Costly Information, Entry, and Credit Access

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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. The model shows that lender entry has the potential to create a segmented market. This segmentation 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 analysis provides new insights into the unexplained consequences of foreign lenders’ entry into emerging markets.

Keywords: Financial Liberalization, Asymmetric Information, Economic Development

JEL Classification: D82, F3, G2, O16, O19.

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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 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 aggregate 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 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 affects firms’ access to credit when the entering lenders enjoy a different cost of capital and ability to acquire information about firms than incumbent lenders. Within this framework, it is possible to identify situations where entry induces a segmented credit market that adversely affects credit access for many firms. This potential decline in credit access provides new insights for understanding why entry may not always increase aggregate output. At the same time, the model provides predictions on when entry is likely to improve output. In particular, the model illustrates 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 focuses on the important role information plays in shaping competition when lenders differ in both their access to information and their cost of capital. Recent work by

¹ For example, Rodrik (1998) and Edison, Levine, Ricci and Sløk (2003) find no effect of open capital markets and financial integration. See Eichengreen (2001) 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 (2005) and Henry (2000) find positive correlations between equity market liberalization and economic performance, while Detragiache, Tressel and Gupta (2008) and Gormley (2010) find foreign bank entry to be negatively related to overall domestic credit.
Dell’Ariccia and Marquez (2004) and Sengupta (2007) demonstrate that these differences among lenders can have important implications for the overall distribution of credit. In both models, one lender, generally understood to be the ‘foreign’ lender, enjoys a cost advantage in extending finance, but at the same time has no information about firms’ quality. The ‘domestic’ (informed) lender, however, has perfect knowledge about some firms’ types but has a higher cost of funds. Under these assumptions, they show that foreign lenders’ entry will induce a segmented credit market, which has broad empirical support (Berger, Klapper, and Udell, 2001; Clarke, Cull, and Peria, 2001; Gormley, 2010; Mian, 2006), but that foreign entry will still improve credit access for all firms.

While insightful, these models suffer from a couple of weaknesses. First, they fail to explain why additional lender entry is sometimes associated with a decline in credit access. Second, they make some potentially unrealistic assumptions. In particular, it is unlikely that incumbent lenders enjoy costless access to information about firms’ quality (Aleem, 1990), and it is unlikely that entering lenders possess no ability to acquire information about firms. Therefore, I use a similar theoretical framework as the aforementioned works, but I instead make the following assumptions: one, both types of lenders have access to information about firms, and two, acquiring this information is costly for both lenders, but may be more costly for the entering lenders. In the model, lenders will acquire this information by paying a fixed screening cost per firm. By incorporating these arguably realistic observations, I am able to derive a number of novel predictions.

First, segmentation of the credit market following new lender entry has the potential to reduce credit access for many firms. The intuition is straightforward. When screening costs are sufficiently high, a competitive equilibrium may occur where incumbent lenders pool all firms together with a uniform financial contract rather than invest in the costly screening technology. Relative to the first-best allocation without information asymmetries, a pooling equilibrium over-funds low-return firms and under-funds high-return firms. But the entrance of new lenders may break this pooling equilibrium. When entering lenders have a lower cost of funds, it can be
worthwhile for them to target and finance the subset of high-return firms capable of profitably investing large amounts of capital—a practice commonly called ‘cream-skimming’. Since screening costs are fixed, entering lenders’ lower marginal cost of funds allows them to offer a more competitive contract than incumbent lenders to these high-return firms, even when the entering lenders’ have a higher cost of screening. This cream-skimming, however, reduces the average quality of firms being pooled by incumbent lenders and may eliminate the feasibility of a pooling equilibrium for firms in which incumbent lenders maintain a competitive advantage. If distinguishing the high-return firms not targeted by new lenders from the low-return firms is too costly, incumbent lenders may exit the market reducing credit access for firms not targeted by the new lenders.

This potential decline in credit 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 can increase net output by eliminating the under-financing of high-return firms capable of profitably investing large amounts of capital, and if incumbent lenders invest in the screening technology in response to entry, this investment will reduce the number of negative net present value (NPV) projects financed by incumbent lenders and also increase net output. However, if screening is too costly, such that incumbent lenders respond to this cream-skimming by exiting some sectors of the economy entirely, many positive NPV projects may lose funding. These projects will remain unfunded if neither incumbent nor entering lenders find it cost-effective to screen firms in these sectors of the economy, and as a result, net output may fall.

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 costs to screening projects, 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, 2005). Because the entering
foreign lenders are relatively disadvantaged in acquiring information about local firms (Mian, 2006; Stein, 2002), they enter via cream-skimming, which can both redirect credit towards the most profitable firms and reduce the credit access of firms that continue to rely on domestic lenders. This fits recent evidence that suggests foreign lender entry is not always associated with an increase in credit and output (E.g. Detragiache, Gupta, and Tressel, 2008; Gormley, 2010).

More broadly, the model sheds light on when the entry of new lenders is likely to reduce credit access and net output. Factors that reduce an entering lender’s relative disadvantage in screening firms will reduce the degree of segmentation and increase the number of firms that potentially benefit from additional lender entry. In the context of opening capital markets, this suggests that both the manner in which lenders enter the country—portfolio inflows, de novo branches, or acquisitions—and the quality of the country’s local institutions may be important. Whether this segmentation adversely affects net output will depend on the distribution of firms and lenders’ costs. A fall in net output is more likely to occur when screening is costly or when there are many low-return firms. This suggests the impact of lender entry will vary across countries and industries. For example, higher screening costs might occur at the country level because of undeveloped credit rating agencies or inadequate enforcement of accounting standards.2 A final implication of the model is that an adverse impact of lender entry may be short-lived. If entering lenders’ relative disadvantage in screening firms decreases with time, it is possible for net output to fall initially following entry but then gradually increase over time. These theoretical predictions suggest a number of interesting avenues for future empirical research.

