Open Capital Markets in Emerging Economies: The Social Costs and Benefits of Cream-Skimming

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Abstract

This paper analyzes the impact of opening capital markets using a theoretical model that incorporates both foreign and domestic lenders in the presence of asymmetric information. The model suggests that when foreign lenders are limited in their ability to obtain information about entrepreneurs, they may engage in cream-skimming by only targeting the largest, most profitable firms. This cream-skimming can induce a reallocation of credit that may either increase or decrease overall net output of the open economy. The consequences of this credit reallocation depend on the type of financial opening and the quality of domestic institutions.

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Prior to the East-Asian financial crisis, the benefits of open capital markets in emerging economies were widely praised. Open capital markets were presumed to increase risk sharing, lower the cost of capital, and alleviate domestic liquidity constraints. Greater competition from foreign lenders was also thought to improve the allocation of credit and corporate governance of entrepreneurs in emerging economies. As a result, many less-developed countries (LDCs) liberalized their capital controls during the 1980s and the early 1990s, resulting in significant financial inflows. By 1995, capital inflows averaged five percent of GDP for both developed and LDCs.1

Following the East-Asian financial crisis, however, many questioned the presumed benefits of financial globalization.2 In particular, Rodrik (1998) found no positive correlation between open capital markets and economic performance across roughly 100 countries. This evidence (or lack thereof) spurred an enormous literature studying the effect of capital controls. Subsequent empirical studies, however, have generated very little consensus regarding the effect of capital account openness on economic growth and investment. For example, Edwards (2001) finds a positive correlation between capital account openness and economic performance, but only for more developed economies. Arteta, Eichengreen, and Wyplosz (2001) find similar evidence, but note it is “decidedly fragile”, while Edison, Levine, Ricci and Slok (2003) find no effect of financial integration.3 More recent research focusing on the specific impact of foreign participation in domestic equity markets and foreign bank entry also reaches differing conclusions.4

A primary argument for the inconclusive evidence is that open capital markets increase countries’ economic volatility and exposure to financial crises. Such volatility can be particularly problematic in emerging economies with inadequate institutions. Subsequently, it is thought that policies limiting the risks of financial instability will ensure the benefits of open capital markets are

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1 See Bosworth and Collins (1999), pp. 149.
2 For example, Bhagwati (1998) argues the claims of benefits from free capital mobility are “not persuasive”.
3 See Eichengreen (2001) for a more detailed review of the literature.
4 For example, Bekaert, Harvey and Lundblad (2006) and Henry (2000) find positive correlations between equity market liberalization and economic performance, while Detragiache, Tressel and Gupta (2005) and Gormley (2006) find foreign bank entry to be negatively related to domestic credit.
realized. Particular emphasis is given to the mismatching of short-term foreign liabilities and long-term domestic assets that can expose domestic intermediaries to financial panics by international lenders or large exchange rate fluctuations.\textsuperscript{5} The presumption that foreign lenders’ entry otherwise improves the domestic credit access remains largely unquestioned.

This paper addresses this continued presumption directly by assessing whether open capital markets necessarily increase output in emerging economies, even in the absence of increased financial volatility. Standard financial theories that incorporate information asymmetries demonstrate that credit may be rationed in equilibrium (Stiglitz and Weiss 1981), and that greater competition among lenders may increase credit rationing (Petersen and Rajan 1995). Such models imply that by increasing competition from foreign lenders, opening capital markets may actually reduce credit and output in emerging economies, where the lack of information about borrowers and the absence of protection for lenders make information asymmetries particularly acute.

To illustrate this point, I develop a theoretical model of financial competition between foreign and domestic lenders that includes information asymmetries between entrepreneurs and lenders. The model extends on existing theory by directly incorporating the differences between foreign and domestic competition and by allowing lenders to differ in their access to funds and information about borrowers. The primary assumption driving the model is that foreign lenders have access to credit at a lower cost, but less access to information about domestic borrowers.

Making use of this variation, the model demonstrates that changes in the distribution of credit may be a more important aspect of financial globalization’s impact than overall changes in economic output and investment. The theory suggests that large, profitable domestic projects are more likely to be financed in the open economy, and negative net present value (NPV) projects are less likely. This redistribution from low to high return projects can increase total factor productivity and net output in the opening economy. However, foreign lenders’ entry can also reduce credit

access for smaller or informationally opaque entrepreneurs with positive NPV projects. This drop in credit to ‘opaque’ entrepreneurs decreases net output and can occur if domestic lenders are ill-equipped to cost-effectively identify borrowers’ types. Thus, the effect of opening capital markets on overall investment or net output is ambiguous when information asymmetries are large.

The intuition of these theoretical findings is straightforward. Lenders face a range of potential projects to finance, but lack information on borrower quality. When costs of screening entrepreneur quality are sufficiently high for domestic lenders, a competitive equilibrium may occur where lenders pool all borrowers rather than invest in costly screening technologies. Relative to the first-best allocation without information asymmetries, a pooling equilibrium over-finances low-return entrepreneurs and under-finances high-return entrepreneurs. The entrance of foreign lenders can break this pooling equilibrium. Using their lower cost of funds, foreign lenders can undercut domestic lending rates for the most profitable entrepreneurs. Through this ‘cream-skimming’, foreign competition alleviates the under-financing of high-return projects but also reduces the quality of projects being pooled by domestic lenders. This decrease in borrower quality increases incentives for domestic lenders to invest in screening technologies which reduces the number of negative NPV projects financed. However, if screening is costly, domestic lenders may instead exit some sectors of the economy entirely, leaving many positive NPV projects un-financed. Neither foreign nor domestic lenders will find it profitable to operate in these sectors, and such exits are more likely for industries or entrepreneurs that are more informationally opaque.

The theory provides a number of testable hypotheses regarding changes in the distribution of credit following a financial opening. First, foreign entry is likely to coincide with ‘cream-skimming’ behavior by foreign lenders and a reduction of credit by domestic lenders. Gormley (2006) finds evidence of exactly this following the entry of foreign banks in India during the 1990s. Second, the model provides predictions regarding the distributional impact of various types of capital market liberalization. Types of openness that yield a smaller informational gap between domestic and foreign
lenders or allow domestic lenders access to international capital markets will exhibit less ‘cream-skimming’ and a smaller likelihood that credit access is impaired for informationally opaque entrepreneurs. Third, local institutions that reduce lenders’ costs of overcoming information asymmetries will mitigate ‘cream-skimming’ and adverse distributional outcomes. To the author’s knowledge, no direct empirical studies of the latter two hypotheses exist.

The theoretical findings are related to various strands of the existing literature. The analysis of competitive financial market equilibria in the presence of imperfect information is similar to the analysis of insurance markets by Rothschild and Stiglitz (1976). Regarding the differences between foreign and domestic lenders, Detragiache, Gupta and Tressel (2005) find a similar outcome of cream-skimming by foreign banks and an adverse affect on credit access for ‘soft’ information entrepreneurs. In their model, however, foreign banks screen ‘hard’ information at a lower cost than domestic banks but screen ‘soft’ information at a higher cost. Another paper that highlights the potential distributional effects of opening capital markets is Trzcinka and Ukhov (2005). Using an international asset-pricing model, they find that foreign entry may have an adverse effect on domestic investors who purchase risky assets to hedge endowment income.

The remainder of the paper proceeds as follows. Section 1 provides the basic setup and assumptions of the model with full commitment. Section 2 discusses the closed economy equilibrium, and Section 3 describes the open economy equilibrium that follows the introduction of foreign competition. Section 4 analyzes the empirical and policy implications of the model. Section 5 extends the model to a repeated game without full commitment, and Section 6 discusses the robustness of the models’ implications and possible extensions. Finally, Section 7 concludes.

1 The Basic Model

1.1 Agents and Technology

There are two types of agents: entrepreneurs and lenders. All agents are risk-neutral, and because of limited liability, no entrepreneur can end up with a negative amount of cash.
The real sector consists of four types of entrepreneurs, \( i \in \{Z, A, B, C\} \), and a continuum \( \theta_i \) of each type, where \( \theta_A + \theta_B + \theta_C = 1 \). The first type, \( Z \), receive zero projects to implement, while the remaining three types each have the ability to implement one project of size \( I \in [1, \lambda] \), where \( \lambda > 1 \). If implemented, the project yields a verifiable return \( RI > r^*I \), where \( r^* \) is the exogenous international cost of capital. All entrepreneurs have zero wealth and must borrow the complete amount \( I \) from lenders. Entrepreneurs that receive financing from a lender may choose action \( q \in \{0, 1\} \), where \( q = 1 \) indicates the project is undertaken and \( q = 0 \) indicates the project is not. The action \( q \) is observable to lenders, and \( q = 0 \) is the only possible action for entrepreneurs of type \( Z \).

Of the entrepreneurs with projects, 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’ always succeed with probability 1, regardless of project size, while ‘bad’ entrepreneurs only succeed with probability \( p \). Projects that only succeed with probability \( p \) have a negative net expected return given the international cost of funds, \( r^* \), such that \( pR < r^* \). ‘Average’ entrepreneurs implement the smaller project of size 1 with certain success, while larger projects only succeed with probability \( p \).

Therefore, the economy’s expected net output is maximized when ‘cream’ entrepreneurs are financed for projects of size \( \lambda \), ‘average’ entrepreneurs for projects of size 1, and ‘bad’ entrepreneurs are not financed. This is the first-best allocation of credit.

