Penn Libraries
UNIVERSITY of PENNSYLVANIA

University of Pennsylvania
ScholarlyCommons

Finance Papers

Wharton Faculty Research

11-2014

Costly Information, Entry, and Credit Access

Todd A. Gormley
University of Pennsylvania

Follow this and additional works at: http://repository.upenn.edu/fnce_papers

Part of the Economic Theory Commons, and the Finance and Financial Management Commons

Costly Information, Entry, and Credit Access

Abstract

Using a theoretical model that incorporates asymmetric information and differing comparative advantages among lenders, this paper analyzes the impact of lender entry on credit access and aggregate net output. The model shows that lender entry has the potential to create a segmented market that increases credit access for those firms targeted by the new lenders but potentially reduces credit access for all other firms. The overall impact on net output depends on the distribution of firms, the relative costs of lenders, and the cost of acquiring information. The model provides new insights into the evidence regarding foreign lenders' entry into emerging markets.

Disciplines
Economic Theory | Finance and Financial Management

Costly Information, Entry, and Credit Access

Todd A. Gormley[*]
University of Pennsylvania

This Draft: May 7, 2014

Abstract

Using a theoretical model that incorporates asymmetric information and differing comparative advantages among lenders, this paper analyzes the impact of lender entry on credit access and aggregate net output. The model shows that lender entry has the potential to create a segmented market that increases credit access for those firms targeted by the new lenders but potentially reduces credit access for all other firms. The overall impact on net output depends on the distribution of firms, the relative costs of lenders, and the cost of acquiring information. The model provides new insights into the evidence regarding foreign lenders' entry into emerging markets.

Keywords: Asymmetric Information, Competition, Credit, Financial Liberalization
JEL Classification: D82, F3, G2, O16, O19.

[*] The Wharton School, University of Pennsylvania, 3620 Locust Walk, SH-DH Suite 2400, Philadelphia, PA 19104. E-mail: tgormley@wharton.upenn.edu. Telephone: 1 (215) 746-0496.

1. Introduction

By allowing financial institutions in developed countries to lend directly to firms in less developed countries (LDCs), open capital markets are generally thought to alleviate domestic liquidity constraints, to improve the allocation of credit, and hence to increase aggregate net output. As a result of these potential benefits, many LDCs opened their capital markets in the 1980s and 1990s. These openings fostered foreign lenders' entry into their economies and changed the local competitive structure of their financial sectors. But, the assumption that opening capital markets is beneficial has recently come under serious doubt, as empirical studies have repeatedly failed to find a consistent relation between foreign lenders' entry, credit access, and net output in LDCs.[1] This lack of empirical evidence leads to this paper's central question: Why might the entry of new lenders, as experienced in many LDCs, *not* increase credit access and aggregate net output?

In this paper, I show that information asymmetries and competitive interactions between lenders with differing comparative advantages provide an answer. This paper presents a theoretical framework that explains how lender entry into an already competitive credit market can affect firms' access to credit when the entering lenders enjoy a different cost of capital and ability to acquire information about firms than incumbent lenders. Specifically, the model assumes entering lenders have a lower cost of capital but incumbent lenders determine firms' quality at a lower fixed screening cost per firm.[2] Within this framework, it is possible to derive a number of novel predictions.

First, new lender entry has the potential to induce a segmented credit market that reduces credit access for many firms. The intuition is straightforward. When the cost of acquiring information is sufficiently high, a competitive, closed-economy equilibrium may occur in which incumbent lenders pool all firms together with a uniform financial contract rather than invest in the

---

[1] For example, Rodrik (1998) and Edison, Levine, Ricci, and Sløk [25] find no effect of open capital markets and financial integration. See Eichengreen [27] for a more detailed review of this literature. More recent research focusing on the specific impact of foreign participation in domestic equity markets and foreign bank entry also reaches differing conclusions. For example, Bekaert, Harvey, and Lundblad [10] and Henry [36] find positive correlations between equity market liberalization and economic performance, whereas Detragiache, Tressel, and Gupta [24] and Gormley [32] find foreign bank entry to be negatively related to overall domestic credit.

[2] The comparative advantage of entering lenders—a higher cost of screening but lower marginal cost of funds— finds substantial support in both the theoretical and empirical literatures on foreign lender entry into LDCs (e.g., see Mian [42,43], Micco, Panizza, and Yañez [44], Stein [52]). This evidence is discussed in Section 7.1.

costly screening technology. Relative to the first-best allocation without information asymmetries, a pooling equilibrium overfunds low-return firms and underfunds high-return firms. The entrance of new lenders may break this pooling equilibrium. Because of their lower cost of funds and the fixed nature of screening costs, entering lenders may find it worthwhile to acquire information about firms' types so as to offer more competitive contracts to high-return firms capable of profitably investing large amounts of capital—a practice commonly called "cream skimming". While some firms benefit from cream skimming, the resulting separating equilibrium may reduce credit access for other firms by changing the set of financial contracts available to them.

This potential decline in credit access leads to the model's second implication: Additional lenders' entry has the potential to either increase or reduce net output. Cream skimming by entering lenders increases net output by eliminating the underfinancing of high-return firms capable of profitably investing large amounts of capital. The net output of all other firms, however, may decline. Because cream skimming reduces the average quality of firms that accept pooling contracts, these contracts may become more expensive, reducing the net output of firms that accept them. In some cases, the pooling contract will become unprofitable for lenders to offer, and the remaining firms will go unfunded entirely, further reducing net output, if neither the incumbent nor entering lenders find it cost-effective to acquire the information necessary to identify the remaining high-return firms.

The model thus provides a relatively simple explanation as to why open capital markets may not necessarily increase overall output in LDCs. In LDCs with significant information acquisition costs, the initial domestic allocation of credit may fail to achieve the first-best allocation because domestic lenders optimally choose to pool risks and cross-subsidize losses on low-return firms with gains on high-return firms rather than invest in costly screening technologies. This type of lending pattern is a standard problem in emerging economies (Banerjee, Cole, and Duflo [6]). Because the entering foreign lenders have a different cost structure, they will enter via cream skimming, which can both redirect credit toward the most profitable firms and reduce the credit access of other firms that are less profitable but still have positive net present value (NPV) projects.

The underlying mechanism by which net output can decline is quite general. The model is robust to allowing for the renegotiation of contracts after screening reveals firms' types and to allowing lenders to offer a very general set of financial contracts, including contracts that pay low return firms to not implement their project. The model is also robust to various assumptions regarding the distribution of firms and assumptions regarding the correlation between firms' productivity and the riskiness of their projects. Instead, the key assumption of the model is that the entering lenders have a different comparative advantage than incumbent lenders; this, combined with imperfect information about borrowers, is what drives the potential change in financial contracts available in the competitive equilibrium that includes both lenders. It can also be shown that the model generates a decline in net output under wide range of parameter spaces.

By demonstrating how the impact of lender entry will depend on the distribution of firms, the relative costs of lenders, and the cost of acquiring information, the model sheds light on why the impact of lender entry might vary across countries and over time. A decline in net output is more likely to occur when the cost of producing information in the local economy is greater. Thus, country-level factors that might affect lenders' cost of screening, including the quality of the country's local institutions (e.g., weak enforcement of accounting standards or a lack of credit rating agencies), will be important. The model can also be extended to demonstrate that cream skimming and a decline in net output is less likely to occur when the comparative advantages of lenders can be combined through a merger or syndicated loan. If allowed, entering lenders will often prefer to expand their screening capacity upon entry via acquiring local lenders, and it can be shown that such acquisitions will reduce the likelihood of a decline in net output. The model also sheds light on how entry can affect incumbent lenders' investments in screening capacity and expertise; the arrival of a lender with a different comparative advantage can increase incumbent lenders' incentive to invest in screening capacity so as to maintain market share in the open economy.

The model can explain a number of the existing empirical findings regarding foreign lenders' entry, credit access, and aggregate output in LDCs. For example, the model can explain why foreign

lenders often only target the least informationally opaque, largest, and most profitable firms (Berger, Klapper, and Udell [11], Clarke, Cull, Peria, and Sánchez [19] , Gormley [32], Mian [43]) and why this cream skimming can be associated with an exit by domestic lenders and overall decline in credit (Beck, Demirguc-Kunt, and Peria [8], Beck and Peria [9], Detragiache, Gupta, and Tressel [24], Gormley [32]). The model also provides an explanation as to why foreign lender entry is not always associated with an increase in subsequent economic growth or why financial liberalization might only be positively associated with growth in countries in which screening costs are likely less, such as high-income countries or countries with stronger local institutions (e.g., Arteta, Eichengreen, and Wyplosz [5], Edwards [26], Galindo, Micco, and Ordoñez [29], Quinn [48]). The model can also explain why acquiring a domestic lender is a popular mode of entry in many LDCs or why an increase in growth is more likely to be observed when such acquisitions are allowed (e.g., Bruno and Hauswald [14], Giannetti and Ongena [30]).

Overall, the analysis provides new insights about the potential consequences of financial liberalization and is related to four distinct literatures. First, the theoretical prediction that lenders more efficient at financing certain types of firms may exit following entry by other lenders is similar to the argument that competition does not always result in "survival of the fittest" (Bolton and Scharfstein [12], Zingales [55]). The model extends this idea by demonstrating that the exit of the seemingly more efficient lender can occur even when the surviving lenders are not shielded from potential new entrants or when the exiting lender does not face direct competition in the market in which it enjoys an efficiency advantage. Instead, the exit is driven by additional entry making it difficult to offer cross-subsidized products in a market with informational asymmetries.

Second, this paper is related to the theoretical literature on the effects of competition in the presence of imperfect information. The potential for positive NPV firms to go unfinanced in competitive credit markets is similar to that of Stiglitz and Weiss [54], while the potential nonexistence of equilibrium and use of cream-skimming strategies is similar to that which can occur in models of insurance markets (e.g., Lewis and Sappington [40], Rothschild and Stiglitz [50]). In

4

contrast to these models, where screening occurs through agents' self-revealing choices from the menu of offered contracts, this paper analyzes the effects of competitive screening in a setting where lenders are able to acquire and use private information about agents' types to limit their choice from the menu of offered contracts. Furthermore, rather than analyze the effects of competition among agents that share the same screening technology, this paper analyzes how the entry of agents with a different comparative advantage can affect the competitive equilibrium. In this regard, the paper is similar to Martin [41], which analyzes how the introduction of a non-exclusive alternative source of funds can affect the competitive equilibrium in a market with asymmetric information.

Third, this paper is related to the growing body of literature concerning the effects of competition on lending relationships and credit access (e.g., Boot and Thakor [13], Petersen and Rajan [46]). Rather than look at in increase in competition, however, this paper analyzes how the introduction of lenders with a different comparative advantage into an already competitive economy affects equilibrium contracts. This is similar to Dell'Ariccia and Marquez [22] and Sengupta [51], which demonstrate that this type of entry can induce segmented credit markets. However, by assuming that incumbent lenders have perfect information about borrower types, neither of these papers is able to shed light on why segmented markets might induce declines in credit access.[3] While this possibility is explored in Detragiache, Gupta, and Tressel [24], this paper differs in that it can capture both cases where all firms benefit from entry and cases where some firms do not. Additionally, this paper explores how entry will affect lenders' incentive to expand their screening capacity and how the impact on net output will depend on the cost of acquiring information.

Finally, this paper is related to the growing body of literature on the impact of open capital markets and capital inflows. Despite growing empirical and anecdotal evidence to suggest a potential dark side to capital inflows, the argument is often made that lowering entry barriers will be

---

[3] However, in Dell'Ariccia and Marquez [22], lender entry does increase incumbent lenders' loan portfolio risk, which in a more complete model with costly capital could cause a reduced lending capacity for incumbent lenders. Although this has the potential to generate adverse effects on credit similar to this paper, their paper does not explore this possibility.

unambiguously beneficial to the growth of LDCs.[4] One possible reason for this apparent disconnect

is that there is little theoretical understanding as to how capital inflows might adversely affect the local

economy beyond their potential to reduce financial stability (Agénor [3], Dell'Ariccia and Marquez

[23], Eichengreen and Leblang [27], Kaminsky and Schmukler [38], Stiglitz [53]). This paper

formalizes a theory for why capital inflows may adversely affect the local economy, even in the

absence of reduced financial stability. The model demonstrates this channel to be quite robust to

assumptions about local competition, firms, and lenders, while also providing guidance on exactly

when fostering entry into financial markets will be beneficial. The resulting policy implications of this

analysis are quite different than those that focus on financial stability.

The remainder of this paper proceeds as follows. Section 2 provides the basic setup and

assumptions of the model. Section 3 discusses the possible equilibria prior to the new lenders' entry,

and Section 4 describes the possible equilibria following entry. Section 5 then analyzes the factors

that determine the impact of lender entry on net output. Section 6 demonstrates the robustness of

the models' findings and discusses possible extensions. Section 7 discusses empirical evidence

regarding the model's key assumptions and testable predictions. Finally, Section 8 concludes.

2.   The Basic Model

2.1   Agents and Technology

There are two types of agents: firms and lenders. All agents are risk neutral, and because of

limited liability, no firm can end with a negative amount of cash.

The real sector consists of three types of firms, $i \in \{A, B, C\}$, and a continuum, θ_i, of each

type, where $\theta_A + \theta_B + \theta_C$ is normalized to equal one. Each type of firm has the ability to implement

one project of size $I \in \{1, \lambda\}$, where $\lambda > 1$. If successfully implemented, the project yields a verifiable

---

[4] For example, in a memo to the World Trade Organization on June 6, 2005, delegations from Japan, the United
States, and European Union argued that "Policies that impede competition, such as entry restrictions and restrictions
on foreign banks, have been shown to raise the cost of financial services and hurt economic performance." WTO
Document #05-2335.

return, $RI > r^*I$, where r^* is an exogenous cost of capital. For simplicity, all firms have zero wealth and must borrow the entire amount I from lenders to implement the project.

Among the three types of firms, there will be one type that lenders always want to finance, C (the "cream"), another type they never want to finance, B (the "bad"), and a third type that they only want to finance for small projects, A (the "average"). This is formally established by having the three types differ in their ability to implement projects successfully. If financed, the cream firms always succeed with probability 1, regardless of project size, whereas bad firms only succeed with probability p. Projects that only succeed with probability p have a negative net expected return given the cost of funds, r^*, such that $pR < r^*$. Average firms, however, implement the smaller project of size 1 with certain success, whereas larger projects only succeed with probability p. Given this setup, the first-best allocation of credit is achieved and net output is maximized when cream firms are financed for projects of size λ, average firms for projects of size 1, and bad firms are not financed.[5]

The concept of cream firms should be interpreted broadly. Their ability to successfully implement the project of size $\lambda > 1$ serves to represent high-return firms capable of profitably investing large amounts of capital. This includes firms able to invest larger amounts of capital today or firms able to invest in more future projects. Hence, cream firms are not necessarily larger in size today or able to invest in larger projects.

The financial sector consists of many perfectly competitive lenders willing to extend capital in the amount of $I \in \{1, \lambda\}$. Without costly investments in the production of information about firms' types, lenders are unable to identify a firm's type, thus providing the source of information asymmetry in the model. Lenders, however, may invest in a screening technology that perfectly identifies a firm's type. The cost of this screening technology will capture the severity of the asymmetric information

---

[5] This setup is a specific case of the more general framework, where bad firms succeed with probability p_L, cream firms succeed with probability $p_H > p_L$, and $p_H R > r^* > p_L R$. Assuming that $p_H = 1$ and $p_L < 1$ only helps simplify expressions, and all subsequent findings and intuition hold in the more general case, which is provided in the online Appendix. Therefore, the implicit negative correlation between risk (variance of output) and productivity in this specific case is not necessary for the model's findings. In the general case, the implicit correlation between risk and productivity can go either way.

problem. There will be two types of lenders: "domestic" and "foreign". Domestic lenders will be the incumbent lenders, whereas foreign lenders will be the potential new entrants into the economy.

Foreign and domestic lenders will differ in two key ways: Domestic lenders will find it less costly to produce information about firms' types, whereas foreign lenders will enjoy a lower cost of funds. Specifically, domestic lenders can screen at cost $\kappa > 0$ per firm, whereas foreign lenders must pay $\kappa^* > \kappa$.[6] The lower screening cost for domestic lenders will reflect their prior experience with lending to firms in the local economy. Regarding the cost of funds, foreign lenders have access to an unlimited supply of funds at cost, $r^* > 0$, whereas domestic lenders' have access to an unlimited funds at a cost, r, where $r > r^*$. The lower cost of funds for foreign lenders will reflect some operational and technological advantage of the new entrant over that of the incumbent lenders.

The differences in costs provide each lender with a potential comparative advantage. Domestic lenders have an information production advantage per firm, whereas foreign lenders have a cost of capital advantage per dollar invested. Thus, for firms with large enough credit needs, a foreign lender will have a competitive advantage regardless of whether information production is necessary. To formalize this comparative advantage and the above restrictions on parameter values, the following assumptions are made:

$$r^* < r, \kappa < \kappa^* \tag{A1}$$

$$r^* + \frac{\kappa^*}{\lambda} < r + \frac{\kappa}{\lambda} \tag{A2}$$

Assumption (A1) formalizes that domestic lenders have a higher cost of funds and a lower screening cost. Assumption (A2) ensures that projects of size λ are sufficiently large to provide foreign lenders the competitive advantage in financing these projects. The assumed comparative advantages of domestic and foreign lenders appear to fit well in the context of international capital markets and cross-border lending. This evidence is discussed in Section 7.1.

---

[6] The assumption of a uniform, per firm screening costs greatly reduces the analysis, but is not essential. All subsequent findings will hold in a more general setting in which screening costs are allowed to vary with the scale of expected lending to a firm so long as the screening cost does not increase 1-1 with the amount of expected lending.

8

2.2 Timing of Events

There is no discounting between periods, and the timing of events is as follows:

$t = 0$: firms discover their type, i,

$t = 1$: lenders choose their menu of financial contracts, F; firms apply for financing,

$t = 2$: lenders screen applicants and provide capital, I, to successful applicants,

$t = 3$: project outcomes are realized; financial contracts are settled.

The basic idea of this time line is the following: Lenders initially choose which menu of financial contracts they wish to offer firms. In doing this, they will choose both which type of financial contracts to offer and to which firms they will offer these contracts. Firms then approach lenders and apply for their preferred financial contract from the menu of available contracts. If the contract is designated for firms of a specific type, the lenders invest in information production and screen applicant firms to verify their type, and financing is provided to successful applicants. Finally, project outcomes are realized and all financial contracts are settled.

2.3 Financial Contracts and Strategies

Let F_j represent the menu of contracts offered by lender j, where $F_j^{I,k}$ denotes a financial contract from lender j in amount I designated for firms of type $k \in \{0, A, B, C\}$. When $k = 0$, the contract is unscreened and available to all firms, regardless of type, but for $k \neq 0$, the lender acquires information about firms' types and the contract is only available to firms for which screening by the lender reveals $i = k$.[7] Each contract is a mapping of the observable output from the project into a payment for the firm. Specifically, $F : \{0, RI\} \rightarrow \mathbb{R}_+$. Each type of contract maps into a nonnegative payment because firms have no initial wealth and cannot receive a negative payment. Moreover, it is important to note that this mapping spans the universe of potential contracts, and hence the concept of a "lender" used here is very general and encompasses debt, equity, or any mixture thereof.

---

[7] The analysis and subsequent findings are qualitatively similar if lenders are allowed to offer nondeterministic screening contracts in which screening only occurs with some probability γ.

A strategy configuration in this economy consists of the set of contracts F_j for each lender $j \in L$, and the contract choice, $f(i)$, for each firm $i \in E$. A firm's choice is limited to the set of contracts offered by lenders, $\mathbb{F}$, or a choice of no contract, $f(i) = \varnothing$. The equilibrium concept used is subgame perfect, and a strategy configuration will be an equilibrium if each lender j and each firm i is maximizing its expected profits given the strategies of all other agents in the economy.

The expected profit of a firm i with financial contract F can be expressed as

$$\pi(F \mid i) = p(i \mid I) F(RI) + (1 - p(i \mid I)) F(0) ,$$

where $p(i \mid I)$ is the probability of success for a firm of type i with a project of size I, which is determined by the amount of financing associated with the finance contract, F.