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

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2 This latter argument provides a potential explanation as to why empirical studies fail to find a strong positive correlation between open capital markets and aggregate output, particularly in LDCs where domestic institutions are generally very weak (Edwards, 2001; Arteta, Eichengreen, and Wyplosz, 2001).
to the argument that competition does not always result in “survival of the fittest” (Bolton and Scharfstein, 1990; Zingales, 1998). 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 that 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, the paper is related to the growing 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 unambiguously beneficial to the growth of LDCs.3 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 (Stiglitz, 2000; Agénor, 2003; Kaminsky and Schmukler, 2008; Eichengreen and Leblang, 2003; Dell'Ariccia and Marquez, 2006). 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.

Third, the paper is related to a growing theoretical literature concerning the unanticipated effect that greater competition may have on the lending relationships that small and medium-sized firms rely on (Boot and Thakor, 2000; Petersen and Rajan, 1995). Rather than look at an 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. The finding of a potential for credit-rationing and the non-existence of equilibrium is similar to that of

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3 For example, in a memo to the World Trade Organization on June 6, 2005, delegations from Japan, the U.S., and E.U. 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.
Rothschild and Stiglitz (1976) and Stiglitz and Weiss (1981). The finding of ‘cream-skimming’ is also similar to that of Detragiache, Gupta, and Tressel (2008). In their model, segmentation can occur when entering lenders have comparative advantage in acquiring specific types of information relative to incumbent lenders, and as a result of this, firms without this type of information are never better off with additional entry. This paper differs in that it assumes entering lenders are always at an informational disadvantage and finds that entry has the potential to lower the cost of borrowing for all firms with positive NPV projects. Additionally, this paper explores how the impact of entry will depend on the distribution of firms, the relative costs of lenders, and industry characteristics.

Finally, the paper is related to the recent literature that explores the important role information plays in shaping competition when lenders differ in both their access to information and their cost of capital. As noted earlier, recent work by Dell’Ariccia and Marquez (2004) and Sengupta (2007) demonstrate that these differences among lenders can induce segmented credit markets but will still improve overall credit access. However, in Dell’Arriccia and Marquez (2004), 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. While this has the potential to generate adverse affects on credit and output similar to this paper, their paper does not explore this possibility. Moreover, by assuming incumbent lenders have perfect information about borrower types while entering lenders have no information, their framework is unable to shed light on when segmented markets will induce declines in credit access, which firms or industries are most likely to be adversely affected, and whether these changes are welfare-enhancing.

The remainder of the paper proceeds as follows. Section 1 provides the basic setup and assumptions of the model. Section 2 discusses the possible equilibria prior to the new lenders’ entry, and Section 3 describes the possible equilibria following entry. Section 4 then analyzes the factors that determine the impact of lender entry. Section 5 demonstrates the robustness of the models’ findings and discusses possible extensions. Finally, Section 6 concludes.
1 The Basic Model

1.1 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 up with a negative amount of cash.

The real sector consists of three types of firms, \( i \in \{A, B, C\} \), and a continuum \( \theta \) of each type, where \( \theta_A + \theta_B + \theta_C \) is normalized to equal 1. 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 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 in order 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, while 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, while larger projects only succeed with probability \( p \). Given this setup, the economy’s expected net output is maximized when cream firms are financed for projects of size \( \lambda \), average firms for projects of size 1, and bad firms are not financed. This is the first-best allocation of credit.

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. This ability to invest larger amounts of capital can also be
generated endogenously in the model by adding a moral hazard problem and a higher return, $R$, on the projects of cream firms. This extension is discussed in Section 5.

The financial sector consists of many perfectly competitive lenders willing to extend capital in the amount of $I \in \{1, \lambda\}$. Without the costly screening of firms, 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 problem. There will be two types of lenders: ‘domestic’ and ‘foreign’. Domestic lenders will already be extending capital to firms in the local economy, 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 overcome information asymmetries, while foreign lenders will enjoy a lower cost of funds. Specifically, domestic lenders can screen at cost $C > 0$ per firm while foreign lenders must pay $C' > C$. 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, $r'$, while 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 a screening advantage per firm while 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 and an incentive to enter the economy. To formalize this comparative advantage, the following assumptions are made:

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4 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 where 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.
\[ r^* + \frac{C^*}{\lambda} < r + \frac{C}{\lambda} < R \]  
(1)

\[ r + C < r^* + C^* \]  
(2)

Inequality (1) ensures it that projects of size \( \lambda \) are sufficiently large to provide foreign lenders the competitive advantage in financing these projects and that it is always feasible to screen and finance firms with these projects. Inequality (2) ensures that domestic lenders maintain a competitive advantage in screening and financing firms for the smaller project.

The assumed comparative advantages of domestic and foreign lenders appear to fit well in the context of international capital markets and cross-border lending. The assumption that screening costs are smaller for domestic lenders is supported by evidence that foreign lenders are informationally-disadvantaged relative to domestic lenders because of differences in institutions, culture, and distance to borrowers. For example, Mian (2006) finds distance barriers are an important informational cost for foreign banks in Pakistan, while Stein (2002) demonstrates that the greater hierarchical structure of foreign lenders likely makes it more costly for them to use the ‘soft-information’ necessary to screen firms. The assumption that foreign lenders enjoy a lower cost of funds is supported by evidence that foreign banks have lower average interest expenses and overhead costs relative to domestic banks (Mian 2003; Micco, Panizza, and Yañez 2007). One potential explanation for this is that local investors in LDCs perceive foreign banks as safer because they are backed by a large, foreign affiliate (Mian 2003) and less subject to political loans (Micco, Panizza, and Yañez 2007). Additionally, 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. Foreign lenders may also enjoy a comparative advantage in raising capital. Well-developed securities markets and better institutions in the home countries of foreign lenders may provide them access to cheaper sources of capital unavailable to lenders based in LDCs.

