# Multinational Firms, FDI Flows and Imperfect Capital Markets

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**Abstract**

How are patterns of cross-border licensing, multinational firm (MNC) activity, and foreign direct investment (FDI) flows determined in a world with frictions in financial contracting and variation in institutional environments? As developers of technologies, MNCs have long been characterized as having comparative advantage in monitoring the deployment of their technology. The model developed in this paper demonstrates that the nonverifiable nature of monitoring coupled with the presence of sufficient financial frictions endogenously gives rise to MNC activity and FDI flows. The mechanism generating MNC activity is *not* the risk of technological expropriation by local partners but the demands of external funders who require MNC participation to ensure value maximization by local entrepreneurs. The model delivers distinctive predictions for the impact of weak financial institutions on patterns of MNC activity and FDI flows. Weak institutional environments limit the scale of multinational firm activity but increase the share of that activity that is financed by multinational parents through FDI flows. The model also emphasizes how the decision to either license or engage in FDI in a given country depends on the verifiability of monitoring and the nature of investor protection. The main predictions of the model are tested and confirmed using firm-level data on U.S. outbound FDI.

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# 1 Introduction

The role of the contracting environment in explaining cross-country differences in financial market development, corporate ownership patterns, and firm investment and economic growth experiences has been a central emphasis in recent scholarship. In this scholarship, firms are presumed to be entirely local, raising and deploying capital within one institutional setting. Firms that span countries, developing technologies or raising capital in one country for exploitation elsewhere, are abstracted from in these models. This oversight is particularly surprising given the increasing importance of multinational firms to the world economy, particularly to those economies typically considered institutionally fragile.

This paper develops a model that considers how firms with proprietary technologies make operational, financing and investment decisions across various institutional environments. Specifically, the model emphasizes how the decision to either license or invest in countries depends on the verifiability of monitoring and the nature of investor protections. The model demonstrates that foreign direct investment (FDI) arises endogenously in settings characterized by financial frictions. This model provides several predictions on the degree to which multinational firm activity is financed by capital flows, when technologies are exploited through licenses, and when and why firms take ownership positions. These predictions are tested using firm-level data on U.S. multinational firms.

The central premise of the model is that developers of technologies have a comparative advantage in monitoring how that technology is exploited. This emphasis on monitoring builds on the insights of Holmstrom and Tirole (1997), where monitoring is critical to understanding financial intermediation. This intuition of superior monitoring ability also reflects findings from granular studies of multinational firms on what these firms do with respect to their overseas activities. Dunning (1970) in his study of multinational firm activity notes that multinational firms provide "informal managerial or technical guidance, ... the dissemination of valuable knowledge and/or entrepreneurship in the form of research and development, production technology, marketing skills, managerial expertise, and so on." As this quote indicates, the participation of multinational firms ensures that technologies are exploited to their fullest potential through managerial guidance.

The characterization of multinational firms as developers of technologies has long been central to models explaining multinational firm activity. In contrast to those models, which emphasize the risk of technology expropriation by local firms, the model in this paper emphasizes financial frictions, a cruder form of managerial opportunism and the role of external funders. Specifically, liquidity-constrained, host-country entrepreneurs are forced by external funders to have multinational firm participation to prevent managerial theft and to ensure value maximization. Without this participation, external funders refuse capital to the entrepreneur. The concern over managerial misbehavior, and the requirement for multinational participation, is greatest in weak institutional environments. As such, while technology is central to these other models and the model in this paper, the mechanism generating multinational firm activity is entirely distinct.

The model delivers the case of participation without investment if monitoring is fully verifiable. When monitoring is fully verifiable and local production is desired, developers of technologies (multinational firms) license technologies to host-country entrepreneurs who exploit those technologies without capital flows or ownership stakes by the developer of the technology. It is also shown that lower investor protections limit the scale of these operations even in this case of fully verifiable monitoring.

When monitoring is nonverifiable, capital flows and multinational ownership of assets abroad arise endogenously to align the incentives of the inventors of technology and the entrepreneurs in host economies. The inability to contract on monitoring necessitates an alternative optimal contract that provides multinational firms with an ongoing reason to provide monitoring services. This optimal contract takes the form of ownership and associated capital flows as external funders demand equity-like participation by multinational firms to ensure ongoing monitoring.[1]

The case of nonverifiable monitoring delivers several novel predictions about the nature of capital flows and patterns of multinational firm activity. First, the model predicts that technology will be exploited in countries with high levels of financial development through unrelated party licensing rather than through affiliate activity. Second, the share of activity abroad financed by capital flows from the multinational parent will be decreasing in the quality of investor protections in host economies. Third, ownership shares by multinational parents will also be decreasing in the quality of investor protections in host economies. These predictions reflect the fact that monitoring by the developer of the technology is more critical in settings where investor protections are weaker. These predictions are not about the scale of activity but rather about the degree to which foreign operations are financed by capital flows and owned by multinational firms, rather than domestically from external sources.

