the option value of waiting to invest and on project staging.[5] In our paper, entrepreneurs sequence projects when reputational gains from paying off projects early reduce future lending costs. Highlighting this trade-off provides a novel approach to thinking about some of the common capital budgeting issues.

The rest of the paper is organized as follows. Section 2 introduces the model. Sections

[4] Kockesen and Ozerturk (2003) also endogenize relationship financing as a choice for the borrower. However, in their model borrowers trade-off benefits from learning about the project (in further stages of project development) with losing future rents. Their borrowers always prefer relationship financing, as their bargaining power depends on the optimally chosen level of initial investment. Hence their model does not feature the key correspondence explored in our model between the ex-ante likelihood of repayment, financing choice, and project sequencing.

[5] 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" the financing of an entrepreneurial venture may be optimal if there is a need to monitor its progress (Sahlman, 1990; Admati and Pfleiderer, 1994; Gompers, 1995; Neher, 1999; Cornelli and Yosha, 2003; among others).

2 to 5 develop the model in necessary detail (these three sections can be safely skipped by any reader less interested in the theoretical mechanics). Section 3 explores the characteristics of arm's-length financing, Section 4 focuses on relationship financing, and Section 5 derives the set of equilibria that exist when entrepreneurs can choose between relationship and arm's-length financing (these equilibria are also depicted in Figures 1 and 2). In Section 6 we interpret the main result (also displayed in Figure 3) and examine the robustness of relaxing the model's assumptions. Section 7 concludes.

2 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 simultaneously or delay one project and pursue the projects sequentially. Without loss of generality, assume that $\pi_A > \pi_B$, and define $\Delta \equiv 2k/(\pi_A + \pi_B)$ and $\Delta_j \equiv k/\pi_j$, $j = A, B$, to be the inverse profitability measures for the simultaneous and sequential projects, respectively. Note that by definition $\Delta_A < \Delta < \Delta_B$.

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 simultaneous 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.[6]

Defaults are only observed by the incumbent lender and the entrepreneur cannot credibly communicate her repayment history to a new lender. True, in developed countries bankruptcy is easily observed by all through so-called "black" credit registers. However such registers often do not exist in developing countries, do not cover cross-border transactions, and do not guarantee accurate and complete reporting (Jappelli and Pagano, 1999). In addition, the assumption that new lenders do not observe default can be viewed "as a shorthand parameterization for the more complicated situation in which there exists a whole range of states for which debtors are able to satisfy their obligatons but among which outsiders have difficulty distinguishing" (Sharpe, 1990, p. 1073). Banks may be evergreening loans for example, making it harder for new lenders to distinguish between good and bad entrepreneurs. Alternatively, the relationship financing arrangement may bonded by a commitment not to disclose repayment history and the first project can be viewed as partial cooperation in the sense of Ghosh and Ray (1996). Of course once two financed projects are observed, outsiders will conclude that the first project's financing was repaid and the entrepreneur would gain access to public markets. Increasing prior information dissemination in this case reduces holdup but also destroys the relationship lender's incentives to finance in the first place. In that sense improving recovery under strategic default (by enhancing creditor rights for example) encourages arm's-length financing and reduces project delay.

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.[7] Each entrepreneur knows her type,

[6] Competition from partially informed outside banks may limit such "holdup" rents (von Thadden, 2004). 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.

[7] This assumption is by no means extraordinary in the literature (see for example, Chan, Greenbaum

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 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 country-specific factors that influence debtor costs of default. Such factors could include a country's choice of accounting standards, the degree of protection given to creditors, bankruptcy procedures, 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 $\rho > \Delta_B$. 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. First, we 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.

3 Arm's-Length Financing

To derive conditions under which projects are financed with arm's-length contracts, we start with the case in which both projects are financed simultaneously in the first period. The entrepreneur proposes a contract specifying the investment amount $2k$ and the repayment level r. A bad entrepreneur never repays r as she is always better

and Thakor, 1986; Petersen and Rajan, 1995; von Thadden, 1995; among others). In addition, the probability has an intuitive interpretation within the confines of the model.

off repudiating. The good entrepreneur pays $\min\{r, \pi_A + \pi_B\}$ by assumption. The risk of repudiation influences negotiations at the beginning of the game. A lender anticipates a breach of contract with probability $1 - p_0$. Hence the lender is only willing to sign a contract when its expected repayment $p_0 r$ at least covers investment $2k$, i.e. $r \geq 2k/p_0$. On the other hand, any repayment r that exceeds $\pi_A + \pi_B$ is impossible because the entrepreneur has no initial wealth, i.e. $r \leq \pi_A + \pi_B$. These two constraints are compatible if and only if $p_0 \geq 2k/(\pi_A + \pi_B) = \Delta$. When this condition holds, the good entrepreneur can offer a repayment $r = 2k/p_0$ which makes the lender indifferent between signing and rejecting and maximizes the entrepreneur's profit $\pi_A + \pi_B - r$. To conceal her intentions, a bad entrepreneur imitates the behavior of a good entrepreneur.