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5 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 2003). This likely provides them a competitive advantage in establishing additional branches from which they can raise new deposits.
1.2 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 timeline is the following: Lenders initially choose what menu of financial contracts they wish to offer firms. In doing this, will they choose both what type of financial contracts to offer and to which firms will they 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 screen applicant firms to verify their type and financing is provided to successful applicants. Finally, project outcomes are realized in the final period and all financial contracts are settled.

1.3 Financial Contracts and Strategies

Let \( F_j \) represent the menu of contracts offered by lender \( j \), where \( F_{j,k}^{i} \) 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 contract is only available to a firms where screening by the lender reveals \( i = k \). 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 non-negative payment since 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.
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, $F$, or to choosing no contract, $f(i) = \emptyset$. 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:

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

where $p(i|I)$ 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,

$$\Pi_j (i|F) = \left[ p(i|I)R - r(j) \right]I - \pi(F) - C(j)S,$$

where $r(j)$ and $C(j)$ 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 1 otherwise.

Finally, let $\chi(F,F)$ be the set of firm types that accept the contract offer $F$ when the set of available financial contracts is $F$. In other words, $i \in \chi(F,F)$ if and only if $f(i) = F$. And for clarity, $f(i) = \emptyset$ is assumed the default choice of firms when no available financial contract provides a positive expected return, and it will be assumed that all firms choose with equal probability among contracts that give the same profit when such contracts provide the highest expected return to the firm. 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 $F$ implied by $F_j$ for each lender $j \in L$, constitutes an equilibrium if and only if,

1. Given $F$, each firm $i \in E$ chooses $f(i) \in F$ to maximize $\pi(f)$. 
2. Each lender \( j \in L \) chooses \( F_j \) to maximize \( \int_{\mathcal{X}(F_j, \mathbb{F})} \prod_{j} (i \mid F_j) \omega \) where \( i \in \mathcal{X}(F_j, \mathbb{F}) \) is given by condition 1, and \( \int_{\mathcal{X}(F_j, \mathbb{F})} \prod_{j} (i \mid F_j) \omega = 0 \)

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, and all lenders make zero expected profits in equilibrium.

Before solving the equilibrium, it is first worth noting two implicit assumptions being made in the model. These assumptions greatly simplify the initial analysis, but are not crucial to results.

First, I am implicitly assuming that lenders can fully commit to their financial contracts in two ways. One, lenders will always screen financial contracts of type \( k \neq 0 \). This eliminates lenders from deterring bad borrowers by declaring all contracts will be screened, but not actually screening them. And two, lenders can fully commit to the initial 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 firms’ type, and hence, firms will have no incentive to misrepresent their type when applying for a screened financial 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.6

Second, I am assuming that all firms implement the project if they receive financing from a lender. In the absence of this assumption, lenders will have an incentive to offer a financial contract

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6 This is accomplished by assuming firms can observe whether lenders have either renegotiated their financial contracts or shirked on their commitment to screen contracts in the past. With this assumption, deviations from full commitment may attract applicants in the future that are ex-ante unprofitable for the lender to do business with. Since these unwanted applicants increase lenders’ future costs, it will be optimal for lenders to never renegotiate or alter their financial contracts. These extensions are provided in the working paper found on the author’s website.
that actually pays firms to not implement the project. This contract could be used to induce bad firms to reveal themselves without having to invest in the costly screening technology. However, this contract would likely never exist in reality since it will never be feasible for lenders to make a positive payoff to firms that identify themselves as bad as this would induce all firms and 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, a financial contract that pays a positive amount to bad firms that abandon their low-return projects will not be feasible.7

2 Equilibrium prior to Entry

In an economy that consists of only domestic lenders, the domestic cost of screening, $C$, will determine whether a pooling or separating equilibrium exists. Domestic lenders can always offer cream firms a lucrative, screened contract of size $\lambda$ that provides expected profits of $\lambda(R - r) - C$ to the firm. While this contract clearly dominates any screened contract of size 1 for a cream firm, it may not dominate an unscreened contract. Unscreened contracts avoid the cost of screening, $C$, but inevitably finance some negative NPV projects. When the cost of screening, $C$, is sufficiently high, cream firms will prefer unscreened contracts being offered by domestic lenders, resulting in a pooling equilibrium where all firms accept the same, unscreened contract. And when $C$ is sufficiently low, cream firms prefer screened contracts, resulting in a separating equilibrium.

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

$$\frac{\theta_n}{\theta_c} > \frac{(R - r)}{r - \rho R}$$

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7 Acemoglu (1998) uses a similar method to eliminate these unrealistic types of contracts, and an extension of the model that relaxes this assumption is available in the working paper found on the author’s website.
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 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 \( C > \zeta \), where \( \zeta \) is defined by equation (6), the economy can exhibit a pooling equilibrium where all firms prefer to accept a small, unscreened contract of size 1. And when \( C \leq \zeta \), the larger, screened contract, which provides a payout \( \lambda (R - r) - C \) will be preferred by cream firms, resulting in a separating equilibrium where cream firms prefer to take screened contracts for the larger investment.8

\[
\zeta \equiv \lambda (R - r) - \left( R - \frac{r}{1 - (1 - p) \theta_b} \right) \quad (6)
\]

The range of screening costs for when a separating equilibrium occurs, \( C \leq \zeta \), will be higher when the amount of capital, \( \lambda \), 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, \( \theta_b \), 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 \( C > \zeta \). The pooling equilibrium always fails to achieve the first-best allocation since cream firms fail to take on larger projects, and bad firms are financed for negative NPV investments. Funds diverted away from bad firms towards larger projects for cream firms would increase net output, and there is a potential for

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8 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.
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 \( r / [1 - (1 - p)\theta_h] \leq R \), and there does not exist any other contract capable of enticing cream firms away from the unscreened contract (i.e. \( C > C \)). This equilibrium is described in Proposition 1.