Likewise, the expected profits of lender j lending to firm i with contract F is

$$\Pi_j(i \mid F) = [p(i \mid I)R - r(j)]I - \pi(F) - \kappa(j)S ,$$

where $r(j)$ and $\kappa(j)$ represent the cost of funds and screening for lender j; I represents the amount of financing associated with contract F; and $S = 0$ for unscreened contracts and equals one otherwise.

Finally, let $\chi(F, \mathbb{F})$ be the set of firm types that accept the contract offer F when the set of available financial contracts is $\mathbb{F}$. In other words, $i \in \chi(F, \mathbb{F})$ if and only if $f(i) = F$. Given this, the economy's equilibrium is formally defined as

> **Definition of Equilibrium:** A strategy configuration, $f(i)$ for each firm $i \in E$ and $\mathbb{F}$ implied by F_j for each lender $j \in L$, constitutes equilibrium if and only if
>
> (1) given $\mathbb{F}$, each firm $i \in E$ chooses $f(i) \in \mathbb{F}$ to maximize $\pi(f)$;
>
> (2) each lender $j \in L$ chooses F_j to maximize $\int_{i \in \chi(F_j, \mathbb{F})} \Pi_j(i \mid F_j) di$, where $i \in \chi(F_j, \mathbb{F})$ is given by condition 1; and
>
> (3) because of free entry, each lender makes zero profits, $\int_{i \in \chi(F_j, \mathbb{F})} \Pi_j(i \mid F_j) di = 0$.

The intuition for the equilibrium is as follows. The first condition states that, given the set of all available contracts offered by lenders, each firm in the economy is choosing the financial contract

that maximizes their expected profits. The second condition states that, given each firm's optimal

contract choice from the available menu of contracts offered by all lenders, each lender is offering a

menu of contracts that maximizes their own expected profits. In other words, no individual lender

can improve their own profitability by deviating and offering a different set of contracts to firms.

The third condition arises from free entry; all lenders make zero expected profits in equilibrium.

Before solving the equilibrium, it is first worth noting the two implicit assumptions being

made in the model. These assumptions simplify the initial analysis but are not crucial to results.

First, I am assuming that all firms implement the project if they receive financing from a

lender. In the absence of this assumption, lenders might have an incentive to offer a contract that

actually pays bad firms to *not* implement the project. Whereas a contract that pays bad firms to do

nothing can never be an equilibrium contract, because each individual lender could improve

profitability by dropping the contract, this type of contract might be a profitable deviation for lenders

in an equilibrium in which bad firms accept unscreened contracts and implement projects. Paying

bad firms to do nothing may be less costly than allowing them to implement projects. In reality, this

deviation is unlikely to be profitable because such payments for doing nothing would induce all

individuals without projects to seek the same payoff. This can be easily captured by introducing a

fourth type of firm that has no project. So long as the mass of these firms is sufficiently large, an

unscreened contract that pays a positive amount to borrowers to take no action will not be a

profitable deviation. A screened contract that pays bad firms to not implement a project will also not

be a profitable deviation so long as the cost of screening exceeds the expected loss on bad firms.[8]

Second, I am implicitly assuming that lenders can fully commit to their financial contracts in

two ways. (1) Lenders will always acquire information about firms' types and screen financial

contracts of type $k \neq 0$. This eliminates lenders from deterring bad borrowers by declaring that all

contracts will be screened, but not actually screening them. (2) Lenders can fully commit to the initial

---

[8] Acemoglu [1] uses a similar method to eliminate these unrealistic types of contracts, and an extension of the model
that relaxes this assumption about implementing projects is available in the online Appendix.

terms of any contract, F, and their initial menu of contracts, F_j. In other words, there is no possibility of renegotiation between lenders and firms after screening reveals a firm's type, and hence firms will have no incentive to misrepresent their type when applying for a screened contract.

With a few extensions of the model, it can be shown that full commitment by lenders is an equilibrium strategy in a repeated game. In a repeated game, full commitment can be accomplished by assuming that firms observe whether lenders have violated full commitment in the past and by assuming that firms assign a nonzero probability of such lenders doing so again in the future. With these assumptions, deviations from full commitment, which can yield immediate gains, will attract applicants in the future that are ex ante unprofitable for the lender to do business with. The future cost of screening these unwanted applicants will exceed the immediate gains and prevent lenders from deviating. For example, consider an equilibrium in which bad firms are not financed and average and cream firms are offered screened contracts. If a lender deviates from full commitment and does not actually screen its average and cream applicants, it gains immediately by avoiding the screening costs. The cost, however, is that all bad firms will apply for the lender's screened financial contract in the future because they assign a nonzero probability of the lender shirking again and their outside option is zero. Screening and turning away these bad firms in the future is costly, and the immediate gains from deviating from full commitment will be offset by these expected losses.[9]

3.   Equilibrium prior to Entry

In an economy that consists of only domestic lenders, the domestic cost of screening, κ, will determine whether a pooling or separating equilibrium exists. Domestic lenders can always offer cream firms a lucrative, screened contract of size λ that provides expected profits of $\lambda(R-r)-\kappa$ to the firm. The cost of screening, κ, reduces the firm's expected profit since the lender will only offer a contract that allows it to recoup its costs and breakeven in expectation. Although this contract clearly dominates any screened contract of size 1 for a cream firm, it may not dominate an unscreened

---

[9] This repeated game extension is available in the online Appendix.

contract. Unscreened contracts avoid the cost of screening, κ, but inevitably finance some negative NPV projects. When the cost of screening, κ, is sufficiently high, cream firms will prefer unscreened contracts being offered by domestic lenders, resulting in a pooling equilibrium in which all firms accept the same unscreened contract. And, when κ is sufficiently low, cream firms prefer screened contracts, resulting in a separating equilibrium.

To simplify the equilibrium, I will assume there is relatively small number of cream firms, such that lenders can never profitably pool just cream and bad firms together on an unscreened contract. This reduces the number of possible pooling equilibriums but does not qualitatively affect the subsequent results.[10] This is accomplished with the following assumption:

$$\frac{\theta_B}{\theta_C} > \frac{(R-r)}{r - pR} \tag{A3}$$

This assumption ensures that for any unscreened contract, the net loss per unit of investment for bad firms, $\theta_B(r - pR)$, exceeds the net gain per unit of investment for cream firms, $\theta_C(R-r)$. This will hold whenever there is a significantly large ratio of bad to cream firms.

With the above assumption, the only possible pooling contract will be one that pools all firms onto the smaller project. The highest expected profits that such a contract can provide to cream firms is $R - r/[1-(1-p)\theta_B]$. Thus, when $\kappa > \underline{\kappa}$, where $\underline{\kappa}$ is defined by equation (1), the economy can exhibit a pooling equilibrium in which all firms prefer to accept a small unscreened contract of size 1. And, when $\kappa \leq \underline{\kappa}$, the larger screened contract, which provides a payout, $\lambda(R-r)-\kappa$, is preferred by cream firms, resulting in a separating equilibrium in which cream firms prefer to take screened contracts for the larger investment.[11]

---

[10] Absent assumption (A3) and when λ is sufficiently large, there will exist an unscreened contract that pools firms onto the larger project. But, similar to the smaller pooling contract, this larger pooling contract only exists in equilibrium if the cost of screening is sufficiently high that lenders cannot profitably offer a large, screened contract that is preferred by cream firms. For this reason, subsequent findings are similar when the closed economy starts from such a pooling equilibrium; foreign entry still increases the likelihood of a separating equilibrium where credit access and net output both decline. However, one difference with starting from this pooling equilibrium is that foreign entry has less potential to increase the net output of cream firms.

[11] Because they can successfully invest larger amounts of capital, cream firms, rather than average firms, are always the firms that lenders can most easily entice to take a screened contract, thus initiating a separating equilibrium.

$$\underline{\kappa} \equiv \lambda(R - r) - \left(R - \frac{r}{1 - (1 - p)\theta_B} \right) \qquad (1)$$

The range of screening costs when a separating equilibrium occurs, $\kappa \leq \underline{\kappa}$, will be higher

when the amount of capital, λ, and return, R, of a cream firm's investment is larger. This will

increase the attractiveness of a screened contract to cream firms. An increase in the number of bad

firms, θ_B, or a reduction in their probability of success, p, will increase the cost of the pooling

contract, also increasing the chance of a separating equilibrium. The outcome for average and bad

firms in a separating equilibrium will depend on whether an unscreened contract that pools just bad

and average firms is feasible or whether it is feasible for lenders to screen average firms.

The more intriguing equilibrium is the potential pooling equilibrium for $\kappa > \underline{\kappa}$. The pooling

equilibrium always fails to achieve the first-best allocation because cream firms fail to take on larger

projects, and bad firms are financed for negative NPV investments. Funds diverted away from bad

firms toward larger projects for cream firms would increase net output, and there is a potential for the

entry of new lenders, with a different comparative advantage, to increase overall output. The pooling

equilibrium will exist if domestic lenders can profitably pool all borrowers, which is true when

$r / [1 - (1 - p)\theta_B] \leq R$, and there does not exist any other contract capable of enticing cream firms

away from the unscreened contract (i.e., $\kappa > \underline{\kappa}$). This equilibrium is described in Proposition 1.

> Proposition 1. *In an economy with only domestic lenders, where $\kappa > \underline{\kappa}$ and $r / \left(1 - (1 - p)\theta_B\right) \leq R$, there*
> *is an unique equilibrium in which all firms accept an unscreened financial contract of size I=1 with payoffs*
>
> $$F(Y) = \begin{cases} R - r / \left(1 - (1 - p)\theta_B\right) & \text{if } Y = R \\ 0 & \text{otherwise} \end{cases}.$$

The equilibrium contract can be interpreted as a debt contract. Firms receive nothing in

failure but receive a positive payoff in success, with an implicit equilibrium interest rate of

$\tilde{r} \equiv r / \left(1 - (1 - p)\theta_B\right) > r$. This interest rate is just enough to offset lenders' expected losses on the

fraction $(1 - p)\theta_B$ of projects that will be taken by bad firms and subsequently fail. A proof of

Proposition 1 is found in the Appendix.

14

In the context of opening capital markets, the pooling equilibrium appears to capture economic characteristics often used to motivate financial liberalization in LDCs. There is an overfinancing of bad firms and underfinancing of good firms. Moreover, the pooling equilibrium occurs when the cost of acquiring information is high, which is a common characteristic of emerging economies (Aleem [4]). Empirical evidence also suggests a lack of information production done by domestic lenders in many emerging markets.[12] Given this, I will now analyze the impact of allowing foreign lenders to enter an economy that exhibits a pooling equilibrium.

4. Equilibrium after Entry

The equilibrium with both foreign and domestic lenders also depends on the cost of screening borrowers, but it now depends on both the foreign and domestic cost of screening. Foreign entry has no effect on the pooling equilibrium allocation of credit described in Proposition 1 if foreign lenders' cost of producing information is prohibitively expensive, such that $\kappa^* > \overline{\kappa}$, where

$$\overline{\kappa} \equiv \lambda(R - r^*) - \left(R - \frac{r^*}{1 - (1-p)\theta_B} \right). \tag{2}$$

This threshold $\overline{\kappa}$ is similar to that of the economy with only domestic lenders, but now the threshold is determined by foreign lenders' cost of funds, r^*, and screening, κ^*, because, by assumption (A2), they enjoy a comparative advantage in financing cream firms. When foreign lenders' cost of screening is sufficiently low, such that $\kappa^* \leq \overline{\kappa}$, foreign lenders induce cream firms in a domestic pooling equilibrium to undertake larger projects by offering them more competitive contracts for those projects. They can accomplish this despite their higher cost of screening because of their lower marginal cost of funds and the fixed nature of screening costs. This result is stated formally in Proposition 2, and the proof is provided in the Appendix.

Proposition 2. *In an economy with both foreign and domestic lenders, where $\kappa > \underline{\kappa}$ and $\kappa^* \leq \overline{\kappa}$, foreign*

---

[12] For an example involving banks in India, see Banerjee, Cole, and Duflo [6]. Gormley, Johnson, and Rhee [33] also provide suggestive evidence that Korean bond holders did not screen their investments in 1998.

entry causes a switch from a pooling equilibrium to a separating equilibrium in which all cream firms accept large screened contracts of size λ offered by foreign lenders. If $\kappa^* > \overline{\kappa}$, only a pooling equilibrium exists.

While the entry of foreign lenders and a switch from a pooling equilibrium to a separating equilibrium benefits cream firms with more lucrative contracts and increases their net output, average firms may be worse off. If average firms are financed in a separating equilibrium, then this will either occur through a domestic or foreign screened contract or a foreign unscreened contract that pools average and bad firms. Average firms' expected profits and net output under either contract, however, may be lower. For example, if average and bad firms continue to choose a pooling contract, the equilibrium payoff of this contract, $R - r^*(\theta_A + \theta_B)/(\theta_A + p\theta_B)$, may be lower than that of the closed economy payoff, $R - r/(1 - (1 - p)\theta_B)$, since the average quality of firms being pooled declines and lenders must charge a higher interest rate to continue breaking even. Moreover, it is possible that neither a screening nor pooling contract will be feasible. If $0 > \max\{R - r - \kappa, R - r^* - \kappa^*\}$, then neither type of lender can profitably screen average firms, and if $\theta_B(r^* - pR) > \theta_A(R - r^*)$, foreign lenders cannot profitably offer an unscreened contract. The expected profits from average firms, $\theta_A(R - r^*)$, would not be enough to offset the expected losses on bad firms, $\theta_B(r^* - pR)$. If both these conditions hold, only cream firms will be financed in the separating equilibrium.

The overall impact of foreign entry on net output will depend on the relative gains and losses of cream, average, and bad firms. For example, in a separating equilibrium in which neither average nor bad firms are financed, the entry of foreign lenders will entice cream firms to take on larger projects. This increases their net output by $\left[\lambda(R - r^*) - \kappa^* - (R - \tilde{r})\right]\theta_C$, where $\tilde{r}$ is the equilibrium interest rate in the closed economy that exhibits a pooling equilibrium. But, the inability of average and bad firms to obtain financing causes a loss in net output of $(R - \tilde{r})(\theta_A + p\theta_B)$. This suggests a

possible decline in output, which is described in Proposition 3 and proven in the Appendix.[13]

> Proposition 3. *In an economy that switches from the pooling equilibrium with domestic lenders to the separating equilibrium with foreign lenders and no financing of average and bad firms, net output will decline when* $(R - \tilde{r})(\theta_A + p\theta_B) > \left[\lambda(R - r^*) - \kappa^* - (R - \tilde{r})\right]\theta_C$, *where* $\tilde{r} = r / \left(1 - (1 - p)\theta_B\right)$.

The potential drop in output can be considerable, as illustrated in the following numerical example: Suppose successful projects yield a 15% return ($R = 1.15$) and that cream firms are able to implement projects four times as large ($\lambda = 4$). Cream firms represent one-fifth of the firms ($\theta_C = 1/5$), whereas the other firms are split equally between average and bad ($\theta_A = \theta_B = 2/5$). Projects of bad firms only succeed with 75% probability ($p = 0.75$). Domestic lenders cost of funds is 3% ($r = 1.03$), whereas foreign lenders cost of funds is only 2% ($r^* = 1.02$). Under this setup, just a small difference in screening costs for the two types of lenders will generate differing comparative advantages and a drop in net output. For example, if $\kappa = 0.48$ and $\kappa^* = 0.50$ (which would imply breakeven lending rates on large, screened loans from domestic and foreign lenders of 15% and 14.5%, respectively), foreign entry will cause a shift from a pooling equilibrium to a separating equilibrium, and net output will decline by 20%.[14]

5. Comparative Analysis and Implications

The model provides a relatively simple explanation as to why entry by additional lenders may not necessarily increase overall output. In markets with significant costs to producing information about firms' types, lenders may choose to pool risks and cross-subsidize losses on low-return firms

---

[13] When a decline in net output occurs in the open economy, the separating equilibrium allocation is always constrained inefficient, and the pooling equilibrium is always constrained efficient. Because of this, it is possible to use a mechanism design approach to analyze potential welfare-maximizing policies for economies that experience a decline in net output after additional lender entry. In particular, it is possible to show that there exists a revenue-neutral policy that will improve net output by subsidizing the cost of capital lent for projects in the economy and taxing the returns on these projects. Taxing project returns can be used to implement the constrained efficient pooling equilibrium by providing a relative disincentive for cream firms to accept a larger screened contract.

[14] The implied equilibrium lending rates of this numerical example are on par with interest rates observed in many credit markets, especially emerging markets. For example, Banerjee and Duflo [7] find that the average interest rate of an India bank in their sample was 16%, Mian (2006) finds that the average interest rate of domestic and foreign banks in Pakistan was 12.75% and 10.75%, respectively, and Giannetti and Ongena [30] estimate that the average interest rate of firms in their Eastern European sample was 23%.

with gains on high-return firms rather than invest in costly screening technologies. Whereas new lenders may be even less effective at producing information, a comparative advantage in funding costs may allow them to offer a more competitive contract to firms capable of investing large amounts of capital. Therefore, their entry can increase net output by inducing these firms to take on larger projects, but at the same time, net output may be declining for other firms as the financial contracts available to these firms will differ in a separating equilibrium. This potential for a decline in credit access and output is not found in existing models of competition between lenders with different comparative advantages in screening; these models find that entry will improve credit access for all firms (Dell'Ariccia and Marquez [22], Sengupta [51]).[15]

At the same time, the model suggests that the inconclusive evidence pertaining to financial liberalization may also be the consequence of differences in the underlying fundamentals. For example, net output can decline if foreign entry results in a switch from a pooling equilibrium to a separating equilibrium where both average and bad firms go unfinanced. This can occur if the cost of obtaining information is sufficiently high for both domestic and foreign lenders, but foreign lenders' cost of funds advantage is sufficient enough to facilitate cream skimming. The parameter space where this occurs is described in Proposition 4 and proven in the Appendix.

> Proposition 4. *Under the following conditions, foreign entry causes a switch from a pooling equilibrium that finances all firms to a separating equilibrium where only cream firms are financed and net output falls:*
> (a) $r > r^*$
> (b) $0 > \theta_A(R - r^*) - \theta_B(r^* - pR)$,
> (c) $\kappa > \max\{\underline{\kappa}, R - r\}$, and
> (d) $\overline{\kappa} > \kappa^* > \max\left\{R - r^*, \lambda(R - r^*) - \dfrac{R(1 - (1 - p)\theta_B) - r}{1 - \theta_A - \theta_B}\right\}$,
>
> *where $\underline{\kappa}$ and $\overline{\kappa}$ are defined by equations* (1) *and* (2)*, respectively.*

---

[15] The key reason for this different outcome is their assumption that incumbent lenders have perfect information about borrower types, whereas entering lenders have no information. The importance of these assumptions can be illustrated using a modified version of the model, where, similar to Dell'Ariccia and Marquez [22], screening is always ineffectual for a fraction α of the bad and average firms. Versions of Propositions 1–3 will still hold in this modified model, but as κ goes to zero and κ^* goes to infinity, the impact of foreign entry instead resembles that of Dell'Ariccia and Marquez [22] in that no firm is worse off because of segmentation.

Condition (a) of Proposition 4 just restates the assumption that foreign lenders enjoy a cost of funds advantage, which is necessary to make cream skimming possible, while condition (b) ensures it is unprofitable to pool average and bad firms in a separating equilibrium. Condition (c) ensures the domestic cost of screening is high enough that the closed economy exhibits a pooling equilibrium ($\kappa > \underline{\kappa}$) and that domestic lenders find it unprofitable to screen average firms in a separating equilibrium ($\kappa > R - r$). Finally, condition (d) ensures that the foreign cost of screening is low enough to break the pooling equilibrium ($\kappa^* < \overline{\kappa}$) but high enough that foreign lenders cannot profitably screen average firms in a separating equilibrium ($\kappa^* > R - r$) and net output declines ($\kappa > \lambda(R - r^*) - (R(1 - (1 - p)\theta_B) - r) / (1 - \theta_A - \theta_B)$). To characterize the set of parameters for which entry breaks the pooling equilibrium, average firms are shut out of the financial market, but net output does *not* decline, one simply drops the second lower bound in condition (d).[16]

The conditions necessary for a decline in net output highlight the importance of information acquisition costs in the local economy. If domestic lenders' cost of producing information, κ, is not too high, then average firms will be screened and financed in a separating equilibrium, thus reducing the likelihood of entry reducing aggregate net output. This suggests that industries in which it is easier for lenders to assess a borrower's potential (i.e., low κ), are more likely to experience an increase in net output after additional lender entry. This might include mature industries, industries that rely less heavily on intangible assets, and industries with less uncertain growth prospects. Low screening costs might also be driven by country-level factors. In countries with transparent accounting rules or strong auditing enforcement standards, the cost of screening is likely less because lenders can rely more on the information contained in firm's financial statements and avoid engaging in the costly collection of additional information through other channels.