For simplicity, it is assumed there are relatively more ‘average’ entrepreneurs than ‘cream’ in the economy, such that \( \theta_A > \theta_C \). Moreover, to eliminate some uninteresting pooling equilibria in both the closed and open economies, the following assumptions are made:

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6 All subsequent findings are robust to dropping this assumption so long assumption (1) is modified to also include \( \theta_A > \theta_C (R - r)/(r - pR) \) such that it is never profitable for lenders to pool ‘bad’ and ‘cream’ entrepreneurs.
\[ \theta_b > \frac{(R - r^*) \theta_d}{r - pR} \]  
(1)

\[ \theta_z > \frac{\theta_b (r^* - pR)}{p(R - r^*)} \]  
(2)

Assumption (1) ensures that the number of ‘bad’ entrepreneurs is sufficiently high to exclude equilibria where lenders can profitably pool ‘bad’ and ‘average’ entrepreneurs together. Assumption (2) ensures that the mass of entrepreneurs without projects, \( \theta_z \), rules out financial contracts that pay a positive amount to ‘bad’ entrepreneurs that abandon their low-return projects. This contract will not exist in equilibrium (and in reality) since all entrepreneurs without projects would also need to be paid this positive amount, thus rendering the contract unprofitable.\(^7\)

The financial sector consists of many perfectly competitive domestic and foreign lenders willing to extend capital in the amount of \( I \in [1, \lambda] \). Without the costly screening of entrepreneurs, lenders are unable to identify an entrepreneur’s type, thus providing the source of information asymmetry in the model. Lenders, however, may invest in screening technology, \( S \in \{0, 1\} \), where \( S = 1 \) implies the investment is made. Investment in the screening technology allows lenders’ to perfectly identify an entrepreneur’s type.

Domestic lenders differ from foreign lenders in two key ways. First, the domestic lenders have access to an unlimited supply of domestic funds at opportunity cost, \( r \), while foreign lenders’ have access to an unlimited supply of international funds at opportunity cost, \( r^* \), where \( r^* < r \). The higher domestic cost of capital seems reasonable given the poor access to international markets and the weak deposit collection technologies of many domestic lenders in emerging economies.\(^8\)

The second difference is that foreign lenders find it more costly to screen borrowers because

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\(^7\) Acemoglu (1998) uses a similar method to eliminate these types of contracts.

\(^8\) One concern about this assumption is that governments in emerging economies often provide subsidized funds to domestic lenders such that their direct cost of funds is less than the cost of capital on international capital markets. However, privileged access to funds does not necessarily imply a lower cost of funds. Domestic lenders typically have much higher non-interest costs than international lenders. For example, the average wage bill of domestic banks is twice as large as the average wage bill of foreign banks in India. By sidestepping local unions, foreign banks in India employ one-seventh the number employers per unit of assets (Hanson 2003).
of distance, cultural, or institutional barriers. Specifically, domestic lenders can screen at cost \( C \) per borrower while foreign lenders must pay \( C' > C \).\(^9\) 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 banks relative to domestic banks also likely makes it more costly for foreign banks to obtain the ‘soft-information’ necessary to screen entrepreneurs effectively.

Foreign lenders’ access to cheap international capital provides a competitive advantage, but the higher screening cost implies this advantage is largest when the per-unit cost of screening is low. Hence, the information asymmetry will induce what might be perceived as ‘cream-skimming’ behavior by foreign lenders which will have a competitive advantage in providing credit to the entrepreneurs that implement larger projects. Specifically, the following assumptions are made:

\[
\begin{align*}
    r' + \frac{C'}{\lambda} &< r + \frac{C}{\lambda} < R \\
    R &< r' + C'
\end{align*}
\]  

(3) \hspace{1cm} (4)

Assumptions (3) and (4) are what distinguish foreign lenders from domestic lenders. The first inequality in equation (3) ensures it is always feasible to screen larger projects in the economy and that the international cost of capital is sufficiently low to offset foreign lenders’ disadvantage in screening larger projects relative to domestic lenders. The international cost of funds may not, however, be low enough to provide the foreign lenders an advantage in financing smaller projects, where the per-unit cost of screening is higher. In fact, equation (4) states that foreign lenders’ per-unit cost of screening smaller projects is too high to profitably screen and finance these projects. It may still be feasible, however, for domestic lenders to screen and finance the smaller projects because of their lower screening cost, depending on whether \( r + C \leq R \).

\(^9\) The model would also be robust to assuming the foreign banks incur the same cost of screening, but receive a lower quality signal of a of entrepreneur’s type than domestic banks.
1.2 Timing of Events

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

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

$t = 1$: lenders offer financial contracts $F$, entrepreneurs choose contracts, if any

$t = 2$: lenders choose investments in the screening technology, $S$

$t = 3$: lenders provide financing capital, $I$

$t = 4$: entrepreneurs receiving capital make investment decision, $q$

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

1.3 Financial Contracts and Strategies

Let $F_j$ represent the menu of contracts offered by lender $j$, where $F_j^{i,k}$ denotes a financial contract from lender $j$ of size $I \in \{1, \lambda\}$ and type $k \in \{0, Z, A, B, C\}$. When $k = 0$, the contract is unscreened, but for $k \neq 0$, the contract is only available to a firms where screening reveals $i = k$.

Each type of contract is a mapping of observables into a payment for the entrepreneur. Specifically,

$F_j^{i,k} : \{0,1\} \times \{0,RI\} \to \mathbb{R}$,

The first argument, $q$, indicates whether the project is undertaken by the entrepreneur, and the second argument, $Y$, is the observed output on the project. Each type of contract maps into a non-negative payment since entrepreneurs have no initial wealth and cannot receive a negative payment.

Entrepreneurs that want a contract of type $k \neq 0$, must first submit themselves to the screening process, which maps into that contract. Specifically, the screening technology is given by

$T_j : \{Z, A, B, C\} \times \{0,1\} \times \{Z, A, B, C\} \to F_j \cup \emptyset$

The first argument is type of contract, $k$, requested by the entrepreneur where $k \neq i$ is allowed. The

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10 This mapping spans the universe of potential contracts. Thus, the concept of ‘lender’ used in this paper is very general and encompasses banks, stockholders, etc. However, equilibrium financial contracts where a project is actually implemented can always be replicated by a pure debt contract. For this reason, all future references will be made regarding pure debt contracts. See Appendix A for more details.
second argument is the lenders’ screening decision, $S$, and the third argument is the entrepreneur’s true type, $i$. It is possible for the screening process to yield no financial contract for the entrepreneur. Specifically, the screening technology of each lender $j$ is designed to work as follows:

$$
T_j(k, S = 0.) = F_{j,k}^i
$$
$$
T_j(k, S = 1, i = k) = F_{j,k}^i
$$
$$
T_j(k, S = 1, i \neq k) = \{F_{j,i}^k\} \cup \emptyset
$$

If an entrepreneur that submits requests a contract of type $k \neq 0$ and lender $j$’s screening reveals the true type is in fact $i = k$, the entrepreneur receives $F_{j,k}^i$ as promised. However, if screening reveals that $i \neq k$, then the entrepreneur receives the contract designated for type $i$, and if no such contract was offered, the entrepreneur receives no contract. Finally, if lender $j$ does not actually screen, than the entrepreneur still gets the screened contract, $F_{j,k}^i$.

In the basic model discussed here, I will assume that lenders can fully commit to their financial contracts in a two key ways. First, 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. Second, lenders can fully commit the initial terms of any contract, $F_{j,k}^i$, and the initial menu of contracts, $F$. This eliminates the possibility for renegotiation between lenders and entrepreneurs after screening reveals an entrepreneurs’ type. Combined with $S = 1$, it also ensures entrepreneurs that submit to screening have no incentive to misrepresent their type. These full commitment assumptions greatly simplify the basic analysis, but are not critical to the main findings. With a few extensions on the basic model, it can be shown that full commitment by lenders is an equilibrium strategy in a repeated game. This is shown in Section 5.

Let $f(i)$ designate the contract choice of entrepreneur of type $i$, where $f(i) = \emptyset$ is allowed. Entrepreneur $i$’s investment decision is given by $q(i)$, and an entrepreneurs’ strategy consists of its contract choice and investment decision. A strategy configuration in this economy consists of the
set of contracts $F_j$ for each $j \in L$, and \( \{ f(i), q(i \mid f(i)) \} \) for each $i \in E$. Entrepreneurs actions are limited in that $f(i) \in \mathcal{F}$, where $\mathcal{F}$ is the set of all $F_j$'s and $q(i \mid f(i)) \in \{0,1\}$. For convenience, the dependence of action $q$ on $f(i)$ will be suppressed in the main text when it will cause no confusion. The equilibrium concept used is Subgame Perfect, and a strategy configuration will be an equilibrium if each lender $j \in L$ is maximizing expected profits and each entrepreneur $i$ is maximizing its expected utility given the strategies of all other agents.

The expected utility of an entrepreneur $i$ with a financial contract can be written as:

$$ u : \mathcal{F} \times \{0,1\} \to \mathbb{R}_+ $$

where the first argument denotes the financial contract accepted, and the second is the choice to implement, $q$. Given the above setup, the expected utility of a contract is

$$ u(F^{j,k}, q = 0 \mid i) = F^{j,k}(0, \cdot) $$

$$ u(F^{j,k}, q = 1 \mid i) = p(i \mid I)F^{j,k}(1, R I) + (1 - p(i \mid I))F^{j,k}(1, 0) $$

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

Likewise, the expected profits of lender $j$ for a given financial contract,

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

is a function of an entrepreneur's type, $i$, and investment decision, $q$. The losses are limited below by the largest amount of capital lender $j$ would ever extend, $\lambda$, at opportunity cost $r(j)$.

$C(j)$ represents the cost of screening for lender $j$. It is then easily shown that at $t = 1$ when financial contracts are offered, that

$$ \pi_j(i, q = 0 \mid F_j^{j,k}) = -F_j^{j,k}(0, \cdot) - C(j) S $$

$$ \pi_j(i, q = 1 \mid F_j^{j,k}) = \left[ p(i \mid I)R - r(j) \right] I - u(F_j^{j,k}, q = 1 \mid i) - C(j) S $$

where $S = 0$ for $k = 0$ and equals 1 otherwise.