Finally, the model predicts that the scale of activity based on multinational technologies in host countries will be an increasing function of the quality of the institutional environment in those countries. Better institutional environments alleviate the losses from the nonverifiable nature of monitoring and, therefore, allow for larger activity. As such, large amounts of

[1] Following Holmstrom and Tirole (1997), in our model contracting is "complete" in the sense that we solve for the optimal contract subject to explicit information frictions. This is in contrast to a large incomplete-contracting literature in corporate finance.

multinational firm activity between well-developed economies reflect the larger efficient scale of activities when the losses of nonverifiable monitoring can be limited. The model provides an explanation for how overall multinational firm activity in host economies can be limited by institutional fragility in those economies.

In order to evaluate these predictions, microdata on the activities of American multinational firms is employed. These data effectively slice open American multinational firms and provide details on their worldwide operations. These data also permit the inclusion of parent-year fixed effects and therefore implicitly control for a variety of unobserved attributes.

The analysis indicates that likelihood of licensing technology to serve a foreign market increases with financial development and that this effect is most pronounced for R&D-intensive firms, as predicted by the model. The share of affiliate assets financed by parental equity and intrafirm debt is a decreasing function of the depth of local capital markets. Similarly, the share of equity that parents own is a decreasing function of the depth of local capital markets. The effects of local capital markets on parental financing choices are most pronounced for R&D intensive firms. As such, parental financing and licensing choices are particularly sensitive to local capital markets precisely when monitoring is the most valuable, as predicted by the model.

Finally, settings where ownership restriction liberalizations are removed provide an opportunity to test the final prediction of the model. Specifically, the model predicts that these liberalizations will have a particularly large effect on multinational affiliate activity in institutionally-weak countries as, in those countries, ownership restrictions were limiting multinational firm activity the most. The analysis indicates that aggregate affiliate activity grows fastest after liberalizations in countries that have shallower capital markets, as predicted by the model.

By examining how the contracting environment influences firm cross-border investments, this paper stands at the intersection of three literatures - the macroeconomic literature on capital flows, the international trade literature on patterns of FDI activity, and the literature on the role of the contracting environment in dictating firm investment patterns. The paradox posed in Lucas (1990) of limited capital flows from rich to poor countries in the face of large presumed rate of return differentials has prompted several scholars to reexamine the determinants of these flows. While Lucas (1990) emphasizes human-capital externalities to help explain this paradox, Reinhart and Rogoff (2004) review subsequent research on aggregate capital flows and argue that "credit markets and political risk are the main reasons that we do not see more capital flows to developing countries." Typically, this evidence employs aggregate capital flows, as in Alfaro, Kalemli-Ozcan and Volosovych

(2004), and does not explain the mechanisms by which FDI, relative to sovereign borrowing or portfolio flows, is limited by weak contract enforcement.

Our model provides an explanation for why weak contract enforcement and credit markets can limit FDI flows by showing how the production decisions of multinational firms endogenously give rise to flows in a world of nonverifiable monitoring.[2] In short, we show that weak institutional environments decrease the scale of multinational firm activity but simultaneously increase the reliance on capital flows from the parent. As such, observed patterns in capital flows reflect these two distinct (and contradictory) effects and the empirical investigations of micro-data provided in the paper indicate that both effects are operative.

Industrial organization and international trade scholars have emphasized the role of market imperfections (eg. transport costs and market power) in determining patterns of multinational activity rather than the determinants of capital flows. Specifically, more recent generations of scholarship on multinational firms investigate alternative motivations for foreign direct investment (either "horizontal" or "vertical" motivations[3]) and the reasons why alternative productive arrangements (whole ownership of foreign affiliates, joint ventures, exports or arms-length contracts[4]) are employed. These analyses of multinational firm activity have largely become divorced from analyses of the underlying capital flows. The model presented below places financial frictions at the center of how firms make production and investment decisions and demonstrates that financial flows are necessitated by production decisions. These financial flows are impacted by the institutional environment of host countries and, in turn, production decisions are influenced as well.[5]

[2] In a related vein, Gertler and Rogoff (1990) show how lending to entrepreneurs in poor countries is limited by their inability to pledge large amounts of their own wealth. This insight is embedded into a multinational firm's production decisions in the model presented here. Our setup also relates to Shleifer and Wolfenzon (2002), who study the interplay between investor protection and equity markets.

[3] The horizontal FDI view represents FDI as the replication of capacity in multiple locations in response to factors such as trade costs, as in Markusen (1984), Brainard (1997), Markusen and Venables (2000), and Helpman, Melitz and Yeaple (2004). The vertical FDI view represents FDI as the geographic distribution of production globally in response to the opportunities afforded by different markets, as in Helpman (1984) and Yeaple (2003). Caves (1996) and Markusen (2002) provide particularly useful overviews of this literature.