The importance of information acquisition costs for foreign lenders is more nuanced. Again, a sufficiently high screening cost, κ^*, is necessary to ensure it is not feasible for average firms to be

---

[16] Interestingly, the second part of Assumption (A1), that foreign lenders have a higher cost of screening, $\kappa^* > \kappa$, is not necessary for a decline in net output. There exist parameter spaces for $\kappa^* < \kappa$ where foreign entry and market segmentation cause a decline in net output; examples of this are discussed later.

screened by foreign lenders in a separating equilibrium and for net output to decline. However, as

shown in condition (d) of Proposition 4, it must also be the case that foreign lenders' cost of

screening is not so high that it offsets their cost of funds advantage and prohibits their ability to break

the pooling equilibrium by offering more competitive contracts to cream firms.   If $\kappa^* > \overline{\kappa}$ and the

closed economy exhibits a pooling equilibrium, then foreign entry will not break the pooling

equilibrium and net output increases because of foreign lenders' lower cost of funds.

For a given set of parameters $\theta_A, \theta_B, r, r^*, \lambda, p,$ and R where conditions (a) and (b) of

Proposition 4 hold, one can use the conditions (c) and (d) of Proposition 4 to map out the possible

equilibria for every possible combination of screening costs, κ and κ^*. An example of this is provided

in Figure 1, where possible equilibria are described for κ and κ^* such that foreign lenders are

disadvantaged in screening (i.e., $\kappa^* > \kappa$), but can offer more competitive contracts to cream firms.[17]

As shown in Figure 1, when $\kappa < \underline{\kappa}$, the equilibrium will be a separating equilibrium in the closed

economy, but for $\kappa > \underline{\kappa}$, the closed economy exhibits a pooling equilibrium. Whether foreign entry

causes a switch to a separating equilibrium and a decline in net output for $\kappa > \underline{\kappa}$ depends on κ^*. For

$\overline{\kappa} \geq \kappa^* > \tilde{\kappa}$, where $\tilde{\kappa} \equiv \lambda(R - r^*) - (R(1 - (1 - p)\theta_B) - r)/(1 - \theta_A - \theta_B)$, entry causes a switch from

the pooling equilibrium to a separating equilibrium where only cream firms obtain financing and net

output declines.[18] When $\tilde{\kappa} \geq \kappa^* > R - r^*$, cream firms remain the only firms financed in the

separating equilibrium, but net output increases. For $R - r^* \geq \kappa^*$, both average and cream firms are

financed in the separating equilibrium and net output rises.

Figure 2 provides a numerical example of Figure 1 under the following assumptions:

successful projects yield a 15% return ($R = 1.15$); bad firms only succeed with 80% probability ($p =$

0.8) and represent one-fifth of the firms with the remaining firms being split evenly between average

and cream ($\theta_B = 1/5, \theta_A = 2/5$); cream firms are able to implement projects two and a half times as

---

[17] For illustrative purposes, Figure 1 assumes that $R - r$ and $R - r^*$ are not the binding lower bounds in conditions (c) and (d) of Proposition 4. It can be shown, however, that these will never be the binding constraints when domestic lenders have a competitive advantage in screening the smaller project, such that $\kappa^* + r^* > \kappa + r$.

[18] While Figure 1 only describes regions where foreign lenders have a higher cost of funds, $\kappa^* > \kappa$, net output also declines for $\overline{\kappa} \geq \kappa^* > \tilde{\kappa}$ even when $\kappa^* < \kappa$.

large ($\lambda = 2.5$); and domestic lenders' cost of funds is 9% ($r = 1.09$), whereas foreign lenders' cost of funds is 7.5% ($r^* = 1.075$).[19] Under these assumptions, the possible equilibria resemble that of Figure 1, and Figure 2 graphs the possible equilibria in the range of screening costs κ and κ^* that capture the switch in equilibrium. As shown in Figure 2, a pooling equilibrium will occur in the closed economy when κ is greater than about 0.135. For example, $\kappa = 0.1375$ would yield a pooling equilibrium in the closed economy with an equilibrium unscreened interest rate of 13.5% and breakeven lending rates on the two (non-equilibrium) screened loans of size 1 and 2.5 equal to 23% and 14.5% respectively. A foreign lender with a higher cost of screening, but one that is below about 0.16, however, could break this equilibrium. For example, a foreign lender with a cost of screening equal to 0.155 would enter the economy and offered screened contracts of size $\lambda = 2.5$ to cream firms with an interest rate of about 13.75%. This entry would break the pooling equilibrium, causing average firms to be shut out from financing, and leading to a reduction in net output of about 7%.

Total net output can also decline even when average firms are not shut out of the credit market following foreign entry. For example, if the pooling contract remains feasible in the separating equilibrium, such that $\theta_A(R - r^*) - \theta_B(r^* - pR) > 0$, both average and bad firms may continue to be financed, but on worse terms than in the closed economy. The equilibrium lending rate on the contract that pools bad and average firms will be $\tilde{r}^* \equiv r^*(1 - \theta_C) / (1 - \theta_C - (1-p)\theta_B)$, whereas the equilibrium lending rate in the closed economy was $\tilde{r} \equiv r / (1 - (1-p)\theta_B)$. The equilibrium lending rate for the pooling contract can rise in the open economy because cream skimming by other lenders increases the ratio of firms accepting the pooling contract that will fail. This increase in borrowing costs can reduce the net output of average and bad firms, and this decline in their net output can exceed the increase in net output from cream firms taking on larger projects. The parameter space where this occurs is described in Proposition 5 and proven in the Appendix.

Proposition 5. *Under the following conditions, foreign entry causes a switch from a pooling equilibrium that finances all firms to a separating equilibrium where cream firms are screened and financed for large projects, average and bad firms continue to accept the pooling contract of size 1, and net output falls:*

(a) $r > r^*$

(b) $\theta_A(R - r^*) - \theta_B(r^* - pR) > 0$,

(c) $\kappa > \max\{\underline{\kappa}, r^*(\theta_A + \theta_B) / (\theta_A + p\theta_B) - r\}$, and

(d) $\bar{\kappa} > \kappa^* > \max\{r^*(1 - p)\theta_B / (\theta_A + p\theta_B), (\lambda - 1)(R - r^*) + (r - r^*) / (1 - \theta_A - \theta_B)\}$,

where $\underline{\kappa}$ and $\bar{\kappa}$ are defined by equations (1) and (2), respectively.

Condition (a) is the same as in Proposition 4, while condition (b) is reversed to ensure it is feasible to pool average and bad firms. Condition (c) ensures the domestic cost of screening is high enough that the closed economy exhibits a pooling equilibrium ($\kappa > \underline{\kappa}$) and average firms find the pooling contract in the open economy more attractive than a domestic screened contract ($\kappa > r^*(\theta_A + \theta_B) / (\theta_A + p\theta_B) - r$). Finally, condition (d) ensures that the foreign screening cost is low enough to break the pooling equilibrium ($\bar{\kappa} > \kappa^*$) but high enough that average firms prefer the open economy pooling contract ($\kappa^* > r^*(1 - p)\theta_B / (\theta_A + p\theta_B)$) over that of a screened contract and net output declines ($\kappa^* > (\lambda - 1)(R - r^*) + (r - r^*) / (1 - \theta_A - \theta_B)$).

While net output can decline even when average firms are financed in the separating equilibrium, the range of κ^* where this occurs is smaller than in the scenario where both average and bad firms are shut out entirely. The threshold level of κ^* above which net output declines in Proposition 5 is greater than the threshold when average firms are shut out entirely in Proposition 4. The intuition is straightforward; the net output of cream firms in the open economy, $\theta_C[\lambda(R - r^*) - \kappa^*]$, is decreasing in the screening cost, κ^*, and remains the same in both scenarios, but the decline in net output for bad and average firms is greater when they lose financing entirely.[20]

---

[20] The likelihood of a decline in net output in this setting is even greater when foreign lenders' supply of capital is limited such they are only able screen and finance a fraction α of the cream firms. In this setting, it can be shown that there exists an open economy equilibrium where $\alpha\theta_C$ cream firms are screened and financed by the foreign lenders, all other firms continue to be pooled by domestic lenders, and net output declines when $\kappa^* > (\lambda - 1)(R - r^*) + (r - r^*)$. The range of κ^* where net output declines is greater in this constrained setting since average and bad firms no longer benefit from foreign lenders' lower cost of funds and fewer cream firms increase their net output.

Similar to before, it is easy to see that the parameter space described in Proposition 5 is non-empty. For example, foreign entry will cause a shift from the pooling equilibrium to a separating equilibrium where average and bad firms continue to be pooled but net output declines by about 4 percent under the following set of assumptions: successful projects yield a 16% return ($R = 1.16$); bad firms only succeed with 80% probability ($p = 0.8$) and represent one-fifth of the firms with the remaining firms being split evenly between average and cream ($\theta_B = 1/5$, $\theta_A = 2/5$); cream firms are able to implement projects three times as large ($\lambda = 3$); and domestic lenders' cost of funds is 9% ($r = 1.09$), whereas foreign lenders cost of funds is 7.5% ($r^* = 1.075$).[21]

6. Robustness and Extensions

This section discusses the robustness of the model's main implications. First, I extend the model by allowing lenders to invest in greater screening expertise, and second, I extend the model by allowing foreign lenders to improve their screening capacity via acquisitions. While providing further insights on how entry affects lenders' incentive to invest in information production, neither extension affects the main findings. Third, I will show that the findings are robust to more general assumptions regarding the distribution of firms, project sizes, and expected returns.

6.1 Investments in Screening Expertise

To analyze how foreign entry might affect lenders' incentives to invest in screening capacity, I now extend the model to allow for such investments. Specifically, I assume that a domestic lender's screening cost is given by $\kappa - e > 0$, where κ is the baseline screening cost, and e is the lender's expertise in screening. Likewise a foreign lender's cost of screening is given by $\kappa^* - e$. While baseline screening costs, κ and κ^*, are still fixed, lenders can lower their per-firm screening cost by investing in expertise, e. A lender's cost of obtaining expertise e is increasing and convex in e and given by

---

[21] It is also possible to show that there exists a non-empty parameter space where foreign entry causes a shift to a separating equilibrium where both average and cream firms accept screened contracts but net output declines. The intuition is similar; net output of average firms can decline when the small, screened contract is more expensive than the closed economy contract that pooled all firms on the small project.

$\eta c(e)$, where $c(0)=c'(0)=0$, $c'(e)>0$, $c''(e)>0$ for $e > 0$, and η equals the number of firms the lender expects to screen (i.e., a bank that plans to screen and acquire information about more firms will need to train more loan officers, etc.). With this change, a strategy configuration in this economy now consists of the set of contracts F_j and choice of e_j and η_j for each lender $j \in L$, and the expected profits of lender j lending to firm i with contract F is now given by

$$\Pi_j(i \mid F) = \left[p(i \mid I)R - r(j) \right]I - \pi(F) - \left(\kappa(j) - e(j) \right)S$$

where $r(j)$ and $\kappa(j)$ represent the cost of funds and baseline screening cost for lender j; I represents the amount of financing associated with contract F; and $S = 0$ for unscreened contracts and equals one otherwise. Lender j's total expected profits is given by $\int_{i \in \chi(F_j, \mathbb{F})} \Pi_j(i \mid F_j) di - \eta_j c(e_j)$.

Using the same notation as in Section 2, the economy's equilibrium is formally defined as

Definition of Equilibrium: A strategy configuration, $f(i)$ for each firm $i \in E$, e_j, η_j, and $\mathbb{F}$ implied by F_j for each lender $j \in L$, constitutes equilibrium if and only if

(1) given $\mathbb{F}$, each firm $i \in E$ chooses $f(i) \in \mathbb{F}$ to maximize $\pi(f)$;

(2) each lender $j \in L$ chooses e_j, η_j, and F_j to maximize $\int_{i \in \chi(F_j, \mathbb{F})} \Pi_j(i \mid F_j) di - \eta_j c(e)$,

where $i \in \chi(F_j, \mathbb{F})$ is given by condition 1; and

(3) because of free entry, each lender makes zero profits, $\int_{i \in \chi(F_j, \mathbb{F})} \Pi_j(i \mid F_j) di - \eta_j c(e_j) = 0$.

To preserve the comparative advantage of domestic lenders in screening and to simplify the analysis, I will continue to assume that foreign lenders' baseline cost of screening, κ^*, is higher than that of domestic lenders but that both lenders have access to the same cost structure for investments in screening expertise. All other assumptions of the model remain the same.

In this extended model, each lender now makes two choices. First, a lender must decide whether they will invest in screening some firms by offering screened contracts. Second, if they offer screened contracts, then they must decide what level of screening expertise to invest in.

In equilibrium, it will turn out that if lenders find it worthwhile to invest in the screening firms, then competition among lenders will induce them to invest in expertise, e, up to the point, $\overline{e}$, which is the level of expertise where the reduction in the screening cost from an additional investment in expertise is equal to the marginal cost of that investment. A lender that offers screened contracts but only invests in expertise $e < \overline{e}$ can always be undercut by a lender that invests $\overline{e}$.

While providing insights on how foreign entry might affect lenders' incentive to invest in screening capacity, this extension does not qualitatively change the possible equilibria. Similar to before, a pooling equilibrium will occur in the closed economy if domestic lenders' baseline cost, κ, is sufficiently high, and foreign entry can cause a separating equilibrium that reduces net output when κ^* falls within a certain range. For example, we have the following proposition, which is proven in the Appendix:

Proposition 6. *With foreign entry and the ability to invest in screening expertise e at cost c(e), a switch from a pooling equilibrium that finances all firms to a separating equilibrium where only cream firms are financed and net output falls will occur when:*

    (a) $r > r^*$

    (b) $0 > \theta_A(R - r^*) - \theta_B(r^* - pR)$,

    (c) $\kappa > \max\left\{\underline{\kappa} + e - c(\overline{e}), R - r + e - c(\overline{e})\right\}$, and

    (d) $\overline{\kappa} > \kappa^* - (\overline{e} - c(\overline{e})) > \max\left\{R - r^*, \lambda(R - r^*) - \dfrac{R(1 - (1 - p)\theta_B) - r}{1 - \theta_A - \theta_B}\right\}$.

where $\overline{e}$ is given by $c'(\overline{e}) = 1$ and $\overline{\kappa}$ and $\underline{\kappa}$ are defined in equations (1) *and* (2).

Comparing Propositions (4) and (6), we see that the ability to invest in screening expertise increases the κ necessary to cause a pooling equilibrium in the closed economy and shifts upward the range of κ^* necessary to cause a separating equilibrium where net output falls. For $\underline{\kappa} + \overline{e} - c(\overline{e}) > \kappa > \underline{\kappa}$, a pooling equilibrium in the closed economy will no longer be sustainable since lenders can invest in screening expertise and improve the attractiveness of their screened contracts, but for $\kappa > \underline{\kappa} + \overline{e} - c(\overline{e})$, the pooling equilibrium persists. Similar dynamics play out when foreign

entry occurs, leading to an upward shift in the range of κ^* that cause a shift to the separating equilibrium and decline in net output.

While the potential decline in net output remains, the extended model highlights how foreign entry can induce greater investment in screening capacity by domestic lenders. In the separating equilibrium, domestic lenders may invest in screening expertise so as to retain a competitive advantage among average firms, and maintaining this competitive advantage will be possible when foreign lenders' disadvantage in screening is sufficiently large, such that $\kappa^* - \kappa > r - r^*$.[22] If the baseline cost of screening, κ, is less than $R - r + e - c(\overline{e})$, it will be feasible for domestic lenders to invest in screening capacity $\overline{e}$ and offer screened contracts to average firms following foreign entry.

Foreign lenders' lower cost of funds, however, might help them offset domestic lenders' investments in screening expertise. For example, if investing in screening capacity requires lenders to borrow funds up front, then foreign lenders' lower cost of funds can provide them an advantage in the race to expand screening expertise. Specifically, if the cost of investment e in screening expertise is instead given by $r\eta c(e)$ for domestic lenders and $r^*\eta c(e)$ for foreign lenders, then foreign lenders will choose to invest more in screening expertise since $r^* < r$. Specifically, they will invest $\overline{e}^*$ where $\overline{e}^*$ is given by $c'(\overline{e}^*) = 1/r^*$, while domestic lenders, if they invest at all, will invest $\overline{e} < \overline{e}^*$ where $\overline{e}$ is given by $c'(\overline{e}) = 1/r$. If foreign lenders' cost of funds advantage is sufficiently large, their investments in expertise may be enough to offset the screening advantage of domestic lenders.

6.2 Investment in Screening Capacity via Mergers

Another route by which foreign lenders might attempt to improve their screening capacity is by acquiring a domestic lender. If domestic lenders' lower screening cost is driven by their loan

---

[22] In this regard, one can think of these investments in screening capacity as an arms race similar to that of Glode, Green, and Lowery [31], though the arms race here is quite different in that one lender's investment in information is not made superfluous by other lenders' investments since each firm is screened by at most one lender. Whether these investments reflect an "overinvestment" in screening capacity depends on the parameter space. In the parameter space described in Proposition 6, one could view foreign lenders' equilibrium investment in screening as an overinvestment since it leads to a constrained inefficient equilibrium, whereas the pooling equilibrium (without screening) is constrained efficient. But if either condition (c) or (d) of Proposition 6 were violated, then the equilibrium investments in screening capacity would increase net output.

officers' greater knowledge about local firms or the ability of these loan officers to better parse local firms' financial statements, then the acquisition of an incumbent lender may allow the entering lender to lower its screening cost and reduce its informational disadvantage.

To formalize this possibility and analyze the potential role of acquisitions in how lenders enhance their screening capacity, I now extend the base model to provide foreign lenders the choice on whether to acquire a domestic lender. Specifically, I assume that if a foreign lender acquires a domestic lender, it is able to lower its cost of screening to κ, but this comes at the cost of taking on some of the inherent organizational or technological disadvantages of the incumbent, such that the foreign lenders cost of funds rises to $r^* + \varepsilon$ for some $\varepsilon > 0$.[23] Under this setup, it can be shown that the merged lender will be able to offer the most competitive screened contract of size 1 when $\varepsilon < \min\{\kappa^* - \kappa, r - r^*\}$ since $\varepsilon < \kappa^* - \kappa$ ensures that the merged lender can offer a more competitive screened contract than foreign lenders and $\varepsilon < r - r^*$ ensures the merged lender can offer a more competitive screened contract than the domestic lender. Furthermore, if $\varepsilon < (\kappa^* - \kappa)/\lambda$, the merged lender will also be able to offer the most competitive screened contract of size λ. The merged lender will never offer a pooling contract since the foreign lender can always offer the most competitive pooling contract because of its lower cost of funds.

With this extension, it is easy to see that the ability to merge can reduce the parameter space under which a decline in net output can occur. For example, average firms will only go unfinanced in a separating equilibrium when the pooling contract is infeasible and

$$0 > \max\left\{R - r - \kappa, R - r^* - \kappa^*, R - (r^* + \varepsilon) - \kappa\right\},$$ such that no lender—domestic, foreign, or merged—finds it feasible to screen average firms. When $\varepsilon < \min\{\kappa^* - \kappa, r - r^*\}$, the latter condition pertaining to the merged lender will be the most binding constraint, which reduces the range of κ where average firms go unfinanced.