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11 Because the entrepreneur's self-declaration of type, $k(i)$, is uniquely determined by the choice $f(i)$, it is not a separate argument of the strategy profile for each entrepreneur.
Finally, let $\chi(F, F')$ be the set of entrepreneur types that accept the contract offer $F$ when the set of available financial contracts is $F$. i.e. $i \in \chi(F, F')$ if and only if $f(i) = F$. And for clarity, $f(i) = \emptyset$ is assumed the default choice of entrepreneurs when no available financial contract provides a positive expected return such that $u(f(i), q(i)) = 0$ $\forall f(i) \neq \emptyset$ and $q(i | f(i))$. Given this, the economy’s equilibrium is defined as:

**Definition of Equilibrium:** A strategy configuration, $\{f(i), q(i | f(i))\}$ for each $i \in E$ and $F$ implied by $F_j$ for each $j \in L$, constitutes an equilibrium if and only if,

1. Given $F$, each $i \in E$ chooses $f(i) \in F$ and $q(i | f) \in \{0,1\}$ to maximize $u(f, q | i)$.

2. Each $j \in L$ chooses $F_j$ to maximize $\int_{i \in \chi(F_j, F)} \pi_j(i, q(i | f_j) \text{d}i$ where $q(i)$ and $i \in \chi(F_j, F)$ are given by condition 1, and $\int_{i \in \chi(F_j, F)} \pi_j(i, q(i | f_j) \text{d}i = 0$.

2 Analysis of the Closed Economy

In the closed economy, the set of lenders, $L$, consists of only domestic lenders. It is shown that either a pooling or separating equilibrium can exist depending on whether the domestic cost of screening, $C$, exceeds some threshold, $C$, defined by equation (7).

$$C = \lambda(R - r) - \left( R - \frac{r}{1 - (1 - p)\theta_e} \right) \quad (7)$$

When the cost of screening does not exceed this value, a separating equilibrium occurs in which ‘cream’ entrepreneurs will be financed for large projects, ‘average’ entrepreneurs for small projects if $r + C \leq R$, and ‘bad’ entrepreneurs are never financed. However, when screening is costly, all entrepreneurs will be pooled on the smaller project using a financial contract that does not screen applicants. The ‘cream’ entrepreneurs will be unwilling to obtain financing for the larger project and the ‘bad’ entrepreneurs will be financed. Hence, the first-best allocation is achieved only when the
information asymmetry (captured by \( C > 0 \)) is sufficiently small. The existence of these two closed economy allocation are stated formally in Proposition 1.

Proposition 1.

1. If \( C > \max \{ C, r - pR \} \) and \( r^\text{pool} \equiv r / (1 - (1 - p)\theta_h) \leq R \), there exists an equilibrium in which a number \( n \geq 2 \) domestic lenders offer the following financial contract to entrepreneurs:

\[
\tilde{F}^{1,0}(q, Y) = \begin{cases} 
R - r^\text{pool} & \text{if } q = 1, Y = R \\
0 & \text{otherwise}
\end{cases}
\]

All entrepreneurs of type \( i \in \{ A, B, C \} \) accept finance from a randomly chosen lender and choose \( q(i \mid \tilde{F}^{1,0}) = 1 \). Off the equilibrium path (i.e. when \( F \neq \tilde{F}^{1,0} \)), all entrepreneurs choose with equal probability among contracts that give the same utility.

2. If \( C \leq \bar{C} \), there exists an equilibrium in which a number \( n \geq 2 \) domestic lenders offer the following financial contract to entrepreneurs:

\[
\tilde{F}^{\bar{C}, C}(q, Y) = \begin{cases} 
\bar{C}(R - r^C) & \text{if } q = 1, Y = R \bar{C} \\
0 & \text{otherwise}
\end{cases}
\]

where \( r^C = r + C / \bar{C} \), and all entrepreneurs of type \( i = C \) accept finance from a randomly chosen domestic lender and choose \( q(C \mid \tilde{F}^{\bar{C}, C}) = 1 \). And if \( r + C \leq R \), domestic lenders also offer the financial contract

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

where \( r^A = r + C \), and all entrepreneurs of type \( i = A \) accept finance from a randomly chosen domestic lender and choose \( q(A \mid \tilde{F}^{1, A}) = 1 \). If \( r + C > R \), \( f(A) = \emptyset \), and \( f(B) = \emptyset \) always. Off the equilibrium path, all entrepreneurs choose with equal probability among contracts that give the same utility.

The allocations described here are the only equilibrium allocations.

A proof of Proposition 1 is found in the appendix, but the intuition is straightforward. When the cost of screening, \( C \), is high, a lender that foregoes screening and pools all borrowers on the
small project can offer the best return to ‘cream’ entrepreneurs. In this case, all firms will choose to accept a cheap (but small) unscreened contract making a pooling equilibrium possible. The pooling equilibrium, however, will only 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’ entrepreneurs away from the unscreened contract. This is true for \( C > \max \{ C, r - pR \} \).  

This pooling contract and allocation of credit is the unique equilibrium when \( C > \max \{ C, r - pR \} \).

When \( C \leq C \), however, perfectly competitive domestic lenders can always offer ‘cream’ entrepreneurs a screened contract that induces them to take the larger project rather than be pooled with all other entrepreneurs. When the ‘cream’ select this larger contract, the pooled contract becomes unprofitable since it is never feasible to pool just ‘average’ and ‘bad’ entrepreneurs. Thus, the ‘average’ will only be financed in this separating equilibrium if domestic lenders can profitably offer them a screened contract. This will only occur for \( r + C \leq R \). This allocation of credit to ‘average’ and ‘cream’ entrepreneurs is the unique equilibrium allocation when \( C \leq C \).

The pooling equilibrium, where \( C > C \), provides an intriguing starting point from which to analyze the effect of opening capital markets. In the separating equilibrium, there is no room for improving the allocation of credit if ‘average’ firms are being financed, while the pooling equilibrium always fails to achieve the first-best. Funds diverted away from ‘bad’ entrepreneurs towards larger projects for ‘cream’ entrepreneurs would increase net output. This ‘over-financing’ of ‘bad’ firms and ‘under-financing’ of ‘good’ firms is a standard criticism of emerging economies. Moreover, the pooling equilibrium is most likely to occur when the cost of screening is high, which is also a

\[ \text{If } C < C < r - pR, \text{ the competitive closed economy has no equilibrium. In this case, a pooling equilibrium cannot exist because lenders could always profitably deviate by offering to screen and finance ‘bad’ entrepreneurs willing to forgo implementing their project. However, this deviation cannot itself be an equilibrium because any individual lender could further increase profits by dropping the contract. See Appendix B, Part 6 for more details.} \]

\[ \text{However, it is not the unique equilibrium contract. For example, a financial contract that pays } F_{1,4}(q = 1, Y = 0) > 0 \text{ but is otherwise identical is also an equilibrium contract. Since } Y = 0 \text{ occurs with probability zero, the payment in failure is not pinned down in equilibrium. See Appendix B for more details.} \]
common characteristic of emerging economies. Empirical evidence also suggests this is a reasonable starting point due to the lack of screening done by domestic lenders in many emerging markets.\footnote{For an example involving banks in India, see Banerjee, Duflo and Cole 2003. Gormley, Johnson and Rhee (2006) also provide suggestive evidence that Korean bond holders did not screen their investments in 1998.}

Given this, I will now analyze the impact of allowing foreign lenders to enter the closed economy which exhibits a pooling equilibrium.

3 Analysis of the Open Economy

In the open economy, the set of lenders, $L$, now consists of both domestic lenders and foreign lenders. I will express financial contracts from foreign lender $j$ as $F_{j,*}$. 

Similar to the closed economy, the open economy equilibrium depends on the cost of screening borrowers, though it now depends on both the international and domestic cost of screening. Foreign entry has no effect on the equilibrium allocation of credit if foreign lenders’ cost of screening domestic entrepreneurs is prohibitively expensive, such that $C^* > \tilde{C}$ where

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

But when the foreign cost of screening is sufficiently low, such that $C^* \leq \tilde{C}$, foreign lenders’ will enter by ‘cream-skimming’ the best borrowers away from domestic lenders. This can break a closed economy pooling equilibrium and induce an output increasing reallocation of credit from ‘bad’ to ‘cream’ entrepreneurs. This ‘cream-skimming’ by foreign lenders, however, may reduce the ability of ‘average’ entrepreneurs to obtain financing for their positive NPV projects as stated in Proposition 2.

Proposition 2. If $C^* \leq \tilde{C}$, there exists an equilibrium in the open economy in which a number $n \geq 2$ foreign lenders offer the following financial contract to entrepreneurs:

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

where $r^{*C} = r^* + C^*/\lambda$ and all entrepreneurs of type $i = C$ accept finance from a randomly chosen foreign
lender and choose \( q(C \mid \tilde{F}_{i,C}) = 1 \). And if \( r + C \leq R \), a number \( n \geq 2 \) domestic lenders offer

\[
\tilde{F}_{i,A}^*(q,Y) = \begin{cases} 
R - r^A & \text{if } q = 1, Y = R \\
0 & \text{otherwise}
\end{cases}
\]

where \( r^A = r + C \) and all entrepreneurs of type \( i = A \) accept finance from a randomly chosen domestic lender and choose \( q(A \mid \tilde{F}_{i,A}) = 1 \). If \( r + C > R \), \( f(A) = \emptyset \), and \( f(B) = \emptyset \) always. Off the equilibrium path, all entrepreneurs choose with equal probability among contracts that give them the same utility. This is the only equilibrium allocation when \( C^* \leq C \).

A formal proof of Proposition 2 can be found in the appendix, but the effect of foreign lenders’ entrance is straightforward. When foreign lenders’ cost of capital is sufficiently low, foreign lenders may be able to induce ‘cream’ entrepreneurs 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 cost of funds. Specifically, the cutoff value of screening in the open economy will be more relaxed than that of the closed economy, such that \( C < C^* \) if \( \lambda > 1/[1 - (1 - p)\theta_d] \). Therefore, when \( C < C^* < C \), the economy may switch from a closed economy pooling equilibrium to an open-economy separating equilibrium.