**Proposition 1.** In an economy with only domestic lenders where \( C > C \) and \( r / (1 - (1 - p)\theta_h) \leq R \), there exists an unique equilibrium where all firms accept an unscreened financial contract of size \( I = 1 \) with payoffs

\[
F(Y) = \begin{cases} 
R - r / (1 - (1 - p)\theta_h) & \text{if } Y = R \\
0 & \text{otherwise}
\end{cases}
\]

The equilibrium contract can be interpreted as a debt contract. Firms receive nothing in failure, but a positive payoff in success, with an implicit interest of \( r / (1 - (1 - p)\theta_h) > r \). This interest rate is just enough to offset lenders’ expected losses on the fraction \((1 - p)\theta_h\) of projects that will be taken by bad firms and subsequently fail. A proof that Proposition 1 is found in the appendix.

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 ‘over-financing’ of bad firms and ‘under-financing’ of ‘good’ firms. Moreover, the pooling equilibrium occurs when information asymmetries are large and the cost of screening is high, which is a common characteristic of emerging economies (Aleem, 1990). Empirical evidence also suggests a lack of screening done by domestic lenders in many emerging markets.\(^9\) Given this, I will now analyze the impact of allowing foreign lenders to enter an economy that exhibits a pooling equilibrium.

### 3 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.

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\(^9\) For an example involving banks in India, see Banerjee, Duflo and Cole (2005). Gormley, Johnson and Rhee (2010) also provide suggestive evidence that Korean bond holders did not screen their investments in 1998.
Foreign entry has no effect on the pooling equilibrium allocation of credit described in Proposition 1 if foreign lenders’ cost of screening firms is prohibitively expensive, such that $C^* > \bar{C}$ where

$$
\bar{C} \equiv \lambda (R - r^*) - \left(R - \frac{r^*}{1 - (1 - \rho)\theta^*} \right).
$$

(7)

This threshold $\bar{C}$ 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, $C^*$, since, by assumption (1), they enjoy a comparative advantage in financing cream firms. When foreign lenders’ cost of capital is sufficiently low, such that $C^* \leq \bar{C}$, foreign lenders induce cream firms in a domestic pooling equilibrium to undertake larger projects by offering them more competitive contracts for larger 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 $C > \bar{C}$ and $C^* \leq \bar{C}$, foreign entry causes a switch from a pooling equilibrium to a separating equilibrium where all cream firms accept large, screened contracts of size $\lambda$ offered by foreign lenders. If $C^* > \bar{C}$, only a pooling equilibrium exists.

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 output. The switch away from the pooling equilibrium, however, will not necessarily benefit average firms that only implement projects of size 1 with certain success. Their outcome will be determined by whether it is feasible for either a domestic or foreign lender to finance them in a separating equilibrium.

If average firms are financed in a separating equilibrium, then this will either occur through a screened contract from domestic lenders or an unscreened contract of size 1 from foreign lenders. By assumption (2), domestic lenders maintain a competitive advantage in screening average firms and can offer the most competitive screening contract to these firms. The only way foreign lenders would
finance average firms is if they can offer a more competitive, unscreened contract that pools average firms with bad firms. If either of these contracts is feasible, then the average firms will continue to be financed, and equilibrium output unambiguously increases with foreign entry.

It is possible, however, that neither of these contracts will be feasible. If \( R - r - C < 0 \), then domestic lenders cannot profitably screen average firms in the separating equilibrium. And, if \( \theta_b(r^* - pR) > \theta_A(R - r^*) \), foreign lenders cannot profitably offer an unscreened contract that pools average and bad firms. 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. While average firms do have positive NPV projects, they will not be financed because continuing to pool them with bad firms is no longer profitable, and both domestic and foreign lenders' find it too costly to screen them.

In a separating equilibrium where neither average nor bad firms are financed, the overall impact on net output will depend on the relative gains and losses from foreign entry. The entry of foreign lenders will entice cream firms to take on larger projects. This increases net output by \( [\lambda(R - r^*) - C^* - (R - r)]\theta_c \). Additionally, the inability of bad firms to obtain financing through an unscreened contract avoids \((r - pR)\theta_b\) in expected losses, further improving net output. But, the inability of average firms to obtain financing causes a loss in net output of \((R - r)\theta_A\). This suggests a possible decline in output, which is described in Proposition 3 and proven in the appendix.

**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 \( (R - r)\theta_A > (R - r^*)\theta_c + (r - pR)\theta_b \).

Proposition 3 suggests that a drop in net output following foreign entry is more likely when there is a relatively larger mass of average firms no longer being financed in the separating
equilibrium. The drop in net output is also more likely when there is a small mass of cream firms benefiting from foreign entry or when the amount of additional investment they do, $\lambda - 1$, is not very large. The drop in net output, however, is less likely if there is a large mass of bad firms no longer financed or the expected losses from financing bad firms, $(r - pR)$, is large.

The potential drop in output can be considerable, as illustrated in the following numerical example: Suppose successful projects yield a 15 percent return ($R=1.15$), and cream firms are able to implement projects of four times as large ($\lambda = 4$). Cream firms represent one-fifth of the firms, $\theta_c = \frac{1}{5}$ whereas the other firms are split equally between average and bad ($\theta_a = \theta_b = \frac{2}{5}$). Projects of bad firms only succeed with 75 percent probability ($p=0.75$). Domestic lenders cost of funds is three percent ($r=1.03$) whereas foreign lenders cost of funds is only two percent ($r^*=1.02$). Under this setup, just a two percentage point difference in screening costs for the two types of lenders will generate differing comparative advantages and a drop in output. For example, if $C=0.48$ and $C^*=0.50$, foreign entry will cause a shift from a pooling equilibrium to separating equilibrium, and net output of the economy will decline by twenty percent.