We allow for randomness in the lender's decision to accept or reject the entrepreneur's proposal. Let $\gamma^* \in [0, 1]$ be the probability that a lender accepts the proposed repayment r.[8] In equilibrium:

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

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 $p_0 > \Delta$.[9] 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 a nonnegative value for the entrepreneur is $r = 2k/p_0$.

The arm's-length contract for financing the two projects sequentially is similar to the single-period contract. In particular, in the second period, the outside lenders cannot learn from the fact that an entrepreneur is seeking financing from them. Therefore, the second-period lenders are not exposed to a Winner's Curse problem. The reason for this

[8] 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.

[9] 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.

is that lenders are able to compute a good entrepreneur's optimal 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, so that $\beta = 0$. Therefore, the two periods are structurally identical, and we can directly apply the analysis derived above. The results are summarized in Proposition 1.

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

(i) *Simultaneous project financing: 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 project financing: 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 simultaneous 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 simultaneous projects when possible. This result is summarized in the following corollary.

Corollary 1 *Under arm's-length financing, projects are financed simultaneously 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.*

4 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 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 $p_1 = \Delta_j$,

$$\beta^* = \overline{\beta} = \frac{p_0}{1-p_0}\frac{1-\Delta_j}{\Delta_j} < 1. \tag{2}$$

$\beta^* = \overline{\beta}$ 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^*.[10] 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:

$$q^* = \begin{cases} 1 & \text{if } \ r_1 \leq \rho\pi_j \text{ and } \ p_0 \geq \Delta_j, \\ p_0/\Delta_j & \text{if } \ r_1 \leq \rho\pi_j \text{ and } \ p_0 < \Delta_j, \\ p_0 & \text{if } \ r_1 > \rho\pi_j, \end{cases} \tag{3}$$

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

$$p_1^* = \frac{p_0}{q^*} = \begin{cases} p_0 & \text{if } \ r_1 \leq \rho\pi_j \text{ and } \ p_0 \geq \Delta_j, \\ \Delta_j & \text{if } \ r_1 \leq \rho\pi_j \text{ and } \ p_0 < \Delta_j, \\ 1 & \text{if } \ r_1 > \rho\pi_j. \end{cases} \tag{4}$$

[10] 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:

$$r_1 \geq k/q^* - (p_1^* r_2^* - k). \tag{5}$$

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:

$$r_1 \leq \pi_i. \tag{6}$$

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:

$$r_1 \leq \rho \pi_j, \tag{7}$$

and if the choice of β^* matters, $p_0 < \Delta_j$. Taking (3) and Corollary 2 into account, inequalities (5), (6) and (7) are compatible if and only if:

$$\min\{\pi_i, \rho\pi_j\} \geq r_1 \geq \frac{k}{p_0}\Delta_j, \tag{8}$$

which implies:

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

Suppose all conditions stated thus far are fulfilled. Then, if the good entrepreneur chooses a contract promising a repayment r_1 satisfying (8), she will choose r_1 as low as possible. Hence she proposes:

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

Hence we arrive at the following four lemmata.

Lemma 1 ***Reputational Equilibrium:*** *For $\Delta_j > p_0 \geq \max\{\Delta_A\Delta_B, \Delta_j^2/\rho\}$, there exists a 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), (6), (7), Corollary 2, and taking (3) into account, we arrive at $\min\{\pi_i, \rho\pi_j\} \geq r_1 \geq 2k - p_0\pi_j$. Since $k < \pi_i$, $\rho > \Delta_B$ and $p_0 \geq \Delta_j$ by assumption, $\min\{\pi_i, \rho\pi_j\} \geq 2k - p_0\pi_j$ is always given.

Given $p_0 \geq \Delta_j$, a good entrepreneur chooses $r_1$as low as possible in order to maximize her profits. Hence she proposes $r_1^* = 2k - p_0\pi_j$. Again, a bad entrepreneur is forced to mimic the good type to prevent detection.

Lemma 2 ***Pooling Equilibrium:*** *Suppose $p_0 \geq \Delta_j$. Then there exists a pooling equilibrium in which the entrepreneur, whether good or bad, proposes a contract promising repayment $r_1^* = 2k - p_0\pi_j$ 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), (6), and taking (3) into account, r_1 must also satisfy $\pi_i \geq r_1 \geq k/p_0 - (\pi_j - k)$, implying $p_0 \geq k/(\pi_A + \pi_B - k)$. The entrepreneur once again proposes $r_1^* = (k - p_0(\pi_j - k))/p_0$ and the bad entrepreneur mimics. $r_1^* > \rho\pi_j$ for $p_0 < k/(\pi_j(1+\rho) - k)$.