The switch away from the pooling equilibrium, however, will not necessarily benefit ‘average’ entrepreneurs that only implement projects of size 1 with certain success. Their resulting high per-unit cost of screening prevents foreign lenders from profitably financing these entrepreneurs, and ‘average’ firms will continue to rely on domestic lenders. But, the fraction of entrepreneurs approaching domestic lenders with positive net present value (NPV) projects is now lower because of foreign lenders’ cream skimming, and by assumption (1), the remaining fraction of ‘bad’ entrepreneurs is sufficiently high that pooling the ‘average’ and ‘bad’ entrepreneurs is not feasible.

So, in order for domestic lenders to finance the ‘average’ entrepreneurs in this open economy equilibrium, \( C \) must be sufficiently low that the domestic lender can profitably screen ‘average’
entrepreneurs given their cost of funds, $r$. This will only be possible when $R \geq r + C$ holds.

So long as both the domestic and foreign costs of screening is sufficiently low, the open economy will reflect the first-best equilibrium in terms of the projects being financed – ‘cream’ entrepreneurs are financed for the largest project, ‘average’ entrepreneurs are financed for the smaller project, and ‘bad’ entrepreneurs are not financed. This is true despite foreign lenders’ higher cost of screening, $C' > C$. However, if information asymmetries are large and the domestic cost of screening is high, such that $R < r + C$, foreign lenders’ targeting of ‘cream’ entrepreneurs may induce domestic lenders to exit the market entirely. In this case, the entrance of foreign lenders increases the size of ‘cream’ projects being implemented at the cost of some ‘average’ entrepreneurs being shut out along with the ‘bad’ entrepreneurs. While ‘average’ entrepreneurs do have positive NPV projects, they will not be financed if both domestic and foreign lenders’ are unable to effectively screen them.

If ‘average’ entrepreneurs no longer receive financing, the overall impact of opening capital markets on net output is unclear. This is stated formally in Proposition 3:

**Proposition 3:** In an economy that switches from the closed economy pooling equilibrium to the open economy separating equilibrium, net output always increases if $R \geq r + C$. Otherwise, net output will decline when

$$(R - r)\theta_A > (\lambda(R - r') - C') - (R - r)\theta_C + (r - pR)\theta_B.$$  

A formal proof of Proposition 3 is in the appendix, but the intuition is straightforward. When $R \geq r + C$, net output increases since the reallocation of finance away from ‘bad’ entrepreneurs to larger ‘cream’ projects always increases net output. However, when $R < r + C$, the opening of capital markets also decreases net output from ‘average’ entrepreneurs. If this loss, $(R - r)\theta_A$, is sufficiently large, overall net output will be lower in the open economy.

### 4 Empirical Implications and Policy Analysis

The model thus provides a relatively simple explanation as to why foreign lenders’ entry may not necessarily increase overall output in the opening economy. In emerging economies with
significant costs to screening projects, the initial domestic allocation of credit may fail to achieve the first-best allocation because domestic lenders choose to pool risks rather than invest in costly screening technologies. While foreign lenders may be even less effective at screening domestic entrepreneurs because of institutional, cultural, or distance barriers, their access to low cost international funds may allow them to more cost effectively finance large, profitable projects. Therefore, their entry can increase the financing of profitable and very large projects, thus increasing output. At the same time, investment may be declining for other borrowers with positive NPV projects if domestic lenders lack the ability to screen them out from the negative NPV projects. The overall effect on net output is unclear. The reallocation from ‘bad’ to ‘cream’ entrepreneurs increases net output, but if ‘average’ entrepreneurs are no longer financed, this can reduce overall output. The theory suggests that the lack of positive correlation between opening capital markets and overall output and investment could be explained by these adverse distributional effects.

Moreover, the theory also lends itself to numerous empirical tests. First, the model indicates foreign lenders would be more likely to target the largest, most profitable entrepreneurs of the domestic economy because it is only with these entrepreneurs they can economize on their higher cost of screening and lower cost of funds. Anecdotal evidence tends to support this ‘cream-skimming’ behavior of foreign lenders in emerging economies, and Gormley (2006) finds direct evidence of such ‘cream-skimming’ by foreign banks in India during the late-1990s. Second, the incentive to ‘cream-skim’ and the potential adverse affect on some entrepreneurs with positive NPV projects is more likely in sectors of the opening economy where screening is particularly costly to do. For example, industries or types of entrepreneurs that are naturally more costly to screen are more likely to exhibit a reallocation upon foreign entry. Third, the potential adverse effect on the ‘average’ borrower is more likely in such sectors, and when foreign lenders engage strictly in ‘cream-skimming’.

Comparative analysis on the cost of screening also suggests some interesting hypotheses. For example, consider allowing the cost of screening to be a function of physical distance between lender
and entrepreneur, \(d\), and ‘institutional distance’, \(\tau\), where \(C_d(d, \tau) > 0\) and \(C_r(d, \tau) > 0\). For domestic lenders, \(d = \tau = 0\), while international lenders face some positive institutional and geographical distances, \(d', \tau' > 0\). The greater the physical distance and ‘institutional distance’ a foreign lender is from the opening economy, the higher its screening cost relative to domestic lenders.

Now consider the variety of different openings emerging economies may implement in practice. The first is to allow direct capital inflows such that foreigners can purchase bonds and stocks of domestic entrepreneurs. This is probably the easiest for foreign lenders to do in that it does not require any physical shift in location away from their home country. However, because the foreign lenders remain abroad, the initial physical distance, \(d'\), and institutional distance, \(\tau'\), remain unchanged. A second option for opening is to also allow foreign lenders to establish a physical presence in the country, such as in a de novo foreign bank branch, but not allow the foreign bank to purchase domestic banks.\(^{15}\) The shift in location of the foreign lender away from its home country reduces the physical distance to \(d'' = d = 0\), but the institutional distance, \(\tau'' > 0\), remains. A third option is to allow foreign lenders to acquire domestic banks. This option would tend to reduce both physical and institutional distance of the foreign lender, though the lower ‘institutional distance’, \(\tilde{\tau}''\) may still be positive, such that \(\tau'' > \tilde{\tau}'' > 0\).\(^{16}\)

While grossly simplified, the basic model suggests that emerging economies should always attempt to reduce the ‘distance’ of foreign lenders, whether it is physical or institutional. If it were the case that \(C(d'^{\prime}, \tau'^{\prime}) > \overline{C} > C(0, \tau^{\prime}) > R - r^{\prime} > C(0, \tilde{\tau}^{\prime})\), then allowing foreign lenders to only purchase domestic bonds and stocks would have no effect on a domestic economy caught in the pooling equilibrium. Allowing them physical entry alone, however, will result in a reallocation of

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\(^{15}\) This type of liberalization may be preferred by governments in emerging economies as it forces foreign lenders to establish a physical presence without divesting the government’s ability to implement social policy through government controlled domestic banks.

\(^{16}\) Purchasing a domestic lender’s assets may not necessarily transfer all local knowledge and information to the new foreign owner. Empirical evidence of foreign bank acquisitions in Argentina suggests the foreign lender is still less likely to finance smaller entrepreneurs (Berger, Klapper and Udell 2001). Moreover, Stein (2002) implies the greater hierarchy of such entities will limit their ability to use ‘soft information’. 
credit, but foreign lenders will be limited to ‘cream-skimming’ and ‘average’ borrowers may be worse off if domestic lenders find it unprofitable to screen them. Allowing foreigners to purchase domestic lenders, however, could reduce the ‘distance’ cost sufficiently enough that they no longer ‘cream-skim’, and the first-best allocation of credit is achieved.\footnote{17} Syndicated lending, where foreign lenders provide capital directly to domestic lenders, may also increase the likelihood of achieving the first-best allocation. This is discussed in greater detail in Section 6.

In this basic setup, restrictions on foreign lenders ability to establish a physical presence or acquire domestic lenders will only increase the likelihood that the benefits of ‘opening’ will be limited to but a few of the largest, most profitable domestic entrepreneurs. The smaller the ‘distance’ gap, the less likely foreign lenders will simply ‘cream-skim’ and the less likely that the ‘average’ domestic borrower will be worse off in the open economy.

Moreover, if institutional or cultural distance decline with time, \( t \), such that \( d\tau'(t)/dt < 0 \), then one might expect the amount of ‘cream-skimming’ done by foreign lenders to fall over time. Thus, their initial entrance may be accompanied by a rise in credit allocated to the largest, most profitable entrepreneurs while all other borrowers find themselves suddenly rationed by domestic lenders inadequate at screening the remaining pool of projects. As time of exposure increases, however, and institutional distance, \( \tau \), declines, foreign lenders will be more able and likely to target the ‘average’ borrowers recently shunned by ineffective domestic lenders.