The use of acquisitions to expand screening capacity, however, does not eliminate the

---

[23] In practice, such a cost structure might be also accomplished through syndicated lending or if incumbent lenders gain access to the lower cost of capital. This might occur if foreign entry coincides with other reforms that foster domestic lenders' access to international capital markets or if entry results in a transfer of technology to incumbent lenders, as suggested by Levine [39].

possibility of a decline in output. To see this, consider the extreme example where $\varepsilon = 0$. In this setting, acquisition of a domestic lender allows the foreign lender to completely capitalize on its lower cost of funds and the incumbent lender's lower cost of screening. Because a merged lender can always offer the most competitive contracts in this special case, foreign lenders will always acquire domestic lenders upon entry, and only merged lenders will offer contracts in equilibrium. Whether net output declines will now only depend on κ. In particular, we have the following proposition, which is proven in the Appendix:

> Proposition 7. *With foreign entry that allows for acquisitions of domestic lenders and* $\varepsilon = 0$ *, a switch from a pooling equilibrium that finances all firms to a separating equilibrium where only cream firms are financed and net output falls will occur when:*
>
> (a) $r > r^*$
>
> (b) $0 > \theta_A (R - r^*) - \theta_B (r^* - pR)$,
>
> (c) $\overline{\kappa} > \kappa > \max\left\{\underline{\kappa}, R - r^*, \lambda(R - r^*) - \dfrac{R\left(1 - (1-p)\theta_B\right) - r}{1 - \theta_A - \theta_B}\right\}$
>
> *where* $\overline{\kappa}$ *and* $\underline{\kappa}$ *are defined in equations* (1) *and* (2).

Comparing Propositions 4 and 7, we see that the range of κ where net output declines is reduced. It can also be shown that the range of κ implied by condition (c) of Proposition 7 is nonempty. For example, in the numerical example from Section 4, there would still be a drop in net output for $\kappa \in (0.495, 0.5034)$. Given the parameters from the first numerical example in Section 5, however, there is no longer a screening cost, κ, that can satisfy condition (c) of Proposition 7.[24]

The potential merger of lender attributes also yields dynamic implications. While the above model is static (such that lenders merge at time of entry), one could easily imagine that such a process might only occur slowly over time. For example, the entering lenders' cost of screening, κ^*, might

---

[24] Interestingly, if lenders' screening costs, κ and κ^*, occur on a *per firm* basis rather than a *per project* basis, then firms will also have an incentive to merge. So long as lenders' screening costs do not scale up one-to-one with the amount of capital, I, that can be successfully invested, firms will have an incentive to merge so as to obtain more lucrative screened financial contracts. To prevent such mergers from occurring until only one large firm remains, one would need to extend to model to include an organizational cost of running such conglomerates. In such an extension, firms would only merge up to the point where the marginal benefit of further mergers, via lower borrowing costs, equals the marginal cost, via greater organizational costs. By changing the set of equilibrium contracts, foreign entry may increase the marginal benefits of such mergers and thus increase the creation of conglomerates after entry.

start high but decline with time (either through mergers or through the accumulation of local knowledge). In such a case, one might start off in parameter space where foreign lenders are limited to cream skimming and net output falls (similar to Proposition 4) and eventually end up in a parameter space where foreign lenders target a larger subset of firms and net output increases.

6.3 Distribution of Firms and Project Sizes

The basic mechanisms of the model are also robust to allowing for a richer distribution of firms with varying project sizes, λ, and returns, R. In such a model, the screening cost thresholds, $\underline{\kappa}$ and $\overline{\kappa}$, would simply become firm specific. For instance, a cream firm, i, with a project of size $\lambda(i)$ and return $R(i)$, such that $\underline{\kappa}(i) \geq \kappa$, would be screened and financed fully in the economy without foreign lenders. And, all cream firms with smaller projects or returns, such that $\underline{\kappa}(i) < \kappa$, will be pooled with average and bad firms. Again, foreign entry has the potential to unravel the pooling equilibrium as foreign lenders' lower cost of funds might allow them to target a larger set of cream firms and reduce the number of firms pooled by domestic lenders.

Allowing for different returns across project sizes also does not affect which firms foreign lenders will target in the open economy. Foreign lenders' lower cost of funds provides them a competitive advantage per dollar invested, and this competitive advantage does not depend on expected returns. Specifically, the highest payoff a foreign lender can offer on screened contracts of size I is $(R - r^*)I - \kappa^*$, while the highest payoff a domestic lender can offer is $(R - r)I - \kappa$. Therefore, foreign lenders will have a competitive advantage in offering screened contracts to any firms with a project of size $I > (\kappa^* - \kappa)/(r - r^*)$.[25]

7. Empirical Evidence

This section discusses the empirical evidence underlying the model's key assumptions about the comparative advantages of foreign and domestic lenders. The section also discusses the model's

---

[25] Maintaining the higher average return of cream firms on the larger project, but allowing for the possibility that average firms produce an even higher return with some probability also does not affect the equilibrium. So long as the expected return of average firms on the large project is lower than the cost of funds, no lender will offer large, screened contracts to average firms.

testable predictions and how they relate to the existing empirical evidence regarding foreign lender entry into LDCs and subsequent changes in local credit and net output.

7.1   Empirical Support for Assumptions

The key assumption of the model is that foreign lender entry coincides with the arrival of a new lending cost structure that has the potential to break a domestic pooling equilibrium. In the model, this is accomplished through the entry of a foreign lender that is assumed to have a higher cost of screening but a lower marginal cost of funds than the incumbent lenders.

The assumption that screening costs are higher for foreign lenders is widely supported by existing empirical evidence. A greater distance between lender and borrower—where distance is broadly defined to include hierarchical, geographical, and cultural distance—can increase a lenders' cost of acquiring information and is a key feature of foreign lending (Berger, Klapper, and Udell [11]). For example, Stein [52] demonstrates that the greater hierarchical structure of foreign lenders can make it more costly for them to use the "soft information" necessary to screen firms, and Petersen and Rajan [47] note that the cost of acquiring information about borrowers likely increases with the geographical distance between the lender and borrower. Consistent with informational costs associated with distance being particularly salient for foreign lenders, Mian [43] finds evidence that distance barriers for foreign banks operating in Pakistan are sufficiently large to exclude them from certain sectors of the economy entirely, and Buch [15] finds a negative correlation between distance and the international banking activities of banks located in France, Germany, Italy, United Kingdom, and the United States. Recent work on lending relationships and loan prices in Belgium, Italy, and the United States also suggest that greater lending distances are associated with increased transportation and informational costs for lenders (Agarwal and Hauswald [2], Degryse and Ongena[21], Mistrulli and Casolaro [45]).

The second assumption that foreign lenders enjoy a lower cost of funds is also supported by existing evidence. Within-country comparisons suggest that foreign banks have, on average, lower interest expenses, overhead costs, and total employment per unit of assets relative to their domestic

counterparts, particularly in LDCs (Mian [42], Micco, Panizza, and Yañez [44]). There are a variety of reasons why foreign banks may enjoy a cost of funds advantage. Foreign lenders are often less beholden to local laws and labor unions than domestic lenders, making it less costly for them to expand operations and raise additional funds in the domestic economy.[26] Foreign banks might also enjoy a comparative advantage in raising capital. Foreign banks may be able to raise capital locally at a lower cost because investors in LDCs perceive foreign banks as safer because they are backed by a large, foreign affiliate (Mian [42]) and less likely to make political loans (Micco, Panizza, and Yañez [44]). Well-developed securities markets and better institutions in the home countries of foreign lenders may also provide them access to cheaper sources of capital.

7.2   Testable Implications and Evidence

The model generates a number of testable predictions regarding the impact of foreign entry.

(P1)   Foreign entry can induce a segmented credit market where foreign lenders only target the largest, most profitable, and least-informationally opaque firms (see Proposition 4).

(P2)   Foreign entry will coincide with a decline in credit from domestic lenders and a potential decline in overall credit and net output (see Propositions 4 and 5).

(P3)   A decline in net output is *less* likely to occur when screening costs in the closed economy are low (see Propositions 4 and 5). In practice, many factors, like strong country-level institutions (e.g., countries with transparent accounting rules and strong auditing enforcement standards), might reduce the screening cost of local lenders.

(P4)   Conditional on a switch from a pooling to separating equilibrium where foreign lenders cream skim, a broad curtailment of lending by domestic lenders (and a decline in net output) is *less* likely to occur when any of the following conditions hold:

     a.   the domestic cost of screening is lower (see Proposition 4c); for example, in countries with strong institutions or in industries with easier to value assets,

---

[26] For example, by sidestepping local unions in India, foreign banks are able to hire fewer workers and pay a lower average wage bill per deposit collected relative to domestic banks (Hanson [35]). This provides them a competitive advantage in establishing additional branches from which they can raise new deposits.

31

b. ratio of bad to average firms is lower (see Proposition 4b); for example, in older, more established industries in which the number of likely failures is lower, and

(P5)   To improve their ability to produce information and obtain a competitive advantage, foreign lenders may prefer to merge with domestic lenders, and a decline in net output is less likely to occur when such mergers occur (see Section 6.2).

Many of these predictions map closely to the broad, existing empirical evidence regarding the effects of financial liberalization on growth and output, whereas other predictions have yet to be formally studied. The remainder of this paper discusses this evidence and proposes areas that are promising directions for future empirical research on financial liberalization.

7.2.1   Evidence on Segmentation and Acquisitions

There is broad empirical support for the model's prediction that foreign lenders cream skim the least informationally opaque, largest, and most profitable firms (Prediction P1). Mian [43] finds that foreign banks in Pakistan tend to avoid loans that are typically associated with acquiring soft information, such as loans to small firms and first-time borrowers, whereas Gormley [32] finds that foreign banks in India only lent to a small subset of the largest, most profitable firms. In particular, only the top 10% of firms, in terms of profitability, appear to experience an increase in bank loans following foreign lender entry in India. Other papers find that foreign banks are less likely to lend to small, informationally opaque firms in Latin America (Berger, Klapper and Udell [11], Clarke, Cull, Peria, and Sánchez [19]), that small firms in Eastern Europe appear to benefit less from foreign entry (Giannetti and Ongena [30]), and that foreign lenders shy away from lower-quality firms with past delinquencies (Berger, Klapper, and Udell [11]).

There is also evidence to support the prediction that, by lowering foreign lenders' cost of screening, acquisitions of domestic lenders will be a preferred mode of entry and allow foreign banks to target a larger share of the lending market (Prediction P5). Anecdotally, countries that allow foreign banks to acquire domestic banks tend to experience a subsequent wave of acquisitions. For example, Mexico first allowed foreign banks to purchase controlling stakes in its largest banks in

32

1997, and the foreign ownership of banking assets quickly increased from 16% in 1997 to 82% in 2004 (Haber and Musacchio [34]). A more limited type of entry tends to occur when countries prohibit such acquisitions. For example, when India allowed the entry of new foreign banks in 1994, entry was largely limited to green field investments, and as of 2009, foreign banks only owned about 5% of the banking assets in India (Gormley [32]).[27] And consistent with acquisitions lowering the cost of screening and allowing foreign lenders to target more firms, Degryse, Havrylchyk, Jurzyk, and Kozak [20] find that foreign banks that enter via acquisition finance more informationally-opaque firms relative to foreign banks that enter via greenfield investments.

7.2.2   Evidence on Heterogeneity of Foreign Entry's Impact

The model's prediction regarding the potential negative impact of foreign entry on overall output and growth (Prediction P2) fits well in the context of the existing empirical literature. To date, many studies find no clear impact of foreign lender entry on overall credit, output, and growth (e.g., Arteta, Eichengreen, and Wyplosz [5], Edison, Levine, Ricci, and Sløk [25], Rodrik [49]) while others find the impact is negative (e.g., Beck and Peria [9], Detragiache, Gupta, and Tressel [24], Gormley [32]). Moreover, in country-specific studies in which foreign entry was found to reduce overall credit, the evidence seems to confirm the model's prediction that this will often coincide with cream skimming by foreign lenders and a decline in lending by domestic banks. Analyzing foreign lender entry into India following its liberalization in 1994, Gormley [32] found that the new foreign banks only lent to a small subset of the most profitable firms and that domestic lenders responded to their entry by sharply curtailing their lending to *all* firms, not just the most profitable firms targeted by the new foreign lenders. On net, Gormley found there was a decline in overall credit in Indian districts in which foreign bank entry occurred relative to districts in which no entry occurred.

Country-specific studies also provide suggestive support to the model's prediction that mergers between foreign and domestic lenders will increase the probability of positive impact on output and credit (Prediction P5). In a study of foreign lenders' entry in Eastern Europe, where

---

[27] These types of restrictions are often put in place because domestic politicians worry about preserving financial stability and about allowing a majority of the country's banking assets to be suddenly acquired by foreigners.

foreign acquisitions were allowed and widespread, Giannetti and Ongena [30] found a positive effect on growth, whereas in a study of foreign lender entry in India, where such acquisitions were prohibited, Gormley [32] found evidence of a decline in credit access for many firms. Using variation across both industries and countries, Bruno and Hauswald [14] provide even more evidence regarding the potential importance of acquisitions. Comparing outcomes across industries that are more- and less-dependent on external financing, they find that increases in foreign bank ownership driven by acquisitions are positively related to a relatively larger increase in economic growth in industries more dependent on external financing; increases in ownership driven by greenfield investments are not associated with changes in growth.

7.2.3 Quality of Local Institutions and Impact of Liberalization

The model's prediction regarding the importance of local institutions (Predictions P3 and P4a) also has the potential to explain a number of existing empirical patterns regarding the impact of financial liberalization. Capital account liberalization tends to be positively associated with subsequent economic growth in high-income countries, where quality of accounting and auditing standards is likely greater, while negatively related to growth in low-income countries, where accounting standards are likely weaker (e.g., see Edwards [26], Quinn [48]). Likewise, foreign bank entry in low-income countries is often associated with a decline in private credit and lending by domestic institutions (Detragiache, Tressel, and Gupta [24], Gormley [32]).

A number of studies also find that opening capital markets and domestic financial liberalization is only associated with a positive impact on growth in countries with greater law and order traditions or better legal protections for creditors, both of which are likely positively correlated with stronger enforcement of accounting standards (e.g., see Arteta, Eichengreen, and Wyplosz [5], Galindo, Micco, and Ordoñez [29]). There is also direct evidence regarding the potential importance of accounting standards. In an analysis of equity market liberalizations, Bekaert, Harvey, and Lundblad [10] find a large increase in economic growth for countries with an above-average accounting quality, but no increase in growth for countries with below average accounting standards.

7.2.4 Scope for Future Empirical Research

Whereas a number of the model's predictions are consistent with the existing empirical literature, there are other predictions that have yet to be extensively studied.

For example, if foreign lenders' cost of obtaining information declines with time, then the model suggests some dynamic implications where foreign lenders target more informationally-opaque firms over time, which can cause further changes in net output. There is evidence that foreign bank profitability is higher the longer the bank has operated in a country (Claessens and van Horen [17]), that cream-skimming-type behavior is less likely to occur when a foreign lender expands its existing operations within a country (Gormley [32]), and that foreign banks lend to more informationally-opaque borrowers as time passes (Degryse, Havrylchyk, Jurzyk, and Kozak [20]), but, to the author's knowledge, there is no direct analysis of whether the impact of foreign lender entry on overall credit, output, and growth changes with time after initial entry occurs.

The model also provides a number of predictions regarding how the effect of liberalization may vary across industries (Predictions P4a and P4b). For example, industries in which it is more difficult to screen the quality of projects or in which the likelihood of failure is greater, such as newer industries or industries with fewer tangible assets, might be more likely to be adversely affected by foreign lender entry. With the exception of Gormley [32], who found that foreign entry in India was more likely to be associated with a subsequent decline in sales growth for industries with fewer tangible assets, there is very little existing evidence on whether financial liberalization has heterogeneous effects across industries.

8. Concluding Remarks

Emerging economies are often criticized for having financial sectors that seem to over finance low-return projects and under finance high-return projects. For this reason, and many others, it is typically argued that opening capital markets would improve credit access and overall output in these economies. However, the theory developed in this paper suggests that this type of domestic credit allocation may occur when information asymmetries are large and domestic lenders choose to pool risks rather than invest in costly screening technologies.

If true, foreign entry may take the form of cream skimming and adversely affect overall credit access. Foreign lenders' may use their lower cost of funds to offer more competitive financial contracts to firms capable of profitably investing large amounts of capital. This type of entry and the resulting separating equilibrium may both redirect credit toward the largest, most profitable firms in the economy and reduce the credit access of informationally opaque firms by changing the set of contracts available to them. As a result, the overall net output may decrease after foreign entry when information asymmetries are sufficiently costly to overcome. The potential decline in output provides new insights to the inconclusive relation between foreign lender entry and aggregate output.

More generally, the model illustrates a possible dark side to liberalization that has been suggested by empirical evidence but is not well understood theoretically. The model is also able to generate predictions of when a new lender's entry will adversely affect credit access and net output. The impact of the lender's entry will depend on the distribution of firms, the comparative advantages of competing lenders, the severity of information asymmetries, whether lenders are allowed to merge, and the quality of local institutions. This yields a number of testable hypotheses on how the impact of lender entry may vary by industry and country. Many of these predictions find substantial support in the data, whereas others provide interesting avenues for future empirical research. The model also provides an explanation for why existing empirical studies on the opening of capital markets, which assume a uniform impact across countries and industries, fail to find consistent evidence.

The model also extends our understanding of how competition in markets with asymmetric information can lead to unfavorable outcomes for many agents. In contrast many existing models, where screening occurs through agents' self-revealing choices from the menu of offered contracts, this paper analyzes the effects of competition in a setting where lenders are able to acquire and use private information about agents' types to limit their choice from the menu of offered contracts. The model also broadens the set of scenarios in which increased competition can facilitate the exit of seemingly more efficient lenders. The model suggests this exit can occur even in already competitive markets or even when an incumbent lender does not face direct competition for borrowers for which it enjoys a competitive advantage in financing.

36

Appendix A. Proof about shape of equilibrium contracts

For all financial contracts where projects are implemented, it is sufficient to consider only contracts with $F(RI) \geq 0$ and $F(0) = 0$ as long as there are many lenders offering identical contracts in equilibrium. This is proven in Lemma 1.

Lemma 1: *For all financial contracts of size $I \in \{1, \lambda\}$ and type $k \in \{0, A, B, C\}$ it is sufficient to consider only equilibrium contracts with $F^{I,k}(RI) \geq 0$ and $F^{I,k}(0) = 0$ when there are $n \geq 2$ lenders offering contracts in equilibrium.*

For each financial contract, lenders must provide a non-negative payment in each state of the world when projects are implemented. This implies some payment $F(RI) \geq 0$ for successful projects and $F(0) \geq 0$ for failures.

For financial contracts where $k \neq 0$, this yields an expected profit of

$\pi(F^{I,k} \mid i = k) = p(k \mid I)F^{I,k}(RI) + [1 - p(k \mid I)]F^{I,k}(0) \equiv \bar{\pi}$ for the firm and an expected

profit of $\Pi_j(k \mid F_j^{I,k}) = [p(k \mid I)R - r(j)]I - \pi(F^{I,k} \mid k) - \kappa(j)$ for the lender. Since all

firms accepting this contract will be of type k, the expected profits can always be

replicated for each agent involved by using a contract where $F^{I,k}(0) = 0$ and

$F^{I,k}(RI) = \bar{\pi} / p(k \mid I)$.

For financial contracts where $k = 0$ and all borrowers accepting it in equili-

brium have the same probability of success, $\tilde{p}(i \mid I)$, a similar reasoning holds. A

payment of $F(RI) = \bar{\pi} / \tilde{p}(i \mid I)$ in success and zero otherwise can always replicate the

expected payment of contracts that pay a non-zero amount in failure.

For financial contracts where $k = 0$ and all borrowers accepting the contract

in equilibrium do not have the same probability of success, $\tilde{p}(i \mid I)$, the expected pay-

ment for all agents cannot be replicated using a contract with $F^{I,k}(0) = 0$. However,

it can be shown that a contract with $F^{I,k}(0) > 0$ cannot exist in equilibrium when

$k = 0$ and not all borrowers accepting the contract have the same probability of success. Consider the case where a lender offers a contract with $F^{I,0}(RI) = G \geq 0$ and $F^{I,0}(0) = H > 0$. If a continuum 1 of entrepreneurs accept the contract where a fraction α only succeed with probability p, the expected return for this lender is given by $\left[[1-\alpha(1-p)](RI-G)-\alpha(1-p)H-rI\right]$ and this must equal zero in equilibrium. If another lender offered a contract where $F^{I,0}(RI) = G + \varepsilon$ and $F^{I,0}(0) = 0$ for some $\varepsilon \in \left(\left[(1-p)/p\right]H, 0\right)$, however, it would make profits of $(1-\alpha)(RI - G - \varepsilon - rI)$ because only firms with probability of success 1 will take this new contract. And, for $(1-\alpha)(RI - G - \varepsilon - rI) > 0$ this contract will be profitable. But, since $[1-\alpha(1-p)](RI-G)-\alpha(1-p)H-rI = 0$ in any equilibrium, it must be true that $RI > G + rI$ when $H > 0$. Therefore, there exists some ε sufficiently small such that $(1-\alpha)(RI - G - \varepsilon - rI) > 0$. Therefore, contracts with $k = 0$ and $H > 0$ can never be an equilibrium contract. QED

Appendix B. Proof of Proposition 1

Given the setup, there are eight different types of financial contracts that domestic lenders could offer: $F^{1,k}, F^{\lambda,k} \ \forall k \in \{0, A, B, C\}$. The proof that the equilibrium of Proposition 1 exists and is the unique allocation will be done in five parts. In parts 1-3, I will show that 5 of the 8 financial contracts cannot be equilibrium contracts. In part 4, I will derive the conditions under which the three remaining financial contracts can co-exist in equilibrium. This will be sufficient to prove the allocation of Proposition 1 exists and is unique when $\kappa > \underline{\kappa}$. Finally, in part 5, I will prove that none of the non-equilibrium contracts can be used to break the equilibrium in Proposition 1.