4 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 screening projects, the initial domestic allocation of credit may fail to achieve the first-best allocation because incumbent lenders 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. While new lenders may be even less effective at screening firms, their comparative advantage in funding may allow them to offer a more competitive contract to firms capable of investing large amounts of capital. Therefore, their entry can increase output by inducing these firms to take on larger projects, but at the same time, investment may be declining for other borrowers with positive NPV projects if incumbent lenders cannot
profitably to screen the remaining pool of borrowers that are not targeted by the new lenders.

The model’s predictions fit well in the context foreign lenders’ entry into LDCs. Market segmentation following foreign lenders’ entry is well documented (Berger, Klapper, and Udell, 2001; Clarke, Cull, and Peria, 2001; Gormley, 2010; Mian, 2006), as is the ambiguous impact on overall credit and output (E.g. Rodrik, 1998; Edison, Levine, Ricci and Slok, 2003; Detragiache, Gupta, and Tressel, 2008; Gormley, 2010). This potential for a decline in credit access and output is not easily understood in the context of existing models of the impact of competition between lenders with different comparative advantages in screening. These models find that the segmentation should improve credit access for all firms (Dell’Ariccia and Marquez, 2004; Sengupta, 2007).

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. In the model, two key factors were necessary for additional entry to reduce net output: the inability of average firms to obtain financing in a separating equilibrium and a relatively small number of cream firms that benefit from entry of the new lender. By analyzing the conditions under which these two factors might hold, the model is able to provide a number of predictions as to when the entry of new lenders will adversely affect net output and when it will not.

4.1 The Exit of Average Firms

The inability of average firms to obtain financing in a separating equilibrium occurs when domestic lenders are unable to profitably screen these firms and it is also unprofitable to pool firms not screened by foreign lenders. In particular, we have the following corollary:

**Corollary 1:** With foreign entry, net output will increase unless both of the following conditions are true:

(a) \( \theta_2 (r^* - pR) > \theta_1 (R - r^*) \)

(b) \( r + C > R \)

Condition (a) of Corollary 1 states that there must be sufficient number of bad firms seeking
credit that it is unprofitable for lenders to pool only the bad and average firms onto an unscreened contract. Condition (b) states that the domestic lending costs, $r$ and $C$, must be sufficiently high that domestic lenders also do not find it profitable to screen the average firms.

The first condition suggests that impact of lender entry will depend on the distribution of firms and the expected of losses and gains of financing average and bad firms. A drop in net output and credit access is more likely in markets where bad entrepreneurs represent a larger fraction of entrepreneurs (i.e. $\frac{\theta_{b}}{\theta_{A}}$ is large), when the expected losses from financing a bad firm, $r^*-pR$, is high, or when the expected gain from financing an average firm, $R-r^*$, is low. This might include industries that represent new product markets, where there are many entrants but only a handful of firms that eventually achieve success. This might also include industries with significant entry costs, where losses on bad investments are likely to be large and the gains from success are small. From a policy perspective, limiting lender entry into these types of industries may actually be beneficial, while fostering lender entry into industries that do not have these characteristics will increase net output.

The second condition suggests that costs for incumbent lenders will also be important. Industries where it is easier for lenders to assess a borrower’s potential (i.e. low $C$), will 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. Strong credit rating agencies or enforcement of accounting standards may make screening less costly for lenders. This suggests that policies to strengthen local institutions prior to lender entry may be important, which is consistent with recent empirical evidence (Edwards, 2001; Arteta, Eichengreen, and Wyplosz, 2001). A drop in net output will also be less likely when entry results in a transfer of technology to incumbent lenders, as suggested by Levine (1996), reducing either their cost of funds, $r$, or their cost of screening, $C$.

4.2 The Extent of Cream-Skimming

A second factor that is needed for a decline in net output is that the gain in output from firms
taking on larger loans from new lenders be less than the loss in output from firms no longer financed in the separating equilibrium. As shown in Proposition 3, an increase in the number of firms that entering lenders can offer more competitive contracts to, $\theta_C^{-}$, and a decrease in the number of firms they cannot, $\theta_A^{-}$, would increase the likelihood of net output rising. While the ratio of these firms is given exogenously in the model, it is implicitly determined by entering lenders’ screening cost, $C^*$. Entering lenders enjoy a comparative advantage when their per unit cost, $r^* + C^*/I$, is less than the incumbent’s per unit cost, $r + C/I$, which can be rewritten as $C^* < I(r - r^*) + C$.

For a given distribution of firms and set of possible investment sizes, $I$, the ratio of firms entering lenders could profitably offer more competitive contracts to would be increasing as $C^*$ declines. Thus, for a smaller $C^*$, there will be less cream-skimming and more firms expanding output following foreign lender entry. This will reduce the likelihood that net output declines when some firms are no longer financed in a separating equilibrium.

Since $C^*$ may reflect industry- and country-specific factors, we would again expect the impact of additional lender entry on net output to vary across industries and countries. In industries where it is costly to screen a borrower’s potential, lender entry would be more likely be limited to a handful of firms, reducing the likelihood of an increase in net output following entry. In the context of opening capital markets, country-level policies regarding the foreign capital inflows may also be important. For example, policies that restrict foreign lender entry to de novo branching and prohibit the acquisition of domestic lenders (and hence, local information) might increase foreigners’ cost of screening, $C^*$, and the likelihood of adverse implications.11 A lenders’ cost of screening and the impact of their entry may also vary over time. The accumulation of knowledge about the local market over time may lower the screening cost of new lenders and broaden the set of firms they can profitably screen.

11 These differences in openings could potentially provide an explanation as to why studies of foreign lenders’ entry in Eastern Europe tend to find more positive effects on aggregate output (Giannetti and Ongena, 2009), whereas studies of countries that restrict acquisitions, such as India, have found signs of cream-skimming and drops in credit access for many firms (Gormley, 2010).
Therefore, it is possible that a decline in net output following entry may be temporary.

5 Robustness and Extensions

This section will discuss the robustness of the model’s main implications. First, I will demonstrate that allowing domestic lenders to borrow from foreign lenders will not affect the main findings so long as the degree of asymmetric information between lenders is sufficiently large. Second, I will show that the findings are robust to more general assumptions regarding the distribution of firm types in regard to size and profitability of projects.