Opening capital markets may also be beneficial if foreign lenders possess better screening technology, such that \( C'(d', \tau') > C(0,0) > C'(0,0) \). If their entry allows domestic lenders to adopt or acquire the foreign screening technology, then opening capital markets may have another benefit in reducing the cost of screening for domestic banks, increasing the likelihood of achieving the first-best

\footnote{17 However, allowing foreign lenders to acquire domestic financial assets could also be very costly if \( C(0,0) > R - r' > C(0,0) \). In this case, the foreign lender will still find it too costly to screen average borrowers, but the domestic lender may not. Therefore, transferring domestic assets to the foreign lender can actually increase the likelihood of ‘average’ entrepreneurs being rationed out of the market by reducing the amount of assets held by the domestic lenders willing to undertake such lending.}
equilibrium where ‘average’ entrepreneurs are not rationed out of the credit market.\textsuperscript{18}

5 Model without Full Commitment

In the basic model, I make the assumption that lenders can perfectly commit to screen projects and fully commit the initial terms of any contract, $F_{i,k}$, and initial menu of contracts, $F$. 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 the basic model, lenders always have an incentive to choose $S = 0$ since entrepreneurs never misrepresent their type in equilibrium. Second, after lenders invest in the screening technology, their optimization problem changes. At time $t = 3$, the cost of screening is sunk and the firms’ type is known. Because of this, a lenders’ initial contract may no longer be optimal, and the threat to refuse financing an entrepreneur caught misrepresenting its type is not credible. For example, financing the ‘average’ entrepreneur caught misrepresenting its type would allow a foreign lender to recoup some of its initial loss, and renegotiation of the initial contract could benefit both the lender and entrepreneur. Therefore, ‘average’ entrepreneurs should know foreign lenders’ threat to provide zero financing is not credible.

To address these weaknesses of the basic model, I now extend the model to a repeated game and 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.

The initial 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. Within in each time-period $t$, there is a stage game broken in six sub-periods, $s$, where at:

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

\textsuperscript{18} Levine (1996) argues that domestic banks may benefit directly by adopting the technologies of foreign banks and foreign banks may encourage the development of better auditing agencies, thus decreasing screening costs for all.
\(s = 1\): lenders offer financial contracts \(F\), entrepreneurs choose contracts, if any

\(s = 2\): lenders choose investments in the screening technology, \(S\)

\(s = 3\): lenders renegotiate new contract, \(\hat{F}\), provide financing, \(I\)

\(s = 4\): entrepreneurs 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 entrepreneurs are short-lived and only play for one period. At the start of each period, \(t\), a new continuum \(1 + \theta_t\) of entrepreneurs is born. The discount rate between time periods for each lender \(j\) is simply the inverse of their opportunity cost of funds, \(1/r(j)\).

The feasible set of actions and contracts for entrepreneurs remain the same as before, but now 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. Lenders are allowed to offer any renegotiated contract to the entrepreneur, but it is only accepted if the new contract represents a pareto improvement for both the lender and entrepreneur. Given this, entrepreneurs’ 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 \(t\). As before, \(F_t^{l,k}\) will designate a financial contract of size \(l \in \{0,1\}\) and type \(k \in \{0,Z,A,B,C\}\) offered by lender \(j\) during the stage game at time \(t\). Then, I will define \(\hat{F}_t^{l,k}\) as the renegotiated contract offered at \(s = 3\). Again, a contract is a mapping of observables into a payment for the entrepreneur, and the screening technology remains the same as before.

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19 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 entrepreneurs accepting this type of contract.
Let \( f_i(i) \) designate the initial contract choice of entrepreneur of type \( i \), during the stage game at time \( t \) where \( f_i(i) = \emptyset \) is allowed, and let \( \hat{f}_i(i) \) represent the contract agreed upon after renegotiation. If no renegotiation occurs, \( f_i(i) = \hat{f}_i(i) \). Entrepreneur \( i \)'s investment decision during the stage game at time \( t \) is given by \( q_i(i) \). As before, an entrepreneurs’ strategy consists of its contract choice and investment decision.

Lender \( j \)'s screening decision during the stage game at time \( t \) is given by \( S_j(j) \), 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 \( a_{j,t} = \{F_j(j), S_j(j), \hat{F}_j(j)\} \), and \( a_t = \bigcup_{j=1}^{\infty} a_{j,t} \). Therefore, the history known by all agents is given by \( b_t = \{a_0, a_1, \ldots, a_{t-1}\} \). Lastly, define \( H_t \) as the set of all possible histories, \( b_t \), and assume that \( b_0 = \emptyset \). 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.

Entrepreneurs’ knowledge of a lenders’ history will be crucial in allowing lenders to establish a ‘reputation’ of following through on their initial financial commitments.

A strategy configuration in this economy consists of \( \{f(i | b_t), q(i | \hat{f}(i), b_t)\} \) for each \( i \in E \), \( b_t \in H_t, \forall t \) and \( \{F_j(j | b_t), S_j(j | \chi(F_j, E_t), b_t), \hat{F}_j(j | \chi(F_j, E_t), i, b_t)\} \) for each \( j \in L \) and \( b_t \in H_t \). As before, \( \chi(F_j, E_t) \) is the set of entrepreneur types in period \( t \) that accept the contract offer \( F_j \) when the set of available financial contracts is \( E_t \). Entrepreneurs actions are limited in
that $f_i(i) \in \mathbb{F}$, where $\mathbb{F}$ is the set of all $F_j(j)$'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 utility of entrepreneurs at time $t$ can again be written as:

$$u_t : \mathbb{F} \times \{0,1\} \rightarrow \mathbb{R}_+$$

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

$$u_t(F_j^{i,k}, q = 0 | i) = F_j^{i,k}(0, r)$$
$$u_t(F_j^{i,k}, q = 1 | i) = p(i | I)F_j^{i,k}(1, R) + (1 - p(i | I))F_j^{i,k}(1, 0)$$

where $p(i | I)$ is the probability of success for an entrepreneur of type $i$ with a project of size $I$.

The expected future returns for lender $j$,

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

is a function the lender’s screening decision, $S(j)$, and an entrepreneur’s type, $i$, and decision, $q$.

The losses are limited below by the largest amount of capital a lender would ever extend, $\lambda$, at opportunity cost $r(j)$ for lender of type $j$. It is then easily shown, that:

$$\pi_{j,i}(S(j), i, q = 0 | F_j^{i,k}, i \leq 2) = -F_j^{i,k}(0, r) - S(j)C(j)$$
$$\pi_{j,i}(S(j), i, q = 1 | F_j^{i,k}, i \leq 2) = [p(i | I)R - r(j)]I - u(F_j^{i,k}, q = 1 | i) - S(j)C(j)$$
$$\pi_{j,i}(S(j), i, q = 0 | F_j^{i,k}, i > 2) = -F_j^{i,k}(0, r)$$
$$\pi_{j,i}(S(j), i, q = 1 | F_j^{i,k}, i > 2) = [p(i | I)R - r(j)]I - u(F_j^{i,k}, q = 1 | i)$$

Compared to the basic model discussed earlier, 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, \( \{F_j(j), S_j(j), \hat{F}_j(j)\}_{j=0}^{\infty} \) for each \( j \in L \) and \( b_j \in H_j \), and \( \{f_j(i), q_j(i)\} \) for each \( i \in E \), \( b_j \in H_j \) \( \forall t \) constitutes an equilibrium if and only if for every period \( t \) it is true that:

1. For every \( \hat{f}_j(i) \) and \( b_j \), each \( i \in E \) chooses \( q_j(i) \in \{0,1\} \) to maximize \( u_{ij}(\hat{f}_j, q) \).

2. For every \( f_j(i) \) and \( b_j \), each \( j \in L \) chooses \( \hat{F}_j(j) \) to maximize

   \[ \pi_{ij}(S(j), i, q_j(i) | \hat{F}_j(j), s > 2) + V_j(j) \] where \( q_j(i) \) is given by condition 1.

3. For every \( f_j(i) \) and \( b_j \), each \( j \in L \) chooses \( S_j(j) \) to maximize

   \[ \pi_{ij}(S_j(j), i, q_j(i) | \hat{F}_j(j), s \leq 2) + V_j(j) \] where \( q_j(i) \) is given by condition 1, and \( \hat{F}_j(j) \) by condition 2.

4. For every set of contracts offered, \( \mathbb{F}_j \), and \( b_j \), each \( i \in E \) chooses \( f_j(i) \in \mathbb{F}_j \) to maximize \( u_{ij}(\hat{f}_j(i), q_j(i) | S_j(j)) \) where \( q_j(i) \) is given by condition 1, \( \hat{f}_j(i) \) by condition 2, and \( S_j(j) \) by condition 3.

5. For every \( b_j \), each \( j \in L \) chooses \( F_j(j) \) to maximize

   \[ \int_{\mathbb{X}(F_j, \mathbb{F}_j)} \pi_{ij}(S_j(j), i, q_j(i) | \hat{F}_j(j), s \leq 2) + V_j(j) \] where \( q_j(i) \) is given by condition 1, \( \hat{F}_j(j) \) by condition 2, \( S_j(j) \) by condition 3, and \( i \in \mathbb{X}(F_j, \mathbb{F}_j) \) by condition 4, and

   \[ \int_{\mathbb{X}(F_j, \mathbb{F}_j)} \pi_{ij}(S_j(j), i, q_j(i) | \hat{F}_j(j), s \leq 2) di = 0 . \]

6. \( V_j(j) = \sum_{m \geq t} \frac{1}{r} \int_{\mathbb{X}(F_j, \mathbb{F}_j)} \pi_{ij}(S_m(j), i, q_m(i) | \hat{F}_m(j), s \leq 2) \] where \( q_m(i) \) is given by condition 1, \( \hat{F}_m(j) \) by condition 2, \( S_m(j) \) by condition 3, \( i \in \mathbb{X}(F_j, \mathbb{F}_m) \) 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 basic model. Specifically, lenders will adopt strategies to always honor their initial financial contracts, such that \( \hat{F}(j) = F(j) \) 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 open economy are the same as the closed economy, I will just state the equilibrium for the open economy that exhibits a separating equilibrium similar to that of Section 3.

Proposition 4. If \( C^* \leq C \), there exists an equilibrium in the open economy in which a number

\[
\lambda = \max \left\{ \frac{\theta_c(r^* - 1)}{\theta_B}, \frac{(R - r^*) (r^* - 1)}{C^* - (R - r^*)}, 2 \right\}
\]

foreign lenders offer the following contract to entrepreneurs:

\[
\hat{F}^{*,C}_j(q, Y) = \begin{cases} 
\lambda (R - r^*) & \text{if } q = 1, Y = R \lambda \\
0 & \text{otherwise}
\end{cases} \quad \forall t
\]

where \( r^* = r + C^* / \lambda \) and all entrepreneurs of type \( i = C \) accept finance from a randomly chosen foreign lender and choose \( q(C \mid \hat{F}^{*,C}_j, b_j) = 1 \). Foreign lenders never renegotiate contracts and choose \( S(j) = 1 \forall t \).