Part 1 – When there are $n \geq 2$ lenders offering the same contracts in equilibrium, any financial contract $F^{I,k}$ yielding negative expected profits for the lender at $t = 1$ cannot be an equilibrium contract as any individual lender could increase profits by dropping the contract. This

allows me to exclude financial contracts that are ex-ante unprofitable for the lender if any firm were to accept the contract. Those contracts are: $F^{\lambda,A}, F^{1,B}$, and $F^{\lambda,B}$. Because contracts take the form of $F(RI) \geq 0$ and $F(0) = 0$, as shown in Lemma 1, and $pR < r$, the $F^{\lambda,A}, F^{1,B}$ and $F^{\lambda,B}$ contracts always yield a negative return for the lender and cannot be equilibrium contracts.

Part 2 – Suppose that $F^{\lambda,0}$ was an equilibrium contract. By assumption (A3) and $pR < r^*$, this contract can only be profitable if cream firms accept it, and will never be profitable if both cream and bad firms accept it. If $F^{1,0}$ is not also an equilibrium contract, however, then all bad firms will also choose $F^{\lambda,0}$ since Part 1 proves that $F^{1,B}$ and $F^{\lambda,B}$ cannot be equilibrium contracts. Therefore, $F^{\lambda,0}$ can only exist in equilibrium if $F^{1,0}$ also exists and bad firms choose it. But if cream firms accept $F^{\lambda,0}$, then it must be that $F^{\lambda,0}(R\lambda) > F^{1,0}(R)$, which implies that bad firms must also prefer this contract since $F(0) = 0$. Therefore, $F^{\lambda,0}$ can never be an equilibrium contract.

Part 3 – In order for the $F^{1,C}$ contract to be an equilibrium contract, it must be that lenders receive non-negative profits from offering it, such that $F^{1,C}(R) \leq R - r - \kappa$, and that cream firms do not prefer any other contract. But if this contract is feasible, then another lender could always feasibly offer the contract $F^{\lambda,C}(RI) = \lambda(R - r) - \kappa$, and cream firms would prefer the this larger contract since its payout exceeds the maximum possible payout of screened contract for the smaller project, $F^{1,C}$. Therefore, $F^{1,C}$ cannot be an equilibrium contract.

Part 4 – From Parts 1-3, we know there are only three possible types of equilibrium contracts: $F^{1,0}, F^{1,A}$ and $F^{\lambda,C}$. Therefore, lenders either offer an unscreened contract for small projects, a screened contract for average firms, or a large screened contract for cream borrowers. Moreover, by Lemma 1, it is sufficient to consider only contracts with $F(RI) \geq 0$ and $F(0) = 0$.

In order for the $F^{1,A}$ contract to be an equilibrium contract, such that lenders have non-negative profits from offering it, such that $F^{1,A}(R) \leq R - r - \kappa$. Likewise, it must be that $F^{\lambda,C}(R\lambda) \leq \lambda(R - r) - \kappa$. Therefore, these are the maximum expected profits that these contracts

39

can provide to average and cream firms respectively. Average or cream firms will prefer the pooling contract, $F^{1,0}$, if its payout, $F^{1,0}(R)$, exceeds the maximum payout of $F^{1,A}$ and $F^{\lambda,C}$. Moreover, if cream prefer the pooling contract, $F^{1,0}$, then average firms must also prefer the pooling contract.

If $F^{1,0}$ is an equilibrium contract, then it must be the case that bad borrowers choose it since there is no other contract available to bad firms. In order for the contract to be feasible for lenders when all firms select it, it must be that $F^{1,0}(R) \leq R - r / \left(1 - (1-p)\theta_B \right)$. When $\kappa > \underline{\kappa}$, the maximum possible payoff $F^{\lambda,C}$ does not exceed the maximum possible payoff of $F^{1,0}$, and $F^{\lambda,C}$ will not be an equilibrium contract. Likewise, $F^{1,A}$ is not an equilibrium contract. This means that $F^{1,0}$ is the unique possible equilibrium contract when $\kappa > \underline{\kappa}$. This contract, however, is only feasible when $r / \left(1 - (1-p)\theta_B \right) \leq R$. Otherwise, lenders can never offer a non-negative payoff to firms, $F^{1,0}(R) \geq 0$, and also make non-negative profits. And, competition and lenders' zero profit condition ensures that $F^{1,0}(R) = R - r / \left(1 - (1-p)\theta_B \right)$.

Part 5 – To prove this is in fact an equilibrium financial contract, it must now be shown that none of the other non-equilibrium contracts can offer a potential profitable deviation for agents.

Consider the case where $\kappa > \underline{\kappa}$, and all firms are pooled on the small project. It can never be a profitable deviation for lenders to offer $F^{1,B}$ contracts since bad firms would still implement their project at a loss and the lender would now take a larger loss because it screens the bad firms. Similarly, it is never profitable to offer $F^{\lambda,A}$ since the contract will always lose money. And, $F^{1,A}$ or $F^{1,C}$ cannot be profitable deviations since a lender since $\kappa > \underline{\kappa}$ ensures that neither $F^{1,A}$ or $F^{1,C}$ can be greater than $F^{1,0}$ (i.e. be preferred by average or cream firms) and be a profitable contract for the lender. The $F^{\lambda,0}$ contract will also by unprofitable by assumption (A3) and the fact that bad will always prefer the contract if cream borrowers do. This leaves only $F^{\lambda,C}$. However, $\kappa > \underline{\kappa}$ implies that lenders can never profitably induce cream firms to take a larger contract with screening. Therefore, $F^{1,0}$ is an equilibrium contract for $\kappa > \underline{\kappa}$ and $r / \left(1 - (1-p)\theta_B \right) < R$. QED

Appendix C. Proof of Proposition 2

To differentiate contracts offered by foreign lenders, I will express their contracts as $F_*^{I,k}$. Using the same logic as in parts 1-3 of the proof of Proposition 1, there are only three potential foreign lender contracts that can be equilibrium contracts $F_*^{1,0}$, $F_*^{1,A}$, and $F_*^{\lambda,C}$, and it is sufficient to consider contracts of the form $F_*(RI) \geq 0$ and $F_*(0) = 0$. In an economy with both domestic and foreign lenders, the domestic lender contract, $F^{\lambda,C}$, can no longer be an equilibrium contract for domestic lenders because of assumption (A2), and $F^{1,0}$ cannot be an equilibrium contract since $r^* < r$. Therefore, there are only four possible equilibrium contracts: $F_*^{1,0}$, $F^{1,A}$, $F_*^{1,A}$, and $F_*^{\lambda,C}$.

Similar to parts 4-5 of Proposition 1, it can be shown that $F_*^{\lambda,C}$ only exists and is preferred by cream firms over the pooling contract $F_*^{1,0}$ for $\kappa^* \leq \overline{\kappa}$. Competition among foreign lenders and their zero profit condition will ensure that $F_*^{\lambda,C}(R\lambda) = \lambda(R - r^*) - \kappa^*$, which exceeds the maximum possible payoff to cream firms with the pooling contract, $F_*^{1,0}$, when $\kappa^* \leq \overline{\kappa}$. QED

Appendix D. Proof of Proposition 3

In the pooling equilibrium with domestic lenders, net output is $(\theta_A + p\theta_B + \theta_C)(R - \tilde{r})$, where $\tilde{r} = r / (1 - (1 - p)\theta_B)$, while in the separating equilibrium where only cream firms accept projects from foreign lenders, the net output is $\theta_C[\lambda(R - r^*) - \kappa^*]$. Thus, a decrease in net output will occur when $(R - \tilde{r})(\theta_A + p\theta_B) > [\lambda(R - r^*) - \kappa^* - (R - \tilde{r})]\theta_C$ is true. QED

Appendix E. Proof of Proposition 4

As shown in Proposition 1, the closed economy exhibits a pooling equilibrium when $\kappa > \underline{\kappa}$, and as shown in Proposition 2, the open economy exhibits a separating equilibrium when $\kappa^* \leq \overline{\kappa}$. Moreover, as shown in the proof of Proposition 2, there are only three possible equilibrium contracts available to average firms in the open economy: $F_*^{1,0}$, $F^{1,A}$, and $F_*^{1,A}$. If $F_*^{1,0}$ exists, it must be

taken by bad firms, since it is the only contract available to them, and it is never feasible if average

firms don't also choose this contract in equilibrium. Given this, $F_*^{1,0}$ only exists if both bad and

average firms take the contract, and the maximum payout that lenders can offer with such a contract

is $F_*^{1,0} \leq R - r^*[(\theta_A + \theta_B)/(\theta_A + p\theta_B)]$. The maximum payout that domestic lenders can offer for the

screened contract is $F^{1,A} \leq R - r - \kappa$, and the maximum payout the foreign lenders can offer for the

small, screened contract is $F_*^{1,A} \leq R - r^* - \kappa^*$. If both $0 > \max\{R - r - \kappa, R - r^* - \kappa^*\}$ and

$R - r^*[(\theta_A + \theta_B)/(\theta_A + p\theta_B)] < 0$, then none of these other contracts provide a positive payoff to

firms, and $F_*^{\lambda,C}$ is the only equilibrium contract.

Below is the list of assumptions and conditions given by Propositions 1-3 that ensure a switch

from a pooling equilibrium in the closed economy to a separating equilibrium in the open economy

where average and bad firms are not financed and net output declines:

$$\kappa^* > \kappa, r > r^*; \text{ Assumption (A1)} \tag{E.1}$$

$$r^* + \frac{\kappa^*}{\lambda} < r + \frac{\kappa}{\lambda}; \text{ Assumption (A2)} \tag{E.2}$$

$$\kappa > \lambda(R - r) - \left(R - \frac{r}{1-(1-p)\theta_B}\right); \text{ pooling equilibrium in closed economy} \tag{E.3}$$

$$R \geq \frac{r}{1-(1-p)\theta_B}; \text{ pooling equilibrium in closed economy is feasible} \tag{E.4}$$

$$\kappa^* < \lambda(R - r^*) - \left(R - \frac{r^*}{1-(1-p)\theta_B}\right); \text{ foreign entry causes separating equilibrium} \tag{E.5}$$

$$0 > \theta_A(R - r^*) - \theta_B(r^* - pR); \text{ infeasible to pool average and bad firms} \tag{E.6}$$

$$0 > \max\{R - r - \kappa, R - r^* - \kappa^*\}; \text{ infeasible to screen average firms} \tag{E.7}$$

$$(R - \tilde{r})(\theta_A + p\theta_B) > [\lambda(R - r^*) - \kappa^* - (R - \tilde{r})]\theta_C; \text{ decline in net output when switch} \tag{E.8}$$

The above conditions, however, can be greatly simplified. For example, equation (E.2) can

be eliminated since it must always holds when $\lambda > 1$ and equations (E.1), (E.3), (E.5), and (E.7) all

hold. To see this, notice that equations (E.3) and (E.7) both place lower bounds on κ, such that

$\kappa > \max\{\underline{\kappa}, R - r\}$, while equation (E.5) places an upper bound on κ^*. One can quickly show that for

$\lambda > 1, r > r^*$, these bounds ensure that equation (E.2) holds. The first half of equation (E.1) can also

be eliminated since it is not actually necessary for a decline in net output; a decline in net output can

occur even when $\kappa^* < \kappa$ so long as equations (E.3)-(E.8) all hold. Equation (E.4) can also be

eliminated since it always hold if equations (E.5) and (E.8) both hold. And, plugging in for

$\tilde{r} = r / (1 - (1-p)\theta_B)$, equations (E.5), (E.7), and (E.8), can be combined to create bounds on κ^*, such

that $\underline{\kappa} > \kappa^* > \max\{R - r^*, \lambda(R - r^*) - (R(1 - (1-p)\theta_B) - r) / (1 - \theta_A - \theta_B)\}$. We are then left with the

four conditions listed in Proposition 4.   QED

Appendix F. Proof of Proposition 5

As shown in Proposition 1, the closed economy exhibits a pooling equilibrium when $\kappa > \underline{\kappa}$,

and as shown in Proposition 2, the open economy exhibits a separating equilibrium when $\kappa^* \leq \overline{\kappa}$.

Moreover, as shown in the proof of Proposition 2, there are only three possible equilibrium contracts

available to average firms in the open economy: $F_*^{1,0}$, $F^{1,A}$, and $F_*^{1,A}$. If $F_*^{1,0}$ exists, it must be

taken by bad firms, since it is the only contract available to them, and it is never feasible if average

firms don't also choose this contract in equilibrium. Given this, $F_*^{1,0}$ only exists if both bad and

average firms take the contract, and the maximum payout that lenders can offer with such a contract

is $F_*^{1,0} \leq R - r^*[(\theta_A + \theta_B) / (\theta_A + p\theta_B)]$. The maximum payout that domestic lenders can offer for the

screened contract is $F^{1,A} \leq R - r - \kappa$, and the maximum payout the foreign lenders can offer for the

small, screened contract is $F_*^{1,A} \leq R - r^* - \kappa^*$. If $R - r^*[(\theta_A + \theta_B) / (\theta_A + p\theta_B)] \geq 0$ and

$R - r^*[(\theta_A + \theta_B) / (\theta_A + p\theta_B)] > \max\{R - r - \kappa, R - r^* - \kappa^*\}$ then the pooling contract is both

feasible and preferred by average firms over a screened contract.

In order for net output to decline in this scenario, it must be that net output in the closed

economy, $(\theta_A + p\theta_B + \theta_C)(R - r / (1 - (1-p)\theta_B))$, exceeds net output in the open economy,

$(\theta_A + p\theta_B)[R - r^*(\theta_A + \theta_B) / (\theta_A + \rho\theta_B)] + \theta_C[\lambda(R - r^*) - \kappa^*]$. This will be true when

$\kappa^* > (\lambda - 1)(R - r^*) + (r - r^*) / (1 - \theta_A - \theta_B)$.

Below is the list of assumptions and conditions that ensure a switch from a pooling equilibrium in the closed economy to a separating equilibrium in the open economy where average and bad firms are pooled and net output declines:

$$\kappa^* > \kappa, r > r^*; \text{ Assumption (A1)} \tag{F.1}$$

$$r^* + \frac{\kappa^*}{\lambda} < r + \frac{\kappa}{\lambda}; \text{ Assumption (A2)} \tag{F.2}$$

$$\kappa > \lambda(R - r) - \left(R - \frac{r}{1 - (1 - p)\theta_B}\right); \text{ pooling equilibrium in closed economy} \tag{F.3}$$

$$R \geq \frac{r}{1 - (1 - p)\theta_B}; \text{ pooling equilibrium in closed economy is feasible} \tag{F.4}$$

$$\kappa^* < \lambda(R - r^*) - \left(R - \frac{r^*}{1 - (1 - p)\theta_B}\right); \text{ foreign entry causes separating equilibrium} \tag{F.5}$$

$$\theta_A(R - r^*) - \theta_B(r^* - pR) > 0; \text{ feasible to pool average and bad firms} \tag{F.6}$$

$$R - r^*[(\theta_A + \theta_B)/(\theta_A + p\theta_B)] > \max\{R - r - \kappa, R - r^* - \kappa^*\}; \text{ average firms prefer pooling} \tag{F.7}$$

$$\kappa^* > (\lambda - 1)(R - r^*) + (r - r^*)/(1 - \theta_A - \theta_B); \text{ decline in net output when switch} \tag{F.8}$$

The above conditions, however, can be greatly simplified. For example, equation (F.2) can be eliminated since it must always holds when $\lambda > 1$ and equations (F.1), (F.3), (F.5), and (F.7) all hold. To see this, notice that equations (F.3) and both place lower bounds on κ, such that

$\kappa > \max\{\underline{\kappa}, r^*(\theta_A + \theta_B)/(\theta_A + p\theta_B) - r\}$, while equation (F.5) places an upper bound on κ^*. One

can quickly show that for $\lambda > 1$, $r > r^*$, these bounds ensure that equation (F.2) holds. The first half of equation (F.1) can also be eliminated since it is not actually necessary for a decline in net output; a decline in net output can occur even when $\kappa^* < \kappa$ so long as equations (F.3)-(F.8) all hold. Equation (F.4) can also be eliminated since it always hold if equations (F.5) and (F.8) both hold. And equations (F.5), (F.7), and (F.8), can be combined to create bounds on κ^*, such that

$\underline{\kappa} > \kappa^* > \max\{r^*(1 - p)\theta_B/(\theta_A + p\theta_B), (\lambda - 1)(R - r^*) + (r - r^*)/(1 - \theta_A - \theta_B)\}$. We are then left with

the four conditions listed in Proposition 5.   QED

Appendix G. Proof of Proposition 6

This proof will proceed in four parts. First, I will prove that a lender that offers a screened contract will always invest an amount $\eta c(\overline{e})$ in screening expertise, where η is the number of firms

screened by the lender in equilibrium and $\overline{e}$ is given by $c'(\overline{e})=1$. Second, I will prove that the conditions in Proposition 6 ensure the closed economy exhibits a pooling equilibrium with contract $F^{1,0}$. This proof will parallel that of Proposition 1. Third, I will prove that that these conditions also ensure that foreign entry results in a separating equilibrium. This proof will parallel that of Proposition 2. Finally, I will prove that only cream firms are financed and net output declines in the separating equilibrium that occurs after foreign entry. This proof will parallel that of Proposition 3.

Part 1 – Using the same logic as in Proposition 1, it can be shown that there are only three possible types of equilibrium contracts: $F^{1,0}, F^{1,A}$ and $F^{\lambda,C}$. Therefore, if lenders offer a screened contract, it will only do so to a firm that succeeds with probability 1. Moreover, by Lemma 1, it is sufficient to consider only contracts with $F(RI)\geq 0$ and $F(0)=0$.

It can then be shown that a screened contract from a lender that invests in screening expertise $e<\overline{e}$, where $\overline{e}$ is given by $c'(\overline{e})=1$, cannot be an equilibrium contract. For example, consider a lender of type j that offers screened contracts but makes zero investment in screening expertise. The best expected payoff, $F(RI)$, that such a lender can offer with on a screened contract for firms of type i, loan size I and still breakeven is $[R-r(j)]I-\kappa(j)$. However, a lender of the same type j that invests $\eta c(e)$ in order to obtain screening expertise $e\in(0,\overline{e})$ for η screened loans will always be offer a more competitive screened contract. The total profits of such a lender that screens and finances η firms of type i is given by $\eta\left[[R-r(j)]I-[\kappa(j)-e]-\tilde{F}(RI)\right]-\eta c(e)$, where $\tilde{F}(RI)$ is the payment provided to firms that accept this contract, and hence, the best expected payoff such a lender can offer firms is $\tilde{F}(RI)=[R-r(j)]I-[\kappa(j)-e]-c(e)$. It can be shown that $\tilde{F}(RI)-F(RI)=e-c(e)>0$ since $c(0)=c'(0)=0, c'(e)>0, c''(e)>0$ for $e>0$, and $c'(e)<1$ for $e<\overline{e}$. Therefore, there will exist an $\varepsilon>0$ such that a lender of type j could always initiate a profitable deviation by investing in expertise $e\in(0,\overline{e})$ and offering screened contracts that provide a payoff $F(RI)+\varepsilon$ to η firms of type i. Using a similar logic, it can then be shown that a screened contract from a lender that invests $e\in(0,\overline{e})$ cannot be an equilibrium contract since there will exist a profitable deviation for a lender that invests in screening expertise $\overline{e}$.