5.1 Cooperation among Lenders

One type of foreign that would be less likely to reduce net output and credit access would be an entry where foreign lenders provide the capital and domestic lenders provide the screening. By combining the cost advantage of each lender, this type of entry minimizes the per unit cost of screening and financing firms, reducing the likelihood that lenders find it unprofitable to screen and finance average firms in the separating equilibrium. So long as $r^* + C \leq R$, a screened contract for average firms would be feasible, and net output would increase with entry.

Such borrowing arrangements, however, may fail to be feasible in the presence of information asymmetries. If screening is not perfectly observable, domestic lenders will always have an incentive to shirk on their obligation to screen after foreign lenders provide capital for projects. Foreign lenders would either need to incur a cost to detect screening or provide compensation to domestic lenders in excess of the true cost of screening, $C$, to ensure the domestic lenders’ incentives are properly aligned. These added costs can render this arrangement between domestic and foreign lenders unprofitable even when $r^* + C \leq R$.¹²

To illustrate this, consider the following example: Foreign lenders may contract a domestic lender to do screening on a loan designated for an average firm. If the project is successful, the

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¹² This moral hazard problem would be very similar to that of Holmstrom and Tirole (1997).
domestic lender is paid an amount $Y$. If the project fails, which would only occur if the domestic lender did not screen and a bad firm was allowed to take the contract, the domestic lender is paid nothing. To ensure that screening of the loan is done, a foreign lender must ensure the following incentive compatibility constraint of the domestic lender holds:

$$ Y - C \geq [1 - \gamma(1 - p)]Y $$

where $1 > \gamma > 0$ is the likelihood of a bad firm applying for such a loan if it is unscreened by the domestic lender. With screening, the domestic lender receives $Y - C$ with certainty since only an average firm would get the loan. Without screening, the domestic lender avoids the cost of screening, $C$, but has a $\gamma(1 - p)$ probability that a bad firm takes the loan and fails, providing a zero payoff. Rewriting this constraint, it is easy to see that a foreign lender must provide a payment $Y > C$ to the domestic lender to ensure screening is done. If $r^* + Y > R$, then this type of arrangement will never be profitable for a foreign lender to engage in.\(^\text{13}\)

5.2 Distribution of Firms and Endogenizing the ‘Size’ of Projects

The basic mechanisms of the model are also robust to allowing for a richer distribution of firms with varying project sizes, $\lambda$, and returns, $R$. In such a model, the screening cost thresholds, $C$ and $\bar{C}$, would simply become firm-specific. For instance, a cream firm $i$ with a project of size $\lambda(i)$ and return $R(i)$ such that $C(i) \geq C$, would be screened and financed fully in the economy without foreign lenders. And, all cream firms with smaller projects or returns, such that, $C(i) < C$, 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.

The assumption that cream firms can successfully invest larger amounts of capital than

\(^{13}\) Another potential way to resolve the moral hazard problem is to require domestic lenders contribute some of their own capital to the project (i.e. require they have ‘skin in the game’). But, given their higher cost of funds, this will again increase the per unit cost of the contract and reduce the likelihood of the contract being feasible.
average firms also can be generated endogenously in a credit model with ex-post moral hazard. In particular, the following assumptions could be added to the model: Firms may now invest capital in any amount \( I \in [1, \infty) \), and all firms begin out with some non-zero amount of wealth, \( W' \in (0, 1) \), that can be used towards the investment. The assumption that initial wealth is less than 1 is necessary to ensure that firms still need to borrow to do an investment. Firms borrowing money will suffer from a moral hazard problem in that they have the ability to abscond with the borrowed money, \( I - W' \), and their own wealth, \( W' \), rather than do the investment. Absconding succeeds with probability \( \tau \), providing a payoff \( I \), and with probability \( 1 - \tau \), they are caught and receive a zero payoff.

With this setup, the financial contracts of lenders, \( F \), must now also satisfy the below incentive compatibility constraint of the firm:\(^{14}\)

\[
p(i \mid I) F(RI) + (1 - p(i \mid I)) F(0) > \tau I
\]

This condition states that the expected return to firm of type \( i \), investing an amount \( I \) under a financial contract \( F \), needs to exceed to the expected return of absconding. When financial contracts have a debt component, this constraint will endogenously place an upper bound on how levered, \( I/W' \), lenders will allow firms to become, and hence, the amount of capital, \( I \), that firms can invest. If a lender allows a firm to borrow too much, the firm will prefer to abscond with the money.

Importantly, the upper bound on \( I \) will be increasing in the return, \( R \). So, if cream firms generate a higher expected return on their projects, this will endogenously generate a cream firm’s ability to invest larger amounts of capital. To see this, the above expression can be rewritten assuming that the lender offers a debt contract with interest rate \( r_g \) and the firm’s probability of success, \( p(i \mid I) \), equals 1. The constraint is now:

\[
RI - r_g(I - W') > \tau I
\]

This constraint can then be rewritten as an upper bound on the amount firms can invest,

\(^{14}\)The contracts must also now satisfy a slightly different participation constraint in that a firm’s outside option is now their initial wealth, \( W' \), rather than zero. This change does not qualitatively affect the model.
\[ r_d W / (\tau - R + \eta) \], which is increasing the firms initial wealth, \( W \), and expected return, \( R \).^{15}

6 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 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’ use their lower cost of funds to offer more competitive financial contracts but only finance firms capable of profitably investing large amounts of capital because of their higher cost of acquiring information about domestic firms. This type of entry may both redirect credit towards the largest, most profitable firms in the economy and reduce the credit access of informationally-opaque firms with positive NPV projects that rely solely on domestic lenders. 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 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, and the severity of information asymmetries. This yields a number of testable hypotheses on how the impact of lender entry may vary by industry and country and suggest a