And if \( r + C \leq R \), a number \( \lambda = \max \left\{ \frac{\theta_c(r - 1)}{\theta_B}, 2 \right\} \) domestic lenders also offer

\[
\hat{F}^{1,C}_j(q, Y) = \begin{cases} 
R - r^* & \text{if } q = 1, Y = R \\
0 & \text{otherwise}
\end{cases} \quad \forall t
\]

where \( r^* = r + C \) and all entrepreneurs of type \( i = A \) accept finance from a randomly chosen domestic lender and choose \( q(i \mid \hat{F}^{1,A}_j, b_i) = 1 \). Domestic lenders never renegotiate contracts and choose \( S(j) = 1 \forall t \). If \( r + C > R \), \( f(A \mid b_j) = \emptyset \), and \( f(B \mid b_i) = \emptyset \) always. Off the equilibrium path, \( f(B \mid b_i) = \hat{F}^{1,A}_j \) if domestic lender \( j \) ever failed to screen in the past and no foreign lender has failed to screen; \( f(B \mid b_i) = \hat{F}_{j,j}^{*,C} \) if foreign lender \( j \) ever failed to screen in the past; if \( r + C > R \), \( f(A \mid b_j) = \hat{F}^{*,C}_{j,j} \) if foreign lender \( j \) has ever renegotiated a contract in the past; otherwise for all other histories, \( b_i \in H_j \), entrepreneurs choose with equal probability among contracts with the same utility.
The proof of Proposition 4 can be found in the appendix, but the intuition as to why full commitment by lenders is an optimal strategy is straightforward. Lenders will always screen their projects when screening is observable and ‘bad’ entrepreneurs apply to lenders with any history of not screening. By not screening today, a lender avoids paying the cost $C^*$ for the $\theta_c/n$ entrepreneurs that accept its contract in equilibrium, but because it fails to screen, all ‘bad’ entrepreneurs in all future periods will choose to accept this lenders’ contract. The loss of ‘reputation’ implies a discounted future loss of $V_t = -\theta_n C^*/(r^* - 1)$. The gains from not screening today will be outweighed by the losses tomorrow when $n \geq \theta_c (r^* - 1)/\theta_n$. Likewise, foreign lenders will refuse to renegotiate with ‘average’ borrowers that take the ‘cream’ project because this also ruins the lenders’ ‘reputation’. When all ‘average’ entrepreneurs of the future can observe this renegotiation and approach foreign lenders’ known for renegotiation, the gains from renegotiation today are outweighed by the expected losses in future periods when $n \geq (R-r^*)(r^* - 1)/[C^* - (R-r^*)]$.

Therefore, in a repeated game where ‘bad’ entrepreneurs are on the lookout for lenders that occasionally do not screen projects and ‘average’ entrepreneurs are watching for lenders that occasionally renegotiate, it will always be optimal for lenders to commit to screening their projects and never renegotiate. Therefore, the basic model described earlier with ‘full commitment’ is a reasonable approximation of the repeated game version of the model.

6 Robustness and Extensions

This section will discuss the robustness of the basic model’s main findings. First, I will demonstrate that allowing the use of syndicated loans may not necessarily mitigate the potential adverse distributional effects of foreign entry and ‘cream-skimming’. Second, I will argue that the basic model’s findings are robust to more general assumptions regarding the distribution of firms. And last, I will demonstrate some potential dynamic implications of the model.
6.1 Syndicated Loans

The model suggests two potential policy tools the domestic government could use to induce the first-best allocation of credit. The first is to reduce the cost of domestic screening such that $C \leq \min R - r, C_\epsilon$. This would ensure that all projects are screened; ‘cream’ entrepreneurs choose larger projects, and ‘bad’ entrepreneurs are not financed. The second is that the government could reduce the cost of funds for domestic lenders. One natural way to do this would be allow the domestic lenders to borrow directly from international capital markets. In essence, the domestic and foreign lenders would engage in syndicated lending where foreign lenders provide the capital at cost $r^* < r$, and domestic lenders do the screening at cost $C < C^*$. By combining the advantages of each type of lender, syndicated lending maximizes the likelihood of achieving equilibria where ‘cream’ entrepreneurs implement larger projects, and ‘average’ entrepreneurs are not rationed.

There are many potential reasons, however, why syndicated lending may not necessarily induce the first-best allocation. First, syndicated lending only achieves the first-best allocation so long as $r^* + C \leq R$. Otherwise, ‘average’ entrepreneurs will still be credit rationed in any separating equilibrium. Second, any corruption among domestic lenders, which is not accounted for in the model here, might make bypassing the domestic lenders optimal.

Third, syndicated lending itself may also suffer from information asymmetries. Because screening is costly, domestic lenders will always have an incentive to shirk on their obligation to screen after foreign lenders provide capital for projects if screening is not perfectly observable. This moral hazard problem would be very similar to that of Holmstrom and Tirole (1997). In the simple model above, the moral hazard would be irrelevant since any project failure is a costless signal that screening was not done. Therefore, foreign lenders could refuse to compensate domestic lenders when projects fail, and syndicated lending is always feasible. However, if screening is imperfect, such that even ‘average’ entrepreneurs fail with some small probability, foreign lenders would either need to incur a cost to detect screening or provide compensation to domestic banks in excess of the true
cost of screening, $C$, to ensure the domestic lenders’ incentives are properly aligned. Either way, the added costs can render syndicated lending unprofitable even when $r' + C < R$.

### 6.2 Allowing for varying $\lambda$ and $R$

The basic mechanisms of the model would also be robust to allowing for a distribution of ‘cream’ entrepreneurs with varying project sizes, $\lambda$, and returns, $R$. The screening cost thresholds, $C$ and $\bar{C}$, would simply become entrepreneur specific in a continuous model. For instance, a ‘cream’ entrepreneur $i$ with a project of size $\lambda(i)$ and return $R(i)$ that implies a cost threshold, $C(i) \geq C$, would be screened and financed fully in the closed economy. However, all ‘cream’ entrepreneurs with small projects or returns will be pooled with ‘average’ and ‘bad’ entrepreneurs. If the mass of ‘cream’ entrepreneurs pooled with ‘average’ entrepreneurs falls too low and screening ‘average’ entrepreneurs is not feasible, than the pooling equilibrium breaks causing all entrepreneurs with projects that imply $C(i) < C$ to lose financing. Again, foreign entry has the potential of unraveling the pooling equilibrium as foreign lenders will be willing to target a wider distribution of ‘cream’ entrepreneurs thus reducing the number of entrepreneurs pooled by domestic lenders.

### 6.3 Overlapping Generations and Dynamic Implications

The model could also be extended to an overlapping generations framework where entrepreneurs exhibit various stages of life. For instance, suppose that entrepreneurs live for two periods, where in the first stage of life, they are ‘young’ and in the second stage they are ‘old’. When ‘young’, entrepreneurs are either ‘average’ or ‘bad’. When they become ‘old’, all ‘bad’ entrepreneurs remain ‘bad’, while there is some stochastic process transforming ‘average’ entrepreneurs into ‘bad’, ‘average’ or ‘cream’. A new set of young entrepreneurs is born each period, and all entrepreneurs ‘die’ at the end of the second period or whenever they are unable to obtain credit, whichever is earliest. If some screening cost is necessary to reassess an ‘average’ entrepreneur’s quality in period 2, than foreign entry can also lead to a decline in future ‘cream’ projects.
The intuition is straightforward. When screening is very costly, domestic lenders may choose to pool all young entrepreneurs along with all old entrepreneurs that successfully implemented their first project when young. Young entrepreneurs that failed are clearly ‘bad’, and hence, never refinanced in old age. Again, foreign lenders will have a competitive advantage in lending to older, ‘cream’ entrepreneurs and will steal these projects away from domestic lenders. If domestic lenders find it costly to screen entrepreneurs in their ‘young’ stage of life, they may exit the market entirely. In this case, future ‘cream’ entrepreneurs will never develop and instead die ‘young’.

7 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, economic growth, and investment 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 via open capital markets may take the form of ‘cream-skimming’ that has distributional implications. Foreign lenders’ use their lower cost of funds to offer more competitive financial contracts but only finance the largest and most profitable projects because of their higher cost of acquiring information about domestic projects. 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 entrepreneurs with positive NPV projects. The overall effect of open capital markets on output and investment can be ambiguous.

The theoretical findings imply some natural policy implications. Types of opening that lower geographic or institutional costs of foreign lenders will reduce the likelihood of an adverse effect on ‘opaque’ borrowers. Improving the quality of local institutions and the ability of domestic lenders to acquire information about entrepreneurs’ quality will also reduce adverse distributional effects.
8 Appendix

A – Justification for Using Pure Debt Contracts

For all financial contracts of size $I \in \{1, \lambda\}$ and type $k \in \{0, Z, A, B, C\}$, it is sufficient to consider only equilibrium contracts with $F^{I,k}(q = 1, Y = RI) \geq 0$ and $F^{I,k}(q = 1, Y = 0) = 0$ as long as there are multiple lenders offering identical contracts in equilibrium. This is shown in Lemma 1. Given this, when projects are implemented (such that $q = 1$) these contracts can be interpreted as pure debt contracts of size $I$ and lending rate $R - F^{I,k}(q = 1, Y = RI)/I$.

Lemma 1: For all financial contracts of size $I \in \{1, \lambda\}$ and type $k \in \{0, Z, A, B, C\}$ it is sufficient to consider only equilibrium contracts with $F^{I,k}(q = 1, Y = RI) \geq 0$ and $F^{I,k}(q = 1, Y = 0) = 0$ 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 $F(q = 1, Y = R) \geq 0$ for successful projects and $F(q = 1, Y = 0) \geq 0$ for failures.