Finally, it can be shown that investing $\eta c(\overline{e})$ to obtain the screening expertise $\overline{e}$ necessary to fund η firms, where η is greater than the actual number of firms screened and financed by the lender in equilibrium, cannot be an equilibrium outcome. A lender could always make a profitable deviation by investing a smaller amount $\tilde{\eta} c(\overline{e})$ where $\tilde{\eta}$ exactly matches the number of firms screened and financed by that lender.

Part 2 – Part (c) of Proposition 6 ensures that the pooling contract $F^{1,0}(R) = R - r / \left(1 - (1-p)\theta_B\right)$ is the equilibrium contract in the closed economy. Given lenders that offer screened contracts must invest in expertise $\overline{e}$, the maximum expected payoffs that domestic screened contracts $F^{1,A}$ and $F^{\lambda,C}$ can provide to firms in the closed economy are $R - r - (\kappa - \overline{e}) - c(\overline{e})$ and $\lambda(R - r) - (\kappa - \overline{e}) - c(\overline{e})$, respectively. Cream firms will prefer the pooling contract, $F^{1,0}$, if its payout, $F^{1,0}(R)$, exceeds the maximum payout of $F^{\lambda,C}$, and if cream prefer the pooling contract, then average firms must also prefer it. Following the same logic as in Parts 4-5 of Proposition 1, it can then be shown that when $\kappa > \underline{\kappa} + \overline{e} - c(\overline{e})$, the maximum possible payoff $F^{\lambda,C}$ does not exceed the maximum possible payoff of $F^{1,0}$, and hence, $F^{\lambda,C}$ and $F^{1,A}$ will not be equilibrium contracts. This $F^{1,0}$ contract is feasible when $r / \left(1 - (1-p)\theta_B\right) \le R$, which similar to the proof of Proposition 4, must hold if condition (d) of Proposition 6 holds. Following the same logic as in Parts 4-5 of Proposition 1, it can then be shown that $F^{1,0}$ is the only equilibrium contract for $\kappa > \underline{\kappa} + \overline{e} - c(\overline{e})$ and since part (c) of Proposition 6 ensures that $\kappa > \underline{\kappa} + \overline{e} - c(\overline{e})$, it must be that $F^{1,0}(R) = R - r / \left(1 - (1-p)\theta_B\right)$ is the only equilibrium contract the closed economy.

Part 3 – Using the same logic as in the proof of Proposition 2, it can be shown that condition (d) of Proposition 6 ensures that the open economy exhibits a separating equilibrium. To differentiate contracts offered by foreign lenders, I will express their contracts as $F_*^{I,k}$. Using the same logic as in parts 1-3 of the proof of Proposition 1, there are only three potential foreign lender

contracts that can be equilibrium contracts $F_*^{1,0}$, $F_*^{1,A}$, and $F_*^{\lambda,C}$, and it is sufficient to consider

contracts of the form $F_*(RI) \geq 0$ and $F_*(0) = 0$. In an economy with both domestic and foreign

lenders, the domestic lender contract, $F^{\lambda,C}$, can no longer be an equilibrium contract for domestic

lenders because of assumption (A2), and $F^{1,0}$ cannot be an equilibrium contract since $r^* < r$.

Therefore, there are only four possible equilibrium contracts: $F_*^{1,0}$, $F^{1,A}$, $F_*^{1,A}$, and $F_*^{\lambda,C}$.

Similar to parts 4-5 of Proposition 1, it can be shown that $F_*^{\lambda,C}$ only exists and is preferred

by cream firms over the pooling contract $F_*^{1,0}$ for $\kappa^* \leq \overline{\kappa} + \overline{e} - c(\overline{e})$. Competition among foreign

lenders and their zero profit condition will ensure that $F_*^{\lambda,C}(R\lambda) = \lambda(R - r^*) - (\kappa^* - \overline{e}) - c(\overline{e})$,

which exceeds the maximum possible payoff to cream firms with the pooling contract, $F_*^{1,0}$, when

$\kappa^* \leq \overline{\kappa} + \overline{e} - c(\overline{e})$. Part (d) of Proposition 6, however, ensures that $\kappa^* \leq \overline{\kappa} + \overline{e} - c(\overline{e})$, such that the

open economy must exhibit a separating equilibrium where cream firms take $F_*^{\lambda,C}$ contracts.

Part 4 – The only contract offered in a separating equilibrium with domestic and foreign

lenders will be $F_*^{\lambda,C}$ contracts. By conditions (c) and (d) of Proposition 6, it must be that

$\kappa > R - r + \overline{e} - c(\overline{e})$ and $\kappa^* > R - r^* + \overline{e} - c(\overline{e})$, which ensures that neither domestic or foreign

lenders can feasibly offer screened contracts $F^{1,A}$ and $F_*^{1,A}$ to average firms in a separating

equilibrium, and Condition (b) ensures that foreign lender cannot profitably offer $F_*^{1,0}$.

Using the same logic as in Proposition 3, one can then show that condition (d) in Proposition

6 ensures that the separating equilibrium in the open economy results in a decline in net output. In

the pooling equilibrium with domestic lenders, net output is $(\theta_A + p\theta_B + \theta_C)(R - \tilde{r})$, where

$\tilde{r} = r / (1 - (1 - p)\theta_B)$, while in the separating equilibrium where only cream firms accept projects

from foreign lenders, the net output is $\theta_C[\lambda(R - r^*) - (\kappa^* - \overline{e}) - c(\overline{e})]$. Thus, a decrease in net output

will occur when $(\theta_A + p\theta_B + \theta_C)(R - \tilde{r}) > \theta_C[\lambda(R - r^*) - (\kappa^* - \overline{e}) - c(\overline{e})]$ is true. But, condition (d) of

Proposition 6 ensures that this must hold. QED

47

Appendix H. Proof of Proposition 7

This proof will proceed in three parts. First, I prove that the conditions in Proposition 7 ensure the closed economy exhibits a pooling equilibrium with contract $F^{1,0}$. This proof parallels that of Proposition 1. Second, I prove that that these conditions also ensure that entry of a merged lender results in a separating equilibrium. This proof parallels that of Proposition 2. Finally, I prove that only cream firms are financed and net output declines in the separating equilibrium that occurs after entry of merged lenders. This proof parallels that of Proposition 3.

Part 1 – Part (c) of Proposition 7 ensures that $\kappa > \underline{\kappa}$, which following the same logic as Proposition 1 implies that the pooling contract $F^{1,0}(R) = R - r / \left(1 - (1 - p)\theta_B\right)$ is the only possible equilibrium contract in the closed economy, and this will be an equilibrium contract so long as $R - r / \left(1 - (1 - p)\theta_B\right) \geq 0$. And, $\overline{\kappa} > \kappa > \lambda(R - r^*) - \left[R\left(1 - (1 - p)\theta_B\right) - r\right] / \left(1 - \theta_A - \theta_B\right)$, as given by condition (c) of Proposition 7, ensures that $R - r / \left(1 - (1 - p)\theta_B\right) \geq 0$ must be true.

Part 2 – Since merged lenders can always offer the most competitive financial contracts (because they have both the lowest cost of screening and lowest cost of funds), it is only necessary to consider equilibria where merged lenders offer financial contracts. Using the same logic as in the proof of Proposition 2, it can be then shown that $\overline{\kappa} > \kappa$, as implied by part(c) of Proposition 7, ensures that the open economy exhibits a separating equilibrium.

Part 3 – Condition (b) and (c) of Proposition 7 ensure that neither a pooling contract with only average and bad firms or a screened contract for average firms is feasible. Therefore, only cream firms will be financed in the separating equilibrium. Using the same logic as in Proposition 3, one can then show that $\kappa > \lambda(R - r^*) - \left[R\left(1 - (1 - p)\theta_B\right) - r\right] / \left(1 - \theta_A - \theta_B\right)$, as implied by part (c) of Proposition 7, ensures that the separating equilibrium in the open economy results in a decline in net output. QED

Acknowledgments

References

[1] Acemoglu, Daron (1998) "Credit Market Imperfections and the Separation of Ownership from Control," *Journal of Economic Theory*, 78, 355-381.

[2] Agarwal, Sumit and Robert Hauswald (2010) "Distance and Private Information in Lending," *Review of Financial Studies*, 23(7), 2757-2788.

[3] Agénor, Pierre-Richard (2003) "Benefits and Costs of International Financial Integration: Theory and Facts," *World Economy*, 26(8), 1089-1118.

[4] Aleem, Irfan (1990) "Imperfect Information, Screening, and the Costs of Informal Lending: A Study of a Rural Credit Market in Pakistan," *World Bank Economic Review*, 4(3), 329-49.

[5] Arteta, Carlos, Barry Eichengreen and Charles Wyplosz (2001) "When Does Capital Account Liberalization Help More than It Hurts?" NBER working paper, 8414.

[6] Banerjee, Abhijit V., Shawn Cole and Esther Duflo (2005) "Bank Financing in India," in *India's and China's Recent Experience with Reform and Growth*, eds. Wanda Tseng and David Cowen, Hampshire, UK and New York: IMF and Palgrave-Macmillan, 138-157.

[7] Banerjee, Abhijit V., and Esther Duflo (in press) "Do Firms Want to Borrow More? Testing Credit Constraints Using a Directed Lending Program," *Review of Economic Studies*.

[8] Beck, Thorsten, Asli Demirguc-Kunt and Maria Soledad Martinez Peria (2007) "Reaching Out: Access to and Use of Banking Services across Countries," *Journal of Financial Economics* 85, 234-266.

[9] Beck, Thorsten and Maria Soledad Martinez Peria (2010) "Foreign Bank Participation and Outreach: Evidence from Mexico," *Journal of Financial Intermediation* 19, 52-73.

[10] Bekaert, Geert, Campbell R. Harvey and Christian Lundblad (2005) "Does Financial Liberalization Spur Growth?" *Journal of Financial Economics*, 77(1), 3-55.

[11] Berger, Allen N., Leora F. Klapper and Gregory F. Udell (2001) "The Ability of Banks to Lend to Informationally Opaque Small Businesses," *Journal of Banking & Finance*, 25, 2127-67.

[12] Bolton, Patrick and David S. Scharfstein (1990) "A Theory of Predation Based on Agency Problems in Finance Contracting," *American Economic Review*, 80(1), 93-106.

[13] Boot, Arnoud W.A. and Anjan V. Thakor (2000), "Can Relationship Banking Survive Competition?" *Journal of Finance*, 55(2), 679-713.

[14] Bruno, Valentina and Robert Hauswald (2011), "The Real Effect of Foreign Banks," working paper, American University.

[15] Buch, Claudia M. (2005) "Distance and International Banking," *Review of International Economics*, 13(4), 787-804.

[16] Claessens, Stijn and Neeltje van Horen (2012a) "Foreign Banks: Trends, Impact and Financial Stability," IMF working paper WP/12/10.

[17] Claessens, Stijn and Neeltje van Horen (2012b) "Being a Foreigner Among Domestic Banks: Asset or Liability?" *Journal of Banking & Finance*, 36, 1276-1290.

[18] Clarke, George R. G., Robert Cull and Maria Soledad Martinez Peria (2001) "Does foreign bank penetration reduce access to credit in developing countries? Evidence from asking borrowers," World Bank, working paper.

[19] Clarke, George R. G., Robert Cull, Maria Soledad Martinez Peria, and Susana M. Sánchez (2005) "Bank Lending to Small Businesses in Latin America: Does Bank Origin Matter?," *Journal of Money, Credit and Banking*, 37(1), 83-118.

[20] Degryse, Hans, Olena Havrylchyk, Emilia Jurzyk, and Sylwester Kozak (2012) "Foreign Bank Entry, Credit Allocation and Lending Rates in Emerging Markets: Empirical Evidence from Poland," *Journal of Banking & Finance*, 36, 2949-2959.

[21] Degryse, Hans and Steven Ongena (2005) "Distance, Lending Relationships, and Competition," *Journal of Finance*, 60(1), 231-266.

[22] Dell'Ariccia, Giovanni and Robert Marquez (2004) "Information and bank credit allocation," *Journal of Financial Economics*, 72, 185-214.

[23] Dell'Ariccia, Giovanni and Robert Marquez (2006) "Lending Booms and Lending Standards," *Journal of Finance*, 61(5), 2511-46.

[24] Detragiache, Enrica, Poonam Gupta and Thierry Tressel (2008) "Foreign Banks in Poor Countries: Theory and Evidence," *Journal of Finance*, 63(5).

[25] Edison, Hali J., Ross Levine, Luca Ricci, and Torsten Sløk (2002) "International Financial Integration and Economic Growth," *Journal of International Money and Finance*, 21, 749-776.

[26] Edwards, Sebastian (2001) "Capital Mobility and Economic Performance: Are Emerging Economies Different?" NBER working paper, 8076.

[27] Eichengreen, Barry (2001) "Capital Account Liberalization: What Do Cross-Country Studies Tell Us?" *The World Bank Economic Review*, 15(3), 341-65.

[28] Eichengreen, Barry and David LeBalang (2003) "Capital Account Liberalization and Growth: Was Mr. Mahathir Right?" *International Journal of Finance and Economics*, 8, 205-24.

[29] Galindo, Arturo, Alejandro Micco, and Guillermor Ordoñez (2002) "Financial Liberalization: Does it Pay to Join the Party?" *Economía*, 3(1), 231-261.

[30] Giannetti, Mariassunta and Steven Ongena (2009) "Financial Integration and Firm Performance: Evidence from Foreign Bank Entry in Emerging Markets," *Review of Finance*, 13(2), 181-223.

[31] Glode, Vincent, Richard C. Green, and Richard Lowery. (2012) "Financial Expertise as an Arms Race," *Journal of Finance*, 67(5), pp. 1723-59.

[32] Gormley, Todd A. (2010) "The Impact of Foreign Bank Entry in Emerging Markets: Evidence from India," *Journal of Financial Intermediation*, 19(1), pp. 26-51.

[33] Gormley, Todd A., Simon Johnson and Changyong Rhee (2011) "Ending 'Too Big to Fail': Government Policy vs. Investor Perceptions," NBER working paper 17518.

[34] Haber, Stephen and Aldo Musacchio (2011) "Foreign Banks and the Mexican Economy, 1997-2004," working paper, Stanford University and Harvard Business School.

[35] Hanson, James A. (2003) "Indian Banking: Market Liberalization and the Pressures for Institutional and Market Framework Reform" in Anne O. Krueger and Sajjid Z. Chinoy eds., *Reforming India's External, Financial, and Fiscal Policies,* Stanford University Press, California, 97-126.

[36] Henry, Peter Blair (2000) "Do Stock Market Liberalizations Cause Investment Booms?" *Journal of Financial Economics*, 58, 301-34.

[37] Holmstrom, Bengt and Jean Tirole (1997) "Financial Intermediation, Loanable Funds, and the Real Sector," *Quarterly Journal of Economics*, 112(3), 663-91.

[38] Kaminsky, Graciela and Sergio Schmukler (2008) "Short-Run Pain, Long-Run Gain: The Effects of Financial Liberalization," *Review of Finance*, 12(2), 253-292.

[39] Levine, Ross (1996) "Foreign Banks, Financial Development, and Economic Growth," in Claude E. Barfield ed., *International Financial Markets: Harmonization versus Competition*, AEI Press, Washington, DC, 224-254.

[40] Lewis, Tracy R. and David E. M. Sappington (1995) "Insurance, Adverse Selection, and Cream-Skimming," *Journal of Economic Theory*, 65, 327-358.

[41] Martin, Alberto (2010) "Adverse Selection, Credit, and Efficiency: the Case of the Missing Market" working paper, Universitat Pompeu Fabra.

[42] Mian, Atif (2003) "Foreign, Private Domestic, and Government Banks: New Evidence from Emerging Markets," working paper, University of Chicago

[43] Mian, Atif (2006) "Distance Constraints: The Limits of Foreign Lending in Poor Economies," *Journal of Finance*, 61(3), 1465-1505.

[44] Micco, Alejandro, Ugo Panizza, and Monica Yañez (2007) "Bank ownership and performance. Does politics matter?" *Journal of Banking & Finance*, 31(1), 219-241.

[45] Mistrulli, Paolo Emilio and Luca Casolaro (2008) "Distance, Lending Technologies and Interest Rates" working paper, Bank of Italy.

[46] Petersen, Mitchell A. and Raghuram G. Rajan (1995) "The Effect of Credit Market Competition on Lending Relationships," *Quarterly Journal of Economics*, 110(2), 407-443.

[47] Petersen, Mitchell A. and Raghuram G. Rajan (2002) "Does Distance Still Matter? The

Information Revolution in Small Business Lending," *Journal of Finance*, 57, 2533-2570.

[48] Quinn, Dennis P. (2000) "Democracy and International Financial Liberalization," working paper, Georgetown University.

[49] Rodrik, Dani (1998) "Who Needs Capital-Account Convertiblity?" *Princeton Essays in International Finance*, 207, 55-65.

[50] Rothschild, Michael and Joseph Stiglitz (1976) "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information," *Quarterly Journal of Economics*, 90(4), 629-49.

[51] Sengupta, Rajdeep (2007) "Foreign Entry and Bank Competition," *Journal of Financial Economics*, 84(2), 502-528.

[52] Stein, Jeremy C. (2002) "Information Production and Capital Allocation: Decentralized versus Hierarchical Firms," *Journal of Finance*, 57(5), 1891-1921.

[53] Stiglitz, Joseph E. (2000) "Capital Market Liberalization, Economic Growth and Instability," *World Development,* 28(6), 1075-86.

[54] Stiglitz, Joseph E. and Andrew Weiss (1981) "Credit Rationing in Markets with Imperfect Information," *American Economic Review*, 71(3), 393-410.

[55] Zingales, Luigi (1998) "Survival of the Fittest of the Fattest? Exit and Financing in the Trucking Industry," *Journal of Finance*, 53(3), 905-938.
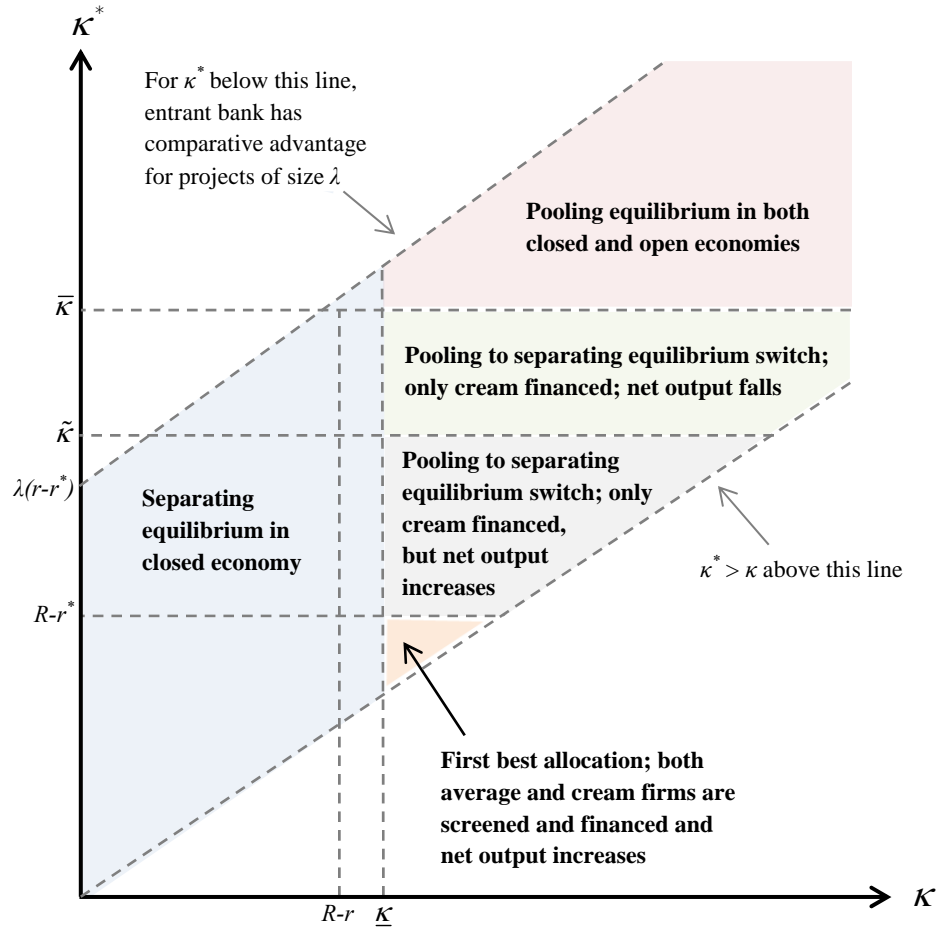
Figure 1. Example of possible equilibria for given screening costs, κ and κ^*.