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15 This upper bound on \( I \) assumes that the per unit expected return of absconding, \( \tau \), exceeds the per unit expected return of borrowing for the firm, \( R - \eta \).
number of interesting avenues for future empirical research. It 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 implications of the model are potentially quite broad. The findings hold for a very general set of financial contracts, competitive environments, and distribution of firms. The findings are also not sensitive to assumptions about lenders’ ability to coordinate so as to capitalize on each lender’s comparative advantage. The model also broadens the set of scenarios where 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.
7 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 the same 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 \( \pi(F^{I,k} \mid i = k) = p(k \mid I)F^{I,k}(RI) + [1 - p(k \mid I)]F^{I,k}(0) \equiv \Pi \) for the firm and an expected profit of \( \Pi_{j}(k \mid F^{I,k}) = [p(k \mid I)R - r(j)]I - \pi(F^{I,k} \mid k) - C(j) \) 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 \( F^{I,k}(RI) = \Pi / p(k \mid I) \).

For financial contracts where \( k = 0 \) and all borrowers accepting it in equilibrium have the same probability of success, \( \hat{p}(i \mid I) \), a similar reasoning holds. A payment of \( F(RI) = \Pi / \hat{p}(i \mid I) \) 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, \( \hat{p}(i \mid I) \), the expected pay-
ment for all agents cannot be replicated using a contract with \( F^{1,k}(0) = 0 \). However, it can be shown that a contract with \( F^{1,k}(0) > 0 \) cannot exist in equilibrium when \( k = 0 \) and not all borrowers accepting the contract have the same probability of success. Consider the case where \( n \geq 2 \) lenders offer a contract with \( F^{1,0}(R_I) = G \geq 0 \) and \( F^{1,0}(0) = H > 0 \). If a continuum of entrepreneurs accept the contract where a fraction \( \alpha \) only succeed with probability \( p \), the expected return for each lender is given by \[ \frac{[1 - \alpha(1 - p)][(R_I - G) - \alpha(1 - p)H - rL]}{n} \] and this must equal zero in equilibrium. A lender that offered a contract where \( F^{1,0}(R_I) = G + \epsilon \) and \( F^{1,0}(0) = 0 \) for some \( \epsilon \in \left((1 - p) / p \right)H, 0 \), however, would make profits of \( (1 - \alpha)(R_I - G - \epsilon - rL) \) because only firms with probability of success 1 will take this new contract. And, for \( (1 - \alpha)(R_I - G - \epsilon - rL) > 0 \) this contract will be more profitable. But, since \( [1 - \alpha(1 - p)][(R_I - G) - \alpha(1 - p)H - rL = 0 \) in any equilibrium, it must be true that \( R_I > G + rL \) when \( H > 0 \). Therefore, there exists some \( \epsilon \) sufficiently small such that \( (1 - \alpha)(R_I - G - \epsilon - rL) > 0 \). Therefore, contracts with \( k = 0 \) and \( H > 0 \) can never be an equilibrium contract. QED

**B – Proof of Proposition 1**

Given the setup, there are eight different types of financial contracts that domestic lenders could offer: \( F^{1,k}, F^{2,k}, \forall k \in \{0, A, B, C\} \). The proof that the equilibrium of Proposition 1 exists and is the unique allocation will be done in six parts. In part 1, I will prove that it is sufficient to only consider contracts of the form \( F(R_I) > 0 \) and \( F(0) = 0 \) when the number of lenders offering identical contracts is \( n \geq 2 \). In parts 2-4, I will show that 5 of the 8 financial contracts cannot be equilibrium contracts. In part 5, 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 $C > \underline{C}$. Finally, in part 6, I will prove that none of the non-equilibrium contracts can be used to break the equilibrium in Proposition 1.

Part 1 – From Lemma 1, we know it is sufficient to consider only equilibrium contracts with $F(RI) \geq 0$ and $F(0) = 0$. If $F(RI) = 0$, however, no firm would actually accept the contract in equilibrium (since by default they choose $f = \emptyset$ if no contract provides a positive return.) Thus, it must be possible to represent any equilibrium contract as $F(RI) > 0$ and $F(0) = 0$.

Part 2 – 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: $F^{A,A}$, $F^{1,b}$, and $F^{A,b}$. Given $pR < r$, the $F^{A,A}$, $F^{1,b}$ and $F^{A,b}$ contracts always yield a negative return for the lender when the contract takes the form $F(RI) > 0$ and $F(0) = 0$.

Part 3 – Suppose that $F^{2,0}$ was an equilibrium contract. By assumption (5) 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. When $F(RI) > 0$ and $F(0) = 0$ in equilibrium, however, it is easy to see that if cream firms prefer this contract in equilibrium, then it must be that $F^{2,0}(R\lambda) > F^{1,0}(R)$. But, $F^{2,0}(R\lambda) > F^{1,0}(R)$ implies that bad firms must also prefer this contract since Part 2 proves that $F^{1,0}$ and $F^{A,0}$ are the only possible contracts available to bad firms in any equilibrium. Therefore, $F^{2,0}$ can never be an equilibrium contract.

Part 4 – 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 $F^{1,C}(R) < R - r - C$, and that cream firms do not prefer any other contract. But by assumption (1), another lender could always feasibly offer the
contract $F^{k,c}(R) = \lambda(R - r) - C$, and cream firms would prefer the this larger contract since its payout exceeds the maximum possible payout of screened contract for the smaller project, $F^{k,c}$. Therefore, $F^{k,c}$ cannot be an equilibrium contract.

Part 5 – From Parts 2-4, we know there are only three possible types of equilibrium contracts: $F^{1,0}$, $F^{1,A}$ and $F^{2,c}$. 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 Part 1, it is sufficient to consider only contracts with $F(RI) > 0$ and $F(0) = 0$.