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

$\nu(F^{I,k}, q = 1 | i = k) = p(k | I)F^{I,k}(q = 1, Y = RI) + [1 - p(k | I)]F^{I,k}(q = 1, Y = 0) = \bar{\omega}$

and expected profit $\pi_j(k, q = 1 | F^{I,k}) = p(k | I)[R - r(j)]I - \nu(F^{I,k}, q = 1 | k) - C(j)$.

Since all firms accepting this contract will be of type $k$, the expected returns can always be replicated for each agent involved by using a contract where

$F^{I,k}(q = 1, Y = 0) = 0$ and $F^{I,k}(q = 1, Y = RI) = \bar{\pi} / p(k | I)$.

For financial contracts where $k = 0$ and all borrowers accepting it in equilibrium have the same probability of success, $\bar{p}(i | I)$, a similar reasoning holds. A payment of $F(q = 1, Y = RI) = \bar{\pi} / \bar{p}(i | I)$ 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 payment for all agents cannot be replicated using a contract with \( F^{1,k}(q = 1,Y = 0) = 0 \).

However, it can be shown that a contract with \( F^{1,k}(q = 1,Y = 0) > 0 \) 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 \( F^{1,0}(q = 1,Y = RI) = G \geq 0 \) and \( F^{1,0}(q = 1,Y = 0) = H > 0 \). If a continuum 1 of entrepreneurs accept the contract where a fraction \( \alpha \) only succeed with probability \( p \), the expected return for each lender is given by \( \left[ (1 - \alpha)(1 - p)[(RI - G) - \alpha(1 - p)H] \right] / n \) and this must equal zero in equilibrium. A lender that offered a contract where \( F^{1,0}(q = 1,Y = RI) = G + \varepsilon \) and \( F^{1,0}(q = 1,Y = 0) = 0 \) for some \( \varepsilon > 0 \), however, would make profits of \( (1 - \alpha)(RI - G - \varepsilon) \) because only entrepreneurs with probability of success 1 will take this new contract. And, for \( (1 - \alpha)(RI - G - \varepsilon) > 0 \) this contract will be more profitable. But, since \( [1 - \alpha(1 - p)][RI - G) - \alpha(1 - p)H = 0 \) in any equilibrium, it must be true that \( RI > G \) when \( H > 0 \). Therefore, there exists some \( \varepsilon \) such that \( (1 - \alpha)(RI - G - \varepsilon) > 0 \). Therefore, contracts with \( k = 0 \) and \( H > 0 \) can never be an equilibrium. QED

B – Proof of Proposition 1

There are 10 different types of financial contracts that lenders could offer:

\( F^{1,k}, F^{2,k} \forall k \in \{0, Z, A, B, C\} \). 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 \( F(1,RI) > 0 \), \( F(1,0) = 0 \) and \( F(0,) = 0 \) when the number of lenders offering identical contracts is \( n \geq 2 \). In parts 2-4, I will show that 7 of the 10 financial contracts cannot be
equilibrium contracts. In part 5, I will then derive the conditions under which the three remaining financial contracts can co-exist in equilibrium. This will be sufficient to prove the allocations of Proposition 1 are unique. 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 – When there are \( n \geq 2 \) lenders offering the same contracts in equilibrium, a contract with \( F(0,\cdot) = G > 0 \) cannot be an equilibrium if any type of entrepreneur actually accepts the contract and chooses \( q = 0 \) in equilibrium. Any individual lender could increase profits by offering the same contract with \( F(0,\cdot) = G - \varepsilon > 0 \), for some \( \varepsilon > 0 \). Entrepreneurs choosing the original contract with \( q = 0 \) would no longer take the new contract from that particular lender, while those that choose \( q = 1 \) would still do so. Since \( \pi(q = 0, i \mid F) < 0 \) for \( F(0,\cdot) > 0 \), the lender’s profits would increase from this change. Therefore, it is sufficient to only consider equilibrium contracts with \( F(0,\cdot) = 0 \).

And, from Lemma 1, we know it is also sufficient to consider only equilibrium contracts with \( F(1,RI) \geq 0 \) and \( F(1,0) = 0 \). If \( F(1,RI) = 0 \), 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 \( F(1,RI) > 0 \), \( F(1,0) = 0 \) and \( F(0,\cdot) = 0 \).

Part 2 -- In equilibrium, any financial contract \( F^{I,A} \) yielding negative expected profits for the lender at \( t = 1 \) cannot be an equilibrium contract as lenders could increase profits by dropping the contract. This allows me to exclude financial contracts that are ex-ante unprofitable for the lender if any entrepreneur were to accept the contract. Those contracts are: \( F^{I,A}, F^{I,B}, F^{I,Z} \) and \( F^{A,Z} \).

Given \( pR < r \), the \( F^{A,A}, F^{I,B} \) and \( F^{A,B} \) contracts always yield a negative return for the lender if \( q = 1 \) when the contract takes the form \( F(1,RI) > 0 \) and \( F(1,0) = 0 \), and \( C > 0 \) ensures that \( F^{I,Z} \) and \( F^{A,Z} \) each yield a negative return for the lender if accepted by entrepreneurs of type \( Z \).

Part 3 -- Suppose that \( F^{I,0} \) was an equilibrium contract. By assumption (1), \( \theta_A > \theta_C \),
$pR < r$, and Part 1, 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 $F(1,RI) > 0$, $F(1,0) = 0$ and $F(0,\cdot) = 0$ in equilibrium, however, it is easy to see that if ‘cream’ firms prefer this contract in equilibrium, then it must be that $F^{2,0}(1,R \lambda) > F^{1,0}(1,R)$. But, $F^{2,0}(1,R \lambda) > F^{1,0}(1,R)$ implies that ‘bad’ firms must also prefer this contract since Part 2 proves that $F^{1,0}$ and $F^{2,0}$ are the only contracts available to bad firms in any equilibrium. Therefore, $F^{2,0}$ can never be an equilibrium contract.

Part 4 -- Suppose $F^{1,C}$ were an equilibrium contract. Then, it must make zero profits, and by Part 1, we know the contract can be implemented as a pure debt contract. Together, this implies that $F^{1,C}$ would charge an interest rate of $r + C$ in equilibrium. But, another lender could always increase profits by offering the larger contract $F^{2,C}$ at exactly the same interest rate, and ‘cream’ firms would always prefer the larger contract. Therefore, $F^{1,C}$ cannot be an equilibrium contract.

Part 5 – From Parts 1-4, we know there are only three possible types of contracts that could be offered in equilibrium: $F^{1,0}, F^{1,A}$ and $F^{2,C}$. Therefore, lenders either offer an unscreened contract for small projects, a screened contract for ‘average’ entrepreneurs, or a large screened contract for ‘cream’ borrowers. Moreover, by Part 1, it is sufficient to consider only contracts with $F(1,RI) > 0$, $F(1,0) = 0$ and $F(0,\cdot) = 0$.

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’ entrepreneurs. Therefore, by assumption (1) and $\theta_A > \theta_C$ this contract can only be profitable if both ‘average’ and ‘cream’ borrowers also select it, and it is feasible for the lender. Therefore, by the zero profit condition, $F^{1,0}$ must offer a lending rate $r^{pool} = r / \left(1 - (1 - p)\theta_b\right)$, and will only be feasible for the lender if $r^{pool} \leq R$. The contract will also only exist if neither of the other two contracts is preferred by either ‘average’ or ‘cream’ entrepreneurs. The zero profit condition ensures that $F^{1,A}$ must offer an equilibrium lending rate of
\[ r^A = r + C \quad \text{and} \quad F_{k,C}^A \] must offer a lending rate of \[ r^C = r + C / \lambda \]. By assumption (3), \( F_{k,C}^A \) is always feasible, but \( F_{k,A}^1 \) will exist only if \( r + C \leq R \). Because \( F_{k,C}^A \) in equilibrium offers a higher return to ‘cream’ firms than \( F_{k,A}^1 \) offers to ‘average’ firms, we need only check when ‘cream’ firms will prefer \( F_{k,C}^A \) to \( F_{k,B}^1 \). This will occur when \( \lambda(R - r^C) \geq R - r^{pool} \), and this is true for \( C \leq C \). Thus, we now know that for \( C \leq C \), \( F_{k,A}^1 \) and \( F_{k,C}^A \) that pay lending rates \( r^A = r + C \) and \( r^C = r + C / \lambda \) respectively are the only possible equilibrium contracts, and for \( C > C \), \( F_{k,B}^1 \) that pays a lending rate \( r^{pool} \leq R \) is the only potential equilibrium contract. Thus the allocation in Proposition 1 is unique.

**Part 6 –** To prove these are in fact equilibrium financial contracts, 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 \( C > C \), and all entrepreneurs are pooled on the small project. While enticing either ‘average’ or ‘cream’ firms to take a contract where \( F(0,.) > 0 \) and then choose \( q = 0 \) can never be a profitable deviation, it is possible that taking such a loss on ‘bad’ firms would be profitable since lenders already take a loss on these entrepreneurs. However, by assumption (2), the losses on such a contract would always be greater for any contract where \( k = 0 \) since all entrepreneurs of type \( Z \) would also take the contract and choose \( q = 0 \). However, for \( F_{k,B}^1 \) contracts, the lender could entice only ‘bad’ entrepreneurs to take the contract and choose \( q = 0 \) if \( F_{k,B}^1(0,.) > p(R - r^{pool}) \). If each ‘bad’ entrepreneur were to switch contracts, the lender takes a minimum loss of \( p(R - r^{pool}) + C \) on the new contract per ‘bad’ entrepreneur, whereas the loss before was \( p(R - r^{pool}) + r - pR \). Thus, if \( C > pR - r \), this deviation can never be profitable. Therefore, no contract where entrepreneurs choose \( q = 0 \) can break this equilibrium.