This figure provides an illustrative example of possible equilibria in both the open and closed economy for a given $\theta_A, \theta_B, r, r^*, \lambda, p,$ and R, where $0 > \theta_A(R - r^*) - \theta_B(r^* - pR)$, $r > r^*$, $\underline{\kappa} \equiv \lambda(R - r) - \left(R - r / (1 - (1 - p)\theta_B)\right)$, $\overline{\kappa} \equiv \lambda(R - r^*) - \left(R - r^*(1 - (1 - p)\theta_B)\right)$, and $\tilde{\kappa} \equiv \lambda(R - r^*) - (R(1 - (1 - p)\theta_B) - r) / (1 - \theta_A - \theta_B)$.
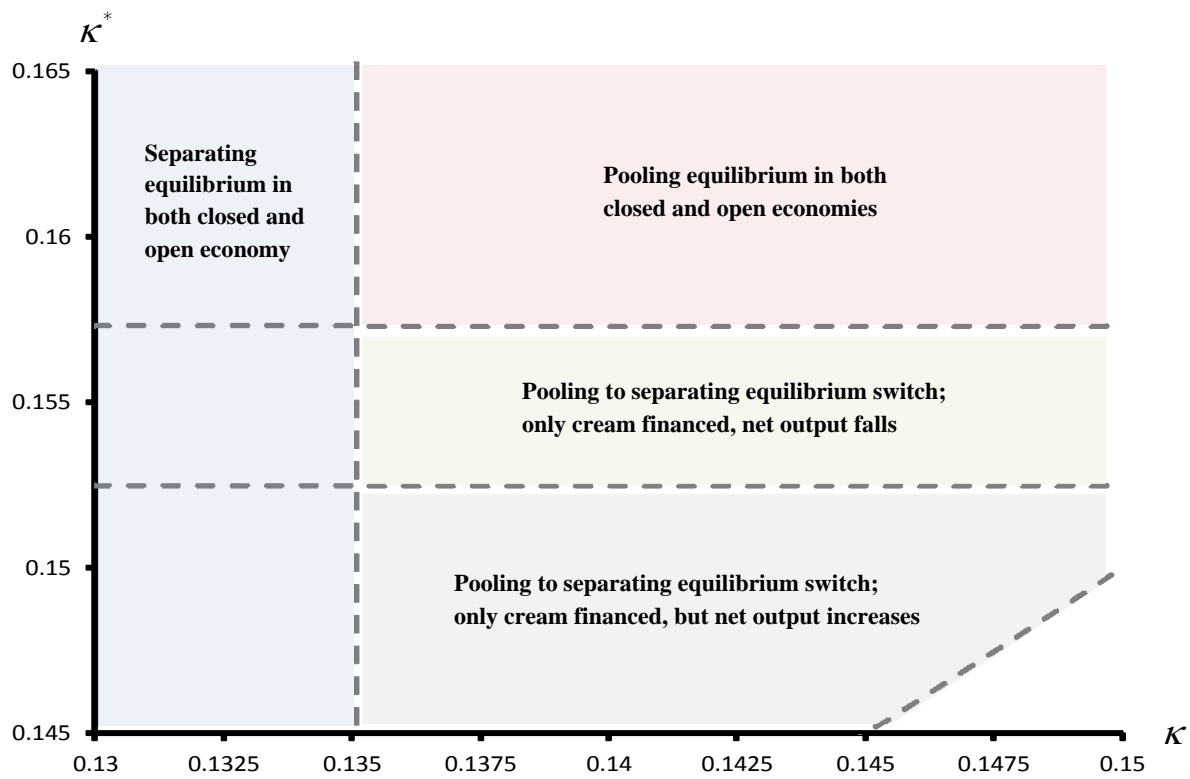
In the figure:

Vertical axis: κ^*. Horizontal axis: κ.

Text annotations:
- For κ^* below this line, entrant bank has comparative advantage for projects of size λ
- Pooling equilibrium in both closed and open economies
- Pooling to separating equilibrium switch; only cream financed; net output falls
- Pooling to separating equilibrium switch; only cream financed, but net output increases
- $\kappa^* > \kappa$ above this line
- Separating equilibrium in closed economy
- First best allocation; both average and cream firms are screened and financed and net output increases

Axis labels: $\overline{\kappa}$, $\tilde{\kappa}$, $\lambda(r - r^*)$, $R - r^*$ (vertical); $R - r$, $\underline{\kappa}$ (horizontal).

Figure 2. Numerical example of possible equilibria for given screening costs, κ and κ^*.

This figure maps the possible equilibria in both the open and closed economy for a range of κ and κ^* when $\theta_A = 0.4, \theta_B = 0.2, r = 1.09, r^* = 1.075, \lambda = 2.5, p = 0.8,$ and $R = 1.15$.

Online Appendix

Costly Information, Entry, and Credit Access

A.1 Model with Generalized Correlation between Risk and Productivity

A.1.1 Setup and Propositions

In the basic model, there is an implicit negative correlation between firms' productivity and the riskiness of their projects. Specifically, for a project of size I and probability of success p, the variance of output is given by $pI(I{-}pI)$. Since, $p = 1$ for cream firms, this variance is zero, whereas for bad firms, where $p<1$, it is something greater than zero. This can be interpreted as a negative correlation between risk and productivity.

To show that this implicit assumption on the correlation between risk and productivity is not necessary for the model's findings, it is sufficient to show that the model's findings hold in a more general framework where bad firms' projects succeed with probability of success p_L and cream firms' projects succeed with a higher probability of success $p_H > p_L$. This more general setup doesn't make any assumption about the correlation between risk and it includes possibility that $p_H = \frac{1}{2}$ and $p_L < \frac{1}{2}$, which would maximize cream firms' variance of output and ensure it exceeds that of bad firms.

Before proving that this change in assumptions doesn't affect the model's findings, it is first necessary to modify a couple other assumptions of the model to reflect the more general assumptions about probability of success. Specifically, to maintain the assumption that cream firms' projects have a positive NPV and bad firms projects have a negative NPV, it must be assumed that $p_HR > r > r^* > p_LR$. And to keep the same structure as the original model where lenders only want to finance average firms for the smaller project, I will assume that average firms succeed with probability p_H for the smaller project and probability p_L with the larger project. Assumptions (A1) and (A2) remains the same, and Assumption (A3) is now given by the following condition:

$$\frac{\theta_B}{\theta_C} > \frac{(p_HR - r)}{r - p_LR} \tag{A3}$$

With this revised setup, it is easy to see that the current version of the model in the paper is just a specific case, $p_H{=}1$ and $p_L{=}p$, of this more general model. Moreover, it can be shown that solving this

more general model proceeds in the exactly the same way as the proof of the more specific case studied

in the paper, and nothing about the intuition or general structure of the paper's propositions changes.

The range of screening costs in the general case of the closed economy where cream firms prefer

to take the pooled contract is now given by $\kappa > \underline{\kappa}$, where

$$\underline{\kappa} \equiv \lambda(p_H R - r) - \left(\frac{R[(1-\theta_B)p_H + \theta_B p_L] - r}{1 - (1-p)\theta_B} \right),$$

and Proposition 1 is now given by:

Proposition 1. *In an economy with only domestic lenders where $\kappa > \underline{\kappa}$ and*

$r / [(1-\theta_B)p_H + \theta_B p_L] \leq R$, *there exists an unique equilibrium where all firms accept an unscreened*

financial contract of size I=1 with payoffs

$$F(Y) = \begin{cases} \dfrac{R[(1-\theta_B)p_H + \theta_B p_L] - r}{1 - (1-p)\theta_B} & \text{if } Y = R \\ 0 & \text{otherwise} \end{cases}.$$

A formal proof of the modified Proposition 1 is provided below.

Then, in the open economy, the general case threshold for $\overline{\kappa}$ is given by:

$$\overline{\kappa} \equiv \lambda(p_H R - r^*) - \left(\frac{R[(1-\theta_B)p_H + \theta_B p_L] - r^*}{1 - (1-p)\theta_B} \right),$$

and Proposition 2 remains exactly the same as before, and Proposition 3 only changes slightly to become

the following:

Proposition 3: *In an economy that switches from the pooling equilibrium with domestic lenders to the*

separating equilibrium with foreign lenders and no financing of average and bad firms, net output will

decline when $(p_H R - r)\theta_A > \left([\lambda(p_H R - r^*) - \kappa^*] - (p_H R - r) \right)\theta_C + (r - p_L R)\theta_B.$

The proofs of Proposition 2 and 3 follow the exact same outline as in the paper and that of the

revised proof of Proposition 1 provided below. For this reason, I haven't included these proofs in the

appendix of this response.

Finally, Proposition 4, would now be given by:

Proposition 4. *With foreign entry, a decline in net output will occur only if the following conditions hold:*

(a) $r > r^*$

(b) $0 > \theta_A(p_H R - r^*) - \theta_B(r^* - p_L R)$,

(c) $\kappa > \max\{\underline{\kappa}, p_H R - r\}$, and

(d) $\overline{\kappa} > \kappa^* > \max\left\{ p_H R - r^*, \lambda(p_H R - r^*) - (p_H R - r) - \dfrac{(p_H R - r)\theta_A - (r - p_L R)\theta_B}{1 - \theta_A - \theta_B} \right\}$

where $\underline{\kappa}$ and $\overline{\kappa}$ are defined above. If these conditions hold, foreign entry causes a switch from a pooling equilibrium with all firms to a separating equilibrium where only cream firms are financed and net output falls.

A.1.2 Proof of Proposition #1 in Generalized Model

Given the setup described Section A.1.1, there are eight different types of financial contracts that domestic lenders could offer: $F^{1,k}, F^{\lambda,k} \ \forall k \in \{0, A, B, C\}$. The proof that the equilibrium of Proposition 1 exists and is the unique allocation will be done in five parts. In parts 1-3, I will show that 5 of the 8 financial contracts cannot be equilibrium contracts. In part 4, I will derive the conditions under which the three remaining financial contracts can co-exist in equilibrium. This will be sufficient to prove the allocation of the revised Proposition 1 exists and is unique when $\kappa > \underline{\kappa}$. Finally, in part 5, I will prove that none of the non-equilibrium contracts can be used to break the equilibrium in Proposition 1.

Part 1 – When there are $n \geq 2$ lenders offering the same contracts in equilibrium, any financial contract $F^{1,k}$ yielding negative expected profits for the lender at $t = 1$ cannot be an equilibrium contract as any individual lender could increase profits by dropping the contract. This allows me to exclude financial contracts that are ex-ante unprofitable for the lender if any firm were to accept the contract. Those contracts are: $F^{\lambda,A}, F^{1,B}$, and $F^{\lambda,B}$. Because contracts take the form of $F(RI) \geq 0$ and $F(0) = 0$, as shown in Lemma 1, and $p_L R < r$, the $F^{\lambda,A}, F^{1,B}$ and $F^{\lambda,B}$ contracts always yield a negative return for the lender and cannot be equilibrium contracts.

Part 2 – Suppose that $F^{\lambda,0}$ was an equilibrium contract. By assumption (A3) and $p_L R < r^*$, this contract can only be profitable if cream firms accept it, and will never be profitable if both cream and bad firms accept it. If $F^{1,0}$ is not also an equilibrium contract, however, then all bad firms will also choose $F^{\lambda,0}$ since Part 1 proves that $F^{1,B}$ and $F^{\lambda,B}$ cannot be equilibrium contracts. Therefore, $F^{\lambda,0}$ can only exist in equilibrium if $F^{1,0}$ also exists and bad firms choose it. But if cream firms accept $F^{\lambda,0}$, then it must be that $F^{\lambda,0}(R\lambda) > F^{1,0}(R)$, which implies that bad firms must also prefer this contract since $F(0) = 0$. Therefore, $F^{\lambda,0}$ can never be an equilibrium contract.

Part 3 – In order for the $F^{1,C}$ contract to be an equilibrium contract, it must be that lenders receive non-negative profits from offering it, such that $F^{1,C}(R) \le p_H R - r - \kappa$, and that cream firms do not prefer any other contract. But if this contract is feasible, then another lender could always feasibly offer the contract $F^{\lambda,C}(RI) = \lambda(p_H R - r) - \kappa$, and cream firms would prefer the this larger contract since its payout exceeds the maximum possible payout of screened contract for the smaller project, $F^{1,C}$. Therefore, $F^{1,C}$ cannot be an equilibrium contract.

Part 4 – From Parts 1-3, we know there are only three possible types of equilibrium contracts: $F^{1,0}, F^{1,A}$ and $F^{\lambda,C}$. Therefore, lenders either offer an unscreened contract for small projects, a screened contract for average firms, or a large screened contract for cream borrowers. Moreover, by Lemma 1, it is sufficient to consider only contracts with $F(RI) \ge 0$ and $F(0) = 0$.

In order for the $F^{1,A}$ contract to be an equilibrium contract, such that lenders have non-negative profits from offering it, such that $F^{1,A}(R) \le p_H R - r - \kappa$. Likewise, it must be that $F^{\lambda,C}(R\lambda) \le \lambda(p_H R - r) - \kappa$. Therefore, these are the maximum expected profits that these contracts can provide to average and cream firms respectively. Average or cream firms will prefer the pooling contract, $F^{1,0}$, if its payout, $F^{1,0}(R)$, exceeds the maximum payout of $F^{1,A}$ and $F^{\lambda,C}$. Moreover, if

cream prefer the pooling contract, $F^{1,0}$, then average firms must also prefer the pooling contract.

If $F^{1,0}$ is an equilibrium contract, then it must be the case that bad borrowers choose it since there is no other contract available to bad firms. In order for the contract to be feasible for lenders when all firms select it, it must be that $F^{1,0}(R) \le \left(R\left[(1-\theta_B)p_H + \theta_B p_L\right] - r\right)/\left(1-(1-p)\theta_B\right)$. When $\kappa > \underline{\kappa}$, the maximum possible payoff $F^{\lambda,C}$ does not exceed the maximum possible payoff of $F^{1,0}$, and $F^{\lambda,C}$ will not be an equilibrium contract. Likewise, $F^{1,A}$ is not an equilibrium contract. This means that $F^{1,0}$ is the unique possible equilibrium contract when $\kappa > \underline{\kappa}$. This contract, however, is only feasible when $r/\left[(1-\theta_B)p_H + \theta_B p_L\right] \le R$. Otherwise, lenders can never offer a non-negative payoff to firms, $F^{1,0}(R) \ge 0$, and also make non-negative profits. And, competition and lenders' zero profit condition ensures that $F^{1,0}(R) = \left(R\left[(1-\theta_B)p_H + \theta_B p_L\right] - r\right)/\left(1-(1-p)\theta_B\right)$.

Part 5 – To prove this is in fact an equilibrium financial contract, it must now be shown that none of the other non-equilibrium contracts can offer a potential profitable deviation for agents.

Consider the case where $\kappa > \underline{\kappa}$, and all firms are pooled on the small project. It can never be a profitable deviation for lenders to offer $F^{1,B}$ contracts since bad firms would still implement their project at a loss and the lender would now take a larger loss because it screens the bad firms. Similarly, it is never profitable to offer $F^{\lambda,A}$ since the contract will always lose money. And, $F^{1,A}$ or $F^{1,C}$ cannot be profitable deviations since a lender since $\kappa > \underline{\kappa}$ ensures that neither $F^{1,A}$ or $F^{1,C}$ can be greater than $F^{1,0}$ (i.e. be preferred by average or cream firms) and be a profitable contract for the lender. The $F^{\lambda,0}$ contract will also by unprofitable by assumption (A3) and the fact that bad will always prefer the contract if cream borrowers do. This leaves only $F^{\lambda,C}$. However, $\kappa > \underline{\kappa}$ implies that lenders can never profitably induce cream firms to take a larger contract with screening. Therefore, $F^{1,0}$ is an equilibrium contract for $\kappa > \underline{\kappa}$ and $r/\left[(1-\theta_B)p_H + \theta_B p_L\right] \le R$. QED

A.2 Model without Full Commitment

A.2.1 General Setup of Model without Full Commitment

In the basic model, I implicitly make the assumption that each lender, j, can perfectly commit to screen projects and fully commit the initial terms of any contract, F, and initial menu of contracts, F_j. This full commitment assumption was important in two key ways. First, it eliminated the possibility that lenders would renege on their commitment to screen. In a more general model, lenders will have an incentive to do this since firms never misrepresent their type in equilibrium. Second, after lenders invest in the screening technology, their optimization problem changes since the cost of screening is sunk, and the firms' type is now known. Because of this, a lender's initial contract may no longer be optimal in a more general model, and the threat to refuse financing a firm caught misrepresenting its type may not be credible. For example, financing an average firm caught misrepresenting its type might allow a foreign lender to recoup some of its initial loss, and renegotiation of the initial contract could benefit both the lender and firm ex-post. If this were true, average firms should know foreign lenders' ex-ante threat to provide zero financing is not credible.

To address these concerns, I now generalize the model and extend it to a repeated game framework where I do not make any assumptions regarding lenders' ability to commit. It will then be shown that a full commitment strategy by lenders can be derived as an optimal equilibrium strategy without affecting any of the main findings of the more basic model. This is accomplished by assuming firms can observe whether lenders have either renegotiated their financial contracts in the past or shirked on their commitment to screen contracts. With this assumption, it can be costly for lenders that renegotiate their contracts in that it may attract applicants in the future that are ex-ante unprofitable for the lender to do business with. Since these unwanted applicants will increase lenders' future costs, it will be optimal for lenders to preserve their reputation by never renegotiating or altering their financial contracts even after information about firms' types is revealed. The same type of argument holds for

lenders that may wish to save money today by not screening their contracts. The future costs of having to screen unwanted applicants that apply on the hope the lender will again fail to screen all their contracts will exceed the benefits of shirking on their commitment to screen today. Therefore, the repeated game equilibrium without full commitment will resemble a non-repeated equilibrium where full commitment is assumed.

I will also generalize the model to allow firms that receive financing to choose whether they wish to implement the project or not after obtaining financing. This is formally done by allowing firms that receive financing from a lender to choose action $q \in \{0,1\}$, where $q = 1$ indicates the project is undertaken and $q = 0$ indicates the project is not undertaken. The action q is observable to lenders. This generalization introduces an additional wrinkle into the problem in that lenders will have an incentive to offer a financial contract that actually pays firms to *not* implement the project as a way to induce bad firms to reveal themselves without having to invest in the costly screening technology.

In reality, however, lenders will not have an incentive to offer contracts that pay bad borrowers to not implement the project since this will induce all firms without projects to seek the same payoff. This will be formally captured in the model by introducing a fourth type of firm, $i = Z$, that has no project to implement and $q = 0$ is their only possible action. Additionally, there will be a continuum θ_Z of these firms, where

$$\theta_Z > \frac{\theta_B (r^* - pR)}{p(R - r^*)} \tag{A4}$$

Assumption (A4) ensures that the mass of firms without projects, θ_Z, is sufficiently large to rule out financial contracts that pay a positive amount to bad firms that abandon their low-return projects.

The remaining assumptions regarding agents remain the same as before. The timing of the model is also similar, except that the game is now repeated and allows for renegotiation of contracts after firms' types becomes known through screening. Within in each time-period t, there is now a stage game broken in six sub-periods, s, where at:

$s = 0$: firms discover their type, i

$s = 1$: lenders choose their menu of financial contracts F; firms apply for contracts

$s = 2$: lenders screen the applicants using screening technology, S

$s = 3$: lenders choose whether to renegotiate new contract, $\hat{F}$, or provide financing, I

$s = 4$: firms receiving capital make investment decision, q

$s = 5$: project outcomes are realized, financial contracts are settled

There is no discounting between sub-periods, but there is discounting between time-periods. Lenders will be long-lived in that they expect to play the game for an infinite amount of periods in the future, while firms are short-lived and only play for one period. At the start of each period, t, a new continuum $1 + \theta_Z$ of firms is born. The discount rate between time periods for each lender j is simply the inverse of their opportunity cost of funds, $1/r(j)$.

Because firms now choose whether to implement the project after receiving financing, the financial contract is now expressed as the following mapping:

$$F : \{0,1\} \times \{0, RI\} \to \mathbb{R}_+ .$$

The first argument, q, indicates whether the project is undertaken by the firm, and the second argument, Y, is again the observed output on the project.