Lemma 3 ***Separating Equilibrium:*** *Suppose $k/(\pi_j(1+\rho) - k) > p_0 \geq k/(\pi_A + \pi_B - k)$. Then there exists a separating equilibrium in which the entrepreneur, whether good or bad, proposes a contract promising repayment $r_1^* = (k - p_0(\pi_j - k))/p_0$ 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-argument of Lemmata 1, 2, and 3.

Lemma 4 ***No Investment Equilibrium:*** *Suppose*

$$p_0 < \min\left\{\max\{\Delta_A\Delta_B, \Delta_j^2/\rho\}, \frac{k}{\pi_A + \pi_B - k}\right\}.$$

Then no contract is signed in the first period.

For some parameter constellations, there are separating as well as reputational equilibria. We discriminate between the two by assuming the good entrepreneur chooses the equilibrium with a higher pay-off. The profits from relationship financing for project sequence $\{i, j\}$ are given by:

$$\begin{aligned} \Pi^{RF}(RE, \{i,j\}) &= \pi_i - \frac{k\Delta_j}{p_0} \\ \Pi^{RF}(PE, \{i,j\}) &= \pi_i - (2k - p_0\pi_j) \\ \Pi^{RF}(SE, \{i,j\}) &= \pi_i - \frac{k - p_0(\pi_j - k)}{p_0}. \end{aligned} \tag{9}$$

The panels of Figure 1 summarize 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 first panel assumes that the entrepreneur chooses to sequence project A first, while the second and third panel assume 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., a 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 repayment.

Second, comparing the first panel with the second and third, 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 low-value project is chosen first (sequence $\{B, A\}$), a separating equilibrium exists only for low values of the second-period project π_A. The higher the second-period project's profit, the higher is first-period repayment, making it less attractive for the bad entrepreneur to seek financing for the second-period project. However,

the separating equilibrium region exists only for low discount factors. For higher discount factors, the region overlaps with the area where the reputational equilibrium exists – an equilibrium that pay-off dominates any separating equilibrium. For the remainder of the paper we assume a high enough discount factor to rule out this rather special case, i.e. we assume $\rho \geq k(\pi_A + \pi_B - k)/\pi_A^2$.[11]

The three panels in 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 in 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. Comparing the payoffs for $\{A, B\}$ and $\{B, A\}$, and combining Lemmata 1 to 4 allows us to fully describe the equilibrium for relationship financing.

Proposition 2 ***Relationship Financing***

- $\pi_A \leq \rho\pi_B^2/k$: *There is a no investment equilibrium for* $p_0 < \max\{\Delta_A\Delta_B, \Delta_A^2/\rho\}$; *there is a reputational equilibrium with project sequence* $\{B, A\}$ *for* $\max\{\Delta_A\Delta_B, \Delta_A^2/\rho\} \leq p_0 < \Delta_B^2/\rho$; *there is a reputational equilibrium with project sequence* $\{A, B\}$ *for* $\Delta_B^2/\rho \leq p_0 < \Delta_B$; *and there is a pooling equilibrium with project sequence* $\{A, B\}$ *for* $p_0 \geq \Delta_B$.

- $\pi_A > \rho\pi_B^2/k$: *There is a no investment equilibrium for* $p_0 < \max\{\Delta_A\Delta_B, \Delta_A^2/\rho\}$; *there is a reputational equilibrium with project sequence* $\{B, A\}$ *for* $\max\{\Delta_A\Delta_B, \Delta_A^2/\rho\} \leq p_0 < \Delta_A$; *there is a separating equilibrium with project sequence* $\{A, B\}$ *for* $\Delta_A \leq p_0 < \Delta_B^2/\rho$; *there is a reputational equilibrium with project sequence* $\{A, B\}$ *for* $\Delta_B^2/\rho \leq p_0 < \Delta_B$; *and there is a pooling equilibrium with project sequence* $\{A, B\}$ *for* $p_0 \geq \Delta_B$.