In order for the $F^{1,c}$ contract to be an equilibrium contract, such that lenders have non-negative profits from offering it, such that $F^{1,c}(R) \leq R - r - C$. Likewise, it must be that $F^{2,c}(R \lambda) \leq \lambda(R - r) - C$. 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 $F^{1,c}$ and $F^{2,c}$. 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 $F^{1,0}(R) \leq R - r / (1 - (1 - p) \theta_b)$. When $C > C$, the maximum possible payoff $F^{2,c}$ does not exceed the maximum possible payoff of $F^{1,0}$, and $F^{2,c}$ 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 $C > C$. This contract, however, is only feasible when $r / (1 - (1 - p) \theta_b) \leq R$. Otherwise, lenders can never offer a positive payoff to firms, $F^{1,0}(R) > 0$, and also make non-negative profits. And, competition and lenders’ zero profit condition ensures that $F^{1,0}(R) = R - r / (1 - (1 - p) \theta_b)$.

Part 6 – 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 \( C > \underline{C} \), and all firms are pooled on the small project. It can never be a profitable deviation for lenders to offer \( F^{1.0} \) 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 \( F^{2.\lambda} \) since the contract will always lose money. And, \( F^{1.\lambda} \) or \( F^{1.C} \) cannot be profitable deviations since a lender since \( C > \underline{C} \) ensures that neither \( F^{1.\lambda} \) 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 \( F^{2.0} \) contract will also by unprofitable by assumption (5) and the fact that bad will always prefer the contract if cream borrowers do. This leaves only \( F^{2.C} \). However, \( C > \underline{C} \) 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 \( C > \underline{C} \) and \( r/(1-(1-p)\theta_u) < R \). QED

\[ C – Proof of Proposition 2 \]

To differentiate contracts offered by foreign lenders, I will express their contracts as \( F^{i.k} \).

Using the same logic as in parts 1-4 of the proof of Proposition 1, there are only three potential foreign lender contracts that can be equilibrium contracts \( F^{i.0} \), \( F^{i.\lambda} \), and \( F^{i.C} \), and it is sufficient to consider contracts of the form \( F_i(RI) > 0 \) and \( F_i(0) = 0 \). In an economy with both domestic and foreign lenders, \( F^{i.\lambda} \) cannot be an equilibrium contract for foreign lenders because domestic lenders can always offer a higher payoff to average firms with \( F^{i.\lambda} \) because of assumption (2). Likewise, the domestic lender contract, \( F^{\lambda.C} \), can no longer be an equilibrium contract for domestic lenders because of assumption (1), and \( F^{1.0} \) cannot be an equilibrium contract since \( r^* < r \). Therefore, there are only three possible equilibrium contracts: \( F^{1.0} \), \( F^{1.\lambda} \), and \( F^{1.C} \).

Similar to parts 5-6 of Proposition 1, it can be shown that \( F^{2.C} \) only exists and is preferred
by cream firms over the pooling contract $F_{i}^{1,0}$ for $C^\ast \leq \bar{C}$. Given assumption (1), the $F_{i}^{2,A,CC}$ contract is feasible for foreign lenders to offer, and competition among foreign lenders and their zero profit condition will ensure that $F_{i}^{2,A,CC} (R \lambda) = \lambda (R - r^\ast) - C^\ast$, which exceeds the maximum possible payoff to cream firms with the pooling contract, $F_{i}^{1,0}$, when $C^\ast \leq \bar{C}$. QED

D – Proof of Proposition 3

In the pooling equilibrium with domestic lenders, net output is $(\theta_A + \theta_c)(R - r) - \theta_b(r - \rho R)$, while in the separating equilibrium where only cream firms accept projects from foreign lenders, the net output is $\theta_c [\lambda (R - r^\ast) - C^\ast]$. Thus, a decrease in net output will occur when

$$(R - r)\theta_A > (\lambda (R - r^\ast) - C^\ast) - (R - r)\theta_c + (r - \rho R)\theta_b$$

is true. QED

E – Proof of Corollary 1

When $C^\ast > \bar{C}$, the economy continues to exhibit a pooling equilibrium, and the proof of this parallels the proof of Proposition 1. Given this, net output does not decline with foreign entry. In fact, net output will rise since the cost of funds declines with foreign entry.

When $C^\ast \leq \bar{C}$, the economy with foreign and domestic lenders will exhibit a separating equilibrium since cream firms will prefer a screened contract, as shown in Proposition 2. As shown in the proof of Proposition 2, there are only two other possible equilibrium contracts in an economy with both foreign and domestic lenders: $F_{i}^{1,0}$ and $F_{i}^{1,A}$. If $F_{i}^{1,0}$ 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, $F_{i}^{1,0}$ only exists if both bad and average firms take the contract, and the maximum payout that lenders can offer with such a contract is $F_{i}^{1,0} \leq R - r[(\theta_A + \theta_b) / (\theta_A + p \theta_b)]$. The maximum payout that domestic lenders can offer for the screened contract is $F_{i}^{1,A} \leq R - r - C$. If both $R - r - C < 0$ and $R - r[(\theta_A + \theta_b) / (\theta_A + p \theta_b)] < 0$, 

however, then neither contract can provide a positive payoff to firms, and $F_{r}^{A,C}$ is the only equilibrium contract. Neither average nor bad firms will receive financing in this separating equilibrium. This allows for a potential drop in net output as shown in Proposition 3.

However, if either $R - r - C < 0$ and $R - r[(\theta_{A} + \theta_{B}) / (\theta_{A} + p\theta_{B})] < 0$ is not true, then there will exist an equilibrium contract that is taken by average firms. If $F_{r}^{A,4}$ is the equilibrium contract taken by average firms, then the economy achieves the first best allocation and net output unambiguously rises from the pooling equilibrium since bad firms are no longer financed. If $F_{r}^{1,4,0}$ is the equilibrium contract taken by average firms, then net output also rises since the only change is that cream firms begin implementing larger projects while average and bad firms continue to be pooled on the unscreened contract. QED