Lender j is allowed to renege on its commitment to screen contracts at $s = 2$ and allowed to renegotiate screening contracts at $s = 3$ after firms' types become known.[1] Lenders are allowed to offer any renegotiated contract to the firm, but it is only accepted if the new contract represents a pareto improvement for both the lender and firm. Given this, firms' decisions regarding the financial contract at $s = 1$ will need to incorporate a lender $j's$ optimal decision on screening investment at $s = 2$ and incentives to renegotiate a screening contract at $s = 3$.

Let $F_t(j)$ be the set of contracts initially offered by lender j during the stage game at time t.

---

[1] There is never any incentive to renegotiate unscreened contracts since no actions are made and no new information is learned between $s = 1$ and $s = 3$ for lenders of firms accepting this type of contract.

As before, $F_{j,t}^{I,k}$ will designate a financial contract of size $I \in \{0,1\}$ and type $k \in \{0, Z, A, B, C\}$ offered by

lender j during the stage game at time t. Then, I will define $\hat{F}_{j,t}^{I,k}$ as the renegotiated contract offered at

$s = 3$. Again, a contract is a mapping of observables into a payment for the firm, and the screening

technology remains the same as before.

Let $f_t(i)$ designate the initial contract choice of firm of type i, during the stage game at time t

where $f_t(i) = \varnothing$ is allowed, and let $\hat{f}_t(i)$ represent the contract agreed upon after renegotiation. If no

renegotiation occurs, $f_t(i) = \hat{f}_t(i)$. Firm $i's$ investment decision during the stage game at time t is

given by $q_t(i)$. A strategy configuration in this economy consists of the set of contracts F_j for each

lender $j \in L$, and $\{f(i), q(i \mid f(i))\}$ for each firm $i \in E$.

Lender $j's$ screening decision during the stage game at time t is given by $S_t(j)$, and a lenders'

strategy consists of the initial set of contracts it offers, its screening decision, and renegotiated set of

contracts. As before, all actions in the stage game will be perfectly observable to all agents. Therefore,

each agent will condition its optimal decision based on actions taken by other agents in previous sub-

periods of the stage game.

Moreover, each agent in the stage game at time t will have perfect knowledge of the history of

actions taken by all lenders prior to period t. I will define $a_{j,t}$ as the actions of lender j during the

stage game at time t where $a_{j,t} = \{F_t(j), S_t(j), \hat{F}_t(j)\}$, and $a_t = \bigcup_{j \in L} a_{j,t}$. Therefore, the history known

by all agents is given by $h_t = \{a_0, a_1, ..., a_{t-1}\}$. Lastly, define H_t as the set of all possible histories, h_t, and

assume that $h_0 = \varnothing$. Since agents have knowledge of lenders' past actions, they will also condition their

decisions in the stage game at time t based on the lenders' history.

In particular, I will assume that when firms observe a lender that has either failed to screen a

contract in the past or renegotiated a contract in the past, the firms assign a probability $\varepsilon > 0$ that the

lender will do so again in the future. This will be important in that if no contract is available for firms of type i that provide a positive, expected return, a firm's choice is not $f(i) = \varnothing$ as before. Instead, a firm's next course of action will be apply for contracts from lenders that have failed to screen their contracts or have renegotiated their contracts in the past on the small hope this will occur again. These applications, which are ex ante unprofitable for lenders, will serve to provide a future cost to lenders that renegotiate contracts or fail to screen their loans.

A strategy configuration in this economy consists of $\left\{ f(i \mid h_t), q\left(i \mid \hat{f}(i), h_t\right) \right\}$ for each $i \in E$, $h_t \in H_t \ \forall t$ and $\left\{ F_t(j \mid h_t), S_t\left(j \mid \chi_t(F_t, \mathbb{F}_t), h_t\right), \hat{F}_t\left(j \mid \chi_t(F_t, \mathbb{F}_t), i, h_t\right) \right\}_{t=0}^{\infty}$ for each $j \in L$ and $h_t \in H_t$. As before, $\chi_t(F_t, \mathbb{F}_t)$ is the set of firm types in period t that accept the contract offer F_t when the set of available financial contracts is $\mathbb{F}_t$. Firms actions are limited in that $f_t(i) \in \mathbb{F}_t$, where $\mathbb{F}_t$ is the set of all $F_t(j)$'s, and $q \in \{0,1\}$. Lenders actions are limited in that $S(j) \in \{0,1\}$. Since all agents actions at time t are a function of history, h_t, I will suppress this notation in subsequent text.

The expected profit of firms at time t can be written as:

$$\pi_t : \mathbb{F}_t \times \{0,1\} \to \mathbb{R}_+$$

where the first argument denotes the financial contract. The second argument is the choice to implement, q. Given the above setup, the expected profit of a contract is

$$\pi_t(F_t^{I,k}, q = 0 \mid i) = F_t^{I,k}(0,.)$$
$$\pi_t(F_t^{I,k}, q = 1 \mid i) = p(i \mid I) F_t^{I,k}(1, RI) + \left(1 - p(i \mid I)\right) F_t^{I,k}(1,0)$$

where $p(i \mid I)$ is the probability of success for a firm of type i with a project of size I.

The expected future returns for lender j,

$$\Pi : \{0,1\} \times \{Z, A, B, C\} \times \{0,1\} \to \left[-r(j)\lambda - \kappa(j), \left(R - r(j)\right)\lambda \right],$$

is a function the lender's screening decision, $S(j)$, and a firm's type, i, and decision, q. The losses are limited below by the largest amount of capital a lender would ever extend, λ, at opportunity cost $r(j)$

for lender of type j. It is then easily shown, that:

$$\Pi_{j,t}\left(S(j),i,q=0\,|\,F_{j,t}^{I,k},s\leq 2\right)=-F_{j,t}^{I,k}(0,.)-S(j)\kappa(j)$$

$$\Pi_{j,t}\left(S(j),i,q=1\,|\,F_{j,t}^{I,k},s\leq 2\right)=[p(i\,|\,I)R-r(j)]I-\pi(F_{j,t}^{I,k},q=1\,|\,i)-S(j)\kappa(j)$$

$$\Pi_{j,t}\left(S(j),i,q=0\,|\,F_{j,t}^{I,k},s>2\right)=-F_{j,t}^{I,k}(0,.)$$

$$\Pi_{j,t}\left(S(j),i,q=1\,|\,F_{j,t}^{I,k},s>2\right)=[p(i\,|\,I)R-r(j)]I-\pi(F_{j,t}^{I,k},q=1\,|\,i)$$

Compared to the basic model discussed in the paper, the lenders' future expected returns from a given financial contract is now a function of the screening decision, $S(j)$. Moreover, it is important to note that the expected profits of the lender for going forward with a screening contract change after screening is conducted at $s=2$. The lender no longer considers the sunk cost of screening when solving its optimization problem. This was also true in the more basic model but irrelevant since full commitment ensured lenders only optimized their contracts at $s=1$. Given this, the economy's Subgame Perfect equilibrium in the repeated game is defined as:

Definition of Equilibrium: A strategy configuration, $\{F_t(j),S_t(j),\hat{F}_t(j)\}_{t=0}^{\infty}$ for each $j\in L$ and $h_t\in H_t$, and $\{f_t(i),q_t(i)\}$ for each $i\in E$, $h_t\in H_t$ $\forall t$ constitutes an equilibrium if and only if for every period t it is true that:

1. For every $\hat{f}_t(i)$ and h_t, each $i\in E$ chooses $q_t(i)\in\{0,1\}$ to maximize $\pi_{i,t}(\hat{f},q)$.

2. For every $f_t(i)$ and h_t, each $j\in L$ chooses $\hat{F}_t(j)$ to maximize

   $\Pi_{j,t}\left(S(j),i,q_t(i)\,|\,\hat{F}_t(j),s>2\right)+V_t(j)$ where $q_t(i)$ is given by condition 1.

3. For every $f_t(i)$ and h_t, each $j\in L$ chooses $S_t(j)$ to maximize

   $\Pi_{j,t}\left(S_t(j),i,q_t(i)\,|\,\hat{F}_t(j),s\leq 2\right)+V_t(j)$ where $q_t(i)$ is given by condition 1, and $\hat{F}_t(j)$ by condition 2.

4. For every set of contracts offered, $\mathbb{F}_t$, and h_t, each $i\in E$ chooses $f_t(i)\in\mathbb{F}_t$ to

   maximize $\pi_{i,t}\left(\hat{f}_t(i),q_t(i)\,|\,S_t(j)\right)$ where $q_t(i)$ is given by condition 1, $\hat{f}_t(i)$ by condition 2, and $S_t(j)$ by condition 3.

5. For every h_t, each $j\in L$ chooses $F_t(j)$ to maximize

$$\int_{i\in\chi(F_{j,t},\mathbb{F}_t)}\Pi_{j,t}\left(S_t(j),i,q_t(i)\,|\,\hat{F}_t(j),s\leq 2\right)+V_t(j) \text{ where } q_t(i) \text{ is given by condition 1,}$$

$\hat{F}_t(j)$ by condition 2, $S_t(j)$ by condition 3, and $i\in\chi_t(F_{j,t},\mathbb{F}_t)$ by condition 4, and

$$\int_{i\in\chi(F_j,\mathbb{F})}\Pi_{j,t}\left(S_t(j),i,q_t(i)\,|\,\hat{F}_t(j),s\leq 2\right)di=0 \ .$$

6. $V_t(j)=\sum_{m=t+1}^{\infty}\frac{1}{r^{m-t}}\left[\int_{i\in\chi(F_{j,m},\mathbb{F}_m)}\Pi_{j,m}\left(S_m(j),i,q_m(i)\,|\,\hat{F}_m(j),s\leq 2\right)\right]$ where $q_m(i)$ is given by

   condition 1, $\hat{F}_m(j)$ by condition 2, $S_m(j)$ by condition 3, $i\in\chi_m(F_{j,m},\mathbb{F}_m)$ by condition

   4, and $F_m(j)$ by condition 5 for all $m\geq t+1$.

Given this definition, it can be shown that there exists an equilibrium allocation similar to that of

the model in the paper. Specifically, lenders will adopt strategies to always honor their initial financial

contracts, such that $\hat{F}_t(j)=F_t(j)$ and $S(j)=1$ for $k\neq 0$. Therefore, the full commitment assumptions

of the more basic model can be generated as an optimal strategy. Since the dynamics of the economy

with or without foreign lenders are the same, I will just state the equilibrium that exhibits a separating

equilibrium similar to that of Section 4 under the special case where $R<r^*+\kappa^*$ (i.e., foreign lenders

cannot feasibly screen average firms). I focus on this special case because it generates a simple separating

equilibrium allocation in the open economy that demonstrates full commitment as an optimal strategy

for both foreign and domestic lenders.

Proposition A1. *If $\kappa^*\leq\overline{\kappa}$, there exists an equilibrium where all foreign lenders offer a financial contract of size λ to cream firms with the following payoffs:*

$$\tilde{F}_{*,t}(q,Y)=\begin{cases}\lambda(R-r^{*,C}) & \text{if } q=1,Y=R\lambda\\0 & \text{otherwise}\end{cases}\forall t$$

where $r^{*,C}\equiv r^*+\kappa^*/\lambda$ and all firms of type $i=C$ accept finance from a foreign lender and choose $q(C\,|\,\tilde{F}_*^{\lambda,C},b_t)=1$. Foreign lenders never renegotiate contracts and choose $S_t(j)=1 \ \forall t$. And if $r+\kappa\leq R$, all domestic lenders offer a contract of size 1 to average firms with payoffs

$$\tilde{F}_t(q,Y)=\begin{cases}R-r^A & \text{if } q=1,Y=R\\0 & \text{otherwise}\end{cases}\forall t$$

where $r^A \equiv r + \kappa$ and all firms of type $i = A$ accept finance from a domestic lender and choose

$q(i \mid \tilde{F}^{1,A}, b_t) = 1$. Domestic lenders never renegotiate contracts and choose $S_t(j) = 1 \ \forall t$. If $r + \kappa > R$,

$f(A \mid b_t) = \varnothing$, and $f(B \mid b_t) = \varnothing$ always. This is the only equilibrium allocation when $\kappa^* \leq \overline{\kappa}$.

The proof of Proposition A1 can be found in the next section, but the intuition as to why full commitment by lenders is an optimal strategy is straightforward. If a lender attempts to skimp on its screening in any period, it gains today but loses in the future because it destroys its reputation as a lender that always screens. With its reputation gone, all bad firms will apply for the screened financial contract in the future driving up the lender's costs. The gains from not screening will be offset by these future losses. Likewise, foreign lenders will refuse to renegotiate with average borrowers that take the cream project because this also ruins the lenders' reputation. Since all average firms of the future can observe this renegotiation and approach foreign lenders' known for renegotiation, the gains from renegotiation today are outweighed by future expected losses.[2]

Therefore, in a repeated game where firms approach lenders that occasionally do not screen projects or have shown a past willingness to renegotiate, it will always be optimal for lenders to commit to screening their projects and never renegotiate. A failure to screen or showing a willingness to renegotiate contracts will be costly for lenders in that it may attract applicants in the future that are ex-ante unprofitable for the lender to do business with. Since these unwanted applicants will increase the lenders future costs, it will be optimal for lenders to preserve their reputation by never renegotiating or altering their financial contracts.

A.2.2 Proof of Proposition A1

This proof will proceed in five parts. First, I will show that all firms are choosing the optimal investment decision q [condition 1 of the equilibrium]. Second, I will prove no lender has an incentive to renegotiate given the equilibrium contracts and investment decisions [condition 2 of the equilibrium].

---

[2] Interestingly, the reputational concerns of lenders provide another rational for bank specialization that is complementary but different from that of Stein (2002).

Third, I will prove that screening after firms have accepted a contract is optimal for lenders [condition 3 of the equilibrium]. Fourth, I will prove firms always choose the optimal contract given those available, lenders' optimal screening decision, and lenders' optimal renegotiation strategy [condition 4 of the equilibrium]. Fifth, I will prove that given optimal investment decisions, renegotiation decisions, screening decisions, and contract choices of firms, that the contracts offered are an equilibrium and provide zero profits [conditions 5 and 6]

Part 1 – For all t and h_t, all firms clearly choose the optimal action $q = 1$ given the contract offered. For cream firms with $\tilde{F}_{*,j,t}^{\lambda,C}$, $q(C \mid \tilde{F}_{*,j,t}^{\lambda,C}, h_t) = 1$ maximizes utility, and for average firms with $\tilde{F}_{j,t}^{1,A}$, $q(A \mid \tilde{F}_{j,t}^{1,A}, h_t) = 1$ clearly maximizes utility.

Part 2 – For all t, h_t, and $f_t(i)$, no lender has an incentive to renegotiate the contract at $s = 3$. It is easy to see that there does not exist any other contract that can increase both the lender and firm's expected payment, so no renegotiation is possible.

Part 3 – Both foreign lenders and domestic lenders (when $r + \kappa \leq R$) choose to screen their contracts for all t and h_t. To see this, consider a foreign lender that chooses to not screen the contract it offers in period t because it knows that only cream firms will select the contract in equilibrium. By parts 1 and 2, we know it will never want to renegotiate the contract, and the cream firms will always implement the project. Therefore, $S = 0$ yields the firm a return of

$\Pi_{j,t}\left(S_t(j) = 0, i, q_t(i) \mid \tilde{F}_{j,s}, s \leq 2\right) = \theta_C \kappa^* / n$ in period t, where n is the number of other lenders offering the same contract in equilibrium. (It avoids paying the cost κ^* for the θ_C / n firms that accept its contract in equilibrium.). Because it failed to screen, however, all bad firms in all future periods will choose to accept this lender's contract. This implies $V_t = -\theta_B \kappa^* / (r^* - 1)$. Therefore, for $S = 0$,

$\Pi_{j,t} + V_t = \theta_C \kappa^* / n - \theta_B \kappa^* / (r^* - 1)$, while for $S = 1$, $\Pi_{j,t} + V_t = 0$. Therefore, the lender will not choose $S = 0$ when

$$0 > \frac{\theta_C \kappa^*}{n} - \frac{\theta_B \kappa^*}{r^* - 1}$$

$$n > \frac{\theta_C (r^* - 1)}{\theta_B}$$

The intuition for this result is straightforward. If the foreign lender attempts to skimp on its screening in any period, it gains today but loses in the future because it destroys its reputation as a lender that always screens. With its reputation gone, all bad firms will apply for the screened financial contract in the future driving up the lenders costs. The gains from not screening will be lower than the future losses when n is high because this implies the lender finances a smaller share of the cream firms and hence, benefits less from not screening. Since, there are an infinite number of foreign lenders in the economy competing for borrowers, i.e. $n = \infty$, this condition always holds and it will never be an equilibrium strategy for lenders to not screen a contract where $k \neq 0$. A similar argument can be used to prove that domestic lenders also never have an incentive to choose $S = 0$.

Part 4 – For every set of contracts offered, $\mathbb{F}_t$, and h_t, each $i \in E$ chooses $f_t(i) \in \mathbb{F}_t$ to maximize $\pi_{i,t}\left(\hat{f}_t(i), q_t(i) \mid S_t(j)\right)$. This statement is clearly true for cream firms who always get the highest possible return by selecting $\tilde{F}_{*,j,t}^{\lambda,C}$. Likewise, when $r + \kappa \leq R$ and $\tilde{F}_{j,t}^{1,A}$ is offered, the average firms maximize their utility by selecting $\tilde{F}_{j,t}^{1,A}$. However, if $r + \kappa > R$, then average may want to choose $\tilde{F}_{*,j,t}^{\lambda,C}$ if they think the contract may be renegotiated once their type becomes known at $s = 3$. This is possible since at $s = 3$, after the screening cost is already sunk, the foreign lender could extract $R - r - \tilde{\varepsilon} > 0$ if it renegotiated and went ahead with a contract of

$$\tilde{F}_{*,t}^{1,A}(q,Y) = \begin{cases} \tilde{\varepsilon} & \text{if } q = 1, Y = R \\ 0 & \text{otherwise} \end{cases}$$

where $\tilde{\varepsilon} > 0$. The average firm would obviously prefer this new contract over receiving no contract at all which is initial agreement. Therefore, the maximum return for the lender of renegotiation at $s = 3$ is

$\Pi_{j,t}\left(S_t(j),i,q_t(i)\,|\,\tilde{F}_{j,t},s>2\right)=\theta_A(R-r^*)\,/\,n$. But, by renegotiating in period t, all average firms in the future will choose to accept this contract because the lenders' reputation for not renegotiating is destroyed. This implies $V_t=-\theta_A\left((r^*+\kappa^*)-R\right)/(r^*-1)$. Thus, renegotiation implies,

$\Pi_t+V_t=\theta_A(R-r^*)\,/\,n-\theta_A\left((r^*+\kappa^*)-R\right)/(r^*-1)$. A foreign lender that chooses to not renegotiate simply makes $\Pi_{j,t}+V_t=0$ because it does not provide them with a contract. Therefore, renegotiation will not be optimal when,

$$0>\frac{\theta_A(R-r^*)}{n}-\frac{\theta_A\left((r^*+\kappa^*)-R\right)}{r^*-1}$$
$$n>\frac{(R-r^*)(r^*-1)}{(r^*+\kappa^*)-R}$$

Again, the intuition is straightforward. If the foreign lender renegotiates the contract today, it gains back some of its initial loss in screening the average firms that approached it, but by renegotiating when no other foreign lender does, it will receive all the average firms again in the next period and thereafter. Average firms will know the lender has a reputation for renegotiation and approach it forever thereafter. But, from the perspective of today, this yields a cost to the foreign lender because it always takes a loss on average firms when $r^*+\kappa^*>R$. Again, when there are many lenders and $n=\infty$, this condition will always hold in the model and it will never be profitable for foreign lenders to renegotiate the contract. Similarly, it can be shown that domestic lenders will also never have an incentive to renegotiate their screened contracts.

Part 5 – Given the lenders never find it optimal to renegotiate or not invest in the screening technology, the lenders are in essence 'fully committed' to their financial contracts. Thus, using a similar approach as in the proofs of Proposition 1 and 2, it is then possible to show that these two contracts are equilibrium contracts in the economy following foreign entry and yield zero profits. Additionally, using the same approach as in Proposition 2, it is possible to show this is the unique equilibrium allocation of credit.