Hence Proposition 2 establishes a general ordering of equilibria, depending on the proportion of good entrepreneurs. When the proportion is very low, no financing takes

[11] For $\pi_A >> \pi_B$, this condition holds whenever $\rho \geq \Delta_B$. Hence, the assumption is only binding for π_A close to π_B.

place. As the proportion of good entrepreneurs increases, the lender is first willing to provide financing in period 1 only if the entrepreneur starts with the less profitable project. For higher proportions, the entrepreneur chooses to finance the more profitable project first. A bad entrepreneur does not pay back at the end of the first period, since the repayment is too high. With increasing proportions of good entrepreneurs, the first-period repayment decreases, such that repaying with positive probability at the end of the first period is of value. For very high proportions of good entrepreneurs the investor is willing to finance the project although a bad entrepreneur does pay back with certainty and the investor faces a loss in period 2 with higher probability. The reason the project gets financed is that the investor understands that there are relatively few bad entrepreneurs in the marketplace.

Figure 2 summarizes these 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.

5 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 gains all 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 profitable 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 tells us that entrepreneurs that can finance both projects with arm's-length financing always find it more profitable to finance the projects simultaneously, rather

than sequentially. This limits the analysis to choosing between arm's-length financing of simultaneous projects and relationship financing of sequential projects.

Because lenders are unwilling to finance simultaneous 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 simultaneous 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.*

Proposition 3 summarizes the main result.

Proposition 3 *For $p_0 \geq \Delta_B$, arm's-length financing emerges and the projects are simultaneously 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.*

6 Model Interpretation, Implications, and Robustness

6.1 Interpretation of the Model

Our last proposition, also illustrated in Figure 3, provides an interesting and straightforward summary of the analysis. The presence of too many bad entrepreneurs in a market ($p_0 < \max(\Delta_A\Delta_B, \Delta_A^2/\rho)$) implies that no financial contracts are written, relationship or arm's-length. For intermediate values of p_0 ($\max(\Delta_A\Delta_B, \Delta_A^2/\rho) \leq p_0 < \Delta_B$) the entrepreneur chooses to sequence projects and to accept that a lender will collect the

entire second-period surplus. That is relationship financing occurs even though borrowers have access to arm's length financing and banks have power to extract holdup rents from the borrowers. As the likelihood of repayment falls, the entrepreneur may even reverse project order, thereby exacerbating holdup costs. But when the number of bad entrepreneurs drops to a sufficiently low level ($p_0 \geq \Delta_B$), relationship financing no longer pays, making simultaneous projects and arm's-length financing the most attractive choice. The reason is that under simultaneous project financing, the repayment cost $r = 2k/p_0$ rises faster as p_0 decreases than under sequential project financing (either as a Reputational Equilibrium with $r_1 + r_2 = k\Delta_B/p_0 + \pi_B$ or a Separating Equilibrium with $r_1 + r_2 = k(1 + p_0)/p_0$). Since relationship financing only exists for relatively low values of p_0, this effect is strong and more than compensates for the loss of the entire second period payoff. These results highlight the value of relationship lending. Thus our stylized model shows that if the lender assesses repayment to be unlikely, an entrepreneur will delay a project and borrow repeatedly from the same lender in order to build a reputation for repayment.

6.2 Robustness of the Model

Our main results are robust to various alterations and extensions. For example, one can easily introduce divisibility by allowing entrepreneurs to 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 simultaneous 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 multiple periods, and to allowing the entrepreneur and the financiers to write long-term contracts.

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 contingent 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.

7 Implications of the Model and Conclusion

Our model illustrates the positive association between various aspects of the accounting and judicial regime on the one hand and the development of financial intermediation documented in the literature on the other hand. Jappelli, Pagano, and Bianco (2003), for example, find that the duration of court trials and the level of trial backlogs are negatively related to the availability of credit in a cross-province panel from Italy, and that mortgage foreclosure costs are negatively related to the depth of mortgage markets across countries.

In our setup, bad entrepreneurs have the option not to repay. We posit that the proportion of bad entrepreneurs in an economy may be negatively related to the quality of accounting standards, creditor rights, and the available contract enforcement mechanism. Stringent contract enforcement for example 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 any weak attempts at judicial enforcement. Lenders may not know ex-ante whether an entrepreneur has access to such skills and resources. For countries with weak legal enforcement, entrepreneurs may be better off delaying projects and seeking relationship-type financing.

Consequently, our stylized model not only links key elements of the informational and judicial regime with decisions about project sequencing, but ultimately with the development and orientation (relationship versus transactional) of the financial inter-

mediary sector, and with the level of investment in an economy. According to our model, when the accounting and judicial system is efficient, entrepreneurs will immediately undertake all accessible projects by borrowing from arm's-length lenders. An inefficient system on the other hand compels entrepreneurs to delay projects to build a reputation for repayment and seek relationship-type financing. If such delays are costly, then inefficient regimes may hamper current investment and reduce contemporaneous demand for funding. To the extent that delayed investment imposes deadweight costs on an economy, our model implies that nations or regions with poor accounting, few creditor rights, and weak legal enforcement could grow more slowly than nations or regions where projects can be financed immediately.

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