Given \( F_{k,B}^1(0,.) > 0 \) can never be a profitable deviation, lenders could never increase profits by offering \( F_{k,B}^1 \) contracts (i.e. ‘bad’ entrepreneurs would still implement their project at a loss, but the lender would now take a larger loss because it screens the ‘bad’ firm). And clearly, it is never
profitable to offer $F_{1,2}$, $F_{A,A}$, $F_{1,A}$ or $F_{1,C}$. The $F_{A,0}$ contract will also by unprofitable by assumption (1), $\theta_A > \theta_C$, and the fact that bad will always prefer the contract if ‘cream’ borrowers do.

This leaves only $F_{A,C}$. However, $C > \underline{C}$ implies that lenders can never profitably induce ‘cream’ entrepreneurs to take a larger contract with screening. Therefore, $F_{1,0}$ is an equilibrium contract for $C > \max\{\underline{C}, r - \rho R\}$, $r_*^{pool} = r / (1 - (1 - \rho)\theta_b)$ and $r_*^{pool} \leq R$.

Now consider the case where $C \leq \underline{C}$. Clearly, no $F_{1,0}, F_{1,2}$ contract can be a profitable deviation, and no $F_{1,0}$ contract can be a profitable deviation since ‘bad’ firms would accept it and a pooling equilibrium with all entrepreneur types is never profitable for lenders when $C \leq \underline{C}$. This only leaves $F_{A,A}$ and $F_{1,C}$. But, $F_{A,A}$ can never be profitable for a lender to offer, and $F_{1,C}$ can never be both profitable for the lender and better for the ‘cream’ entrepreneur given $F_{A,C}$.

Therefore, for $C \leq \underline{C}$, $F_{1,A}$ and $F_{A,C}$ are the unique equilibrium contracts, which can be expressed as pure debt contracts that pay lending rates $r_A = r + C$ and $r_C = r + C / \lambda$ respectively. And, $F_{1,A}$ is an equilibrium contract if and only if $r_A \leq R$. QED

C – Proof of Proposition 2

Using the same logic as in parts 1-4 of the proof of Proposition 1, there are only two potential foreign lender contracts that can be equilibrium contracts $F_{1,0}$ and $F_{A,C}$, and it is sufficient to consider contracts of the form $F_z(1,RJ) > 0$, $F_z(1,0) = 0$ and $F_z(0,.) = 0$. [Unlike domestic lenders, $F_{1,A}$ cannot be an equilibrium contract for foreign lenders because of assumption (4).] And similar to parts 5-6 of Proposition 1, it can be shown that $F_{1,0}$ only exists as a pure debt contract with interest rate $r_*^{pool} = r^* / (1 - (1 - \rho)\theta_b)$ for $C^* > \max\{\underline{C}, r^* - \rho R\}$, $r_*^{pool} \leq R$ and $F_{A,C}$ only exists for $C^* \leq \underline{C}$, and charges a lending rate $r_*^C = r^* + C^* / \lambda$. Moreover, it can be shown that these two contracts always exclude their domestic equivalents from being equilibrium contracts. Thus, the only other
possible equilibrium contract is \( F^{1,A} \) where \( F^{1,A} \) exists only if \( r^1 \leq R \), \( C^* \leq \bar{C} \) just as in the closed economy. Then, using the same approach as in part 6 of the proof for Proposition 1, it is easy to see that no other available contracts break this equilibrium. QED

**D – Proof of Proposition 3**

For an economy to switch from a pooling equilibrium in the closed economy to the separating equilibrium in the open economy, it must be that \( C^* \leq \bar{C} \) and \( r^{pool} \leq R \). Moreover, in the pooling equilibrium, net output is \((\theta_A + \theta_C)(R - r) - \theta_b(r - pR)\), while in the open economy where \( r + C \leq R \), net output is \((\lambda(R - r^*) - C^*)\theta_C + (R - r)\theta_A\). Therefore, net output will increase when:

\[
(\lambda(R - r^*) - C^*)\theta_C + (R - r)\theta_A > (\theta_A + \theta_C)(R - r) - \theta_b(r - pR)
\]

\[
C^* < \lambda(R - r^*) + \theta_b(r - pR) / \theta_C - (R - r)
\]

Given assumption (1) and \( \theta_A > \theta_C \), this condition is always true when \( C^* \leq \bar{C} \) and \( r^{pool} \leq R \).

In the open economy where \( r + R > C \), the equivalent condition for an increase in net output is easily shown to be: \((R - r)\theta_A > \left( [\lambda(R - r^*) - C^*] - (R - r) \right)\theta_C + (r - pR)\theta_b \) QED

**E – Proof of Proposition 4**

This proof will proceed in five parts. First, I will show that all entrepreneurs 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]. Third, I will prove that screening after entrepreneurs have accepted a contract is optimal for lenders [condition 3 of the equilibrium]. Fourth, I will prove entrepreneurs 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 entrepreneurs, that the contracts offered are an equilibrium and provide zero profits [condition 5].
Part 1 – For all $t$ and $b_j$, all entrepreneurs clearly choose the optimal action $q = 1$ given the contract offered. For cream entrepreneurs with $\tilde{F}^{i,c}_{t,j}$, $q(C) | \tilde{F}^{i,c}_{t,j}, b_j) = 1$ maximizes utility, and for average entrepreneurs with $\tilde{F}^{i,a}_{t,j}$, $q(A) | \tilde{F}^{i,a}_{t,j}, b_j) = 1$ clearly maximizes utility.

Part 2 – For all $t$, $b_j$, and $f_j(i)$, 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 entrepreneurs expected payment, so no renegotiation is possible.

Part 3 – Both foreign lenders and domestic lenders (when $r + C \leq R$) choose to screen their contracts for all $t$ and $b_j$. 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’ entrepreneurs will select the contract in equilibrium. By parts 1 and 2, we know it will never want to renegotiate the contract, and the ‘cream’ entrepreneurs will always implement the project. Therefore, $S = 0$ yields the entrepreneur a return of $\pi_{j,i} \left( S, i, q(i) | \tilde{F}_{j,i}, s \leq 2 \right) = \theta_c C^* / n$ in period $t$. (It avoids paying the cost $C^*$ for the $\theta_c / n$ entrepreneurs that accept its contract in equilibrium). Because it failed to screen, however, all ‘bad’ entrepreneurs in all future periods will choose to accept this lenders’ contract. This implies $V_{t,i} = -\theta_BC^*/(r^*-1)$. Therefore, for $S = 0$, $\pi_{j,i} + V_{t,i} = \theta_c C^*/n - \theta_BC^*/(r^*-1)$, while for $S = 1$, $\pi_{j,i} + V_{t,i} = 0$. Therefore, the lender will not choose $S = 0$ when

\[
0 > \frac{\theta_c C^*}{n} - \frac{\theta_b C}{r^*-1} \\
n > \frac{\theta_c (r^*-1)}{\theta_b}
\]

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’ entrepreneurs 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’ entrepreneurs and hence, benefits less from not screening. 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, \( F_t \), and \( b_t \), each \( i \in E \) chooses \( f_j(i) \in F_j \) to maximize \( u_{i,j}(\tilde{f}_j(i), q_j(i) | S_t(j)) \). This statement is clearly true for ‘cream’ entrepreneurs who always get the highest possible return by selecting \( \tilde{F}_{s_t,j}^{A,C} \). Likewise, when \( r + C \leq R \) and \( \tilde{F}_{s_t,j}^{1,A} \) is offered, the ‘average’ entrepreneurs maximize their utility by selecting \( \tilde{F}_{s_t,j}^{1,A} \). However, if \( r + C > R \), then ‘average’ may want to choose \( \tilde{F}_{s_t,j}^{2,C} \) 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 \( R - r - \varepsilon > 0 \) if it renegotiated and went ahead with a contract of

\[
\tilde{F}_{s_t,j}^{1,A}(q, Y) = \begin{cases} 
\varepsilon & \text{if } q = 1, Y = R \\
0 & \text{otherwise}
\end{cases}
\]

where \( \varepsilon > 0 \). The ‘average’ entrepreneur 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 \( \pi_{s_t,j}(S_t(j), i, q_j(i) | \tilde{F}_{s_t,j}, s > 2) = \theta_A(R - r^*)/n \). But, by renegotiation in period \( t \), all ‘average’ entrepreneurs in the future will choose to accept this contract because the lenders’ reputation for not renegotiating is destroyed. This implies \( V_f = -\theta_A((r^* + C^*) - R)/(r^* - 1) \). Thus, renegotiation implies, \( \pi_f + V_f = \theta_A(R - r^*)/n - \theta_A((r^* + C^*) - R)/(r^* - 1) \). A foreign lender that chooses to not renegotiate simply makes \( \pi_{s_t,j} + V_f = 0 \) because it does not provide them with a contract. Therefore, renegotiation will not be optimal when,

\[
0 > \frac{\theta_A(R - r^*)}{n} - \frac{\theta_A((r^* + C^*) - R)}{r^* - 1}
\]

\[
n > \frac{(R - r^*)(r^* - 1)}{(r^* + C^*) - R}
\]
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 $r^* + C^* > R$.

So, ‘average’ firms will not have an incentive to choose the foreign lender contract designed for ‘cream’ firms because they know it is not optimal for foreign lenders to renegotiate once their type becomes known. Likewise, ‘bad’ entrepreneurs will never choose either equilibrium contract, because it is never optimal for either foreign or domestic lenders to renegotiate with a ‘bad’ entrepreneur. They always make an expected loss when financing a ‘bad’ firm.

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 the financial contracts, $\tilde{F}_{j,t}^{A}$ and $\tilde{F}_{s,j,t}^{C}$. 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 open economy and yield zero profits.
References