[4] Antràs (2003, 2005), Antràs and Helpman (2004), Desai, Foley and Hines (2004), Ethier and Markusen (1996), Feenstra and Hanson (2005), and Grossman and Helpman (2004) analyze the determinants of alternative foreign production arrangements.

[5] Two exceptions to the cleavage between studies of activity levels and flows are worth noting. First, high frequency changes in FDI capital flows have been linked to relative wealth levels through real exchange rate movements (as in Froot and Stein (1991) and Blonigen (1997)), broader measures of stock market wealth (as in Klein and Rosengren (1994) and Baker, Foley and Wurgler (2005)) and to credit market conditions (as in Klein, Peek and Rosengren (2002)). Second, multinational firms have also been shown to opportunistically employ internal capital markets in weak institutional environments (as in Desai, Foley and Hines (2004b)) and during currency crises (as in Aguiar and Gopinath (2005) and Desai, Foley and Forbes (2005)). These papers emphasize how heterogeneity in access to capital can interact with multinational firm production decisions. Marin and Schnitzer (2004) also study the financing decisions of multinational firms in a model that stresses managerial incentives. Their model however takes the existence of multinational firms as given

Finally, a large and growing literature has emphasized the role of institutional environments in dictating the depth of financial markets and patterns of economic growth. In particular, scholars have emphasized investor protections (as in La Porta, Lopez-de-Silanes, Shleifer and Vishny (1997, 1998)) and property rights institutions (as in Acemoglu and Johnson (2005)). At the firm level, several studies, including Rajan and Zingales (1998) and Wurgler (2000), have shown that financial market conditions influence firm investment behavior and, in the case of Acemoglu, Johnson and Mitton (2005), that the contracting environment can influence the nature of industrial activity and levels of vertical integration. This paper extends the investigation of the role of institutions in dictating patterns of firm activity by explicitly analyzing how firms make production and financing decisions across institutional environments.[6]

Section 2 of the paper lays out the model and discusses the case of fully verifiable monitoring, extends the model to settings of nonverifiable monitoring and then generates several predictions related to the model. Section 3 provides details on the data employed in the analysis. Section 4 presents the results of the analysis and section 5 concludes.

# 2 Theoretical Framework

In this section, we develop a new theoretical framework for understanding multinational activity and foreign direct investment flows. In order to build intuition, we begin by describing a simple partial equilibrium model of financing that extends the work of Holmstrom and Tirole (1997). We later illustrate how the model is able to generate both multinational activity as well as foreign direct investment flows. Finally, we explore some firm-level empirical predictions that emerge from the model.

## 2.1 A Simple Model of Financial Contracting

### Environment

We consider the problem of an agent – an **inventor** –, who is endowed with an amount $W$ of financial wealth and the technology or knowledge to produce a differentiated good

and also considers an incomplete-contracting setup (in contrast to our complete-contracting setup). The predictions from their model are quite distinct (and typically contradictory) to the ones we develop here and we show to be supported by U.S. data.

[6] Harrison, Love, and McMillan (2004) consider the related, but distinct, question of whether the presence of FDI flows alleviates the financing constraints characteristic of emerging markets. While Harrison, Love and McMillan (2004) find that the presence of FDI alleviates financial constraints for local firms, this paper explicitly considers the interaction of multinational firms with local entrepreneurs and how this interaction is mediated by the quality of investor protections.

using a unique composite factor of production – labor. Consumers in two countries, Home and Foreign, derive utility from consuming this differentiated good.[7] The good is, however, prohibitively costly to trade and thus servicing a particular market requires setting up a production facility in that country. The inventor is located at Home and cannot fully control production in Foreign. Servicing that market thus requires contracting with a foreign agent – an **entrepreneur** – to manage production there. We normalize the foreign wage to equal 1. We assume that entrepreneurs are endowed with no financial wealth and their outside option is normalized to 0. There also exists a continuum of infinitessimal external **investors** in Foreign that have access to a technology that gives them a gross rate of return equal to 1 on their wealth. All parties are risk neutral and are protected by limited liability.

**Consumer Preferences and Technology**

In the main text, we focus on describing production and financing decisions in the Foreign market. For that purpose, we assume that preferences and technology at Home are such that the inventor obtains a constant gross return $\beta > 1$ for each unit of wealth he invests in production at Home. We refer to this gross return as the inventor's *shadow value of cash.* In Appendix A.1, the value of $\beta$ is endogenously derived in a multi-country version of the model where consumer preferences, technology and financial contracting in all countries are fully specified.

We assume that Foreign preferences are such that the revenue obtained from the sale of the differentiated good in Foreign can be expressed as a strictly increasing and concave function of the quantity produced, i.e, $R(x)$, with $R'(x) > 0$ and $R''(x) \leq 0$, We also assume the standard conditions $R(0) = 0$, $\lim_{x\to 0} R'(x) = +\infty$, and $\lim_{x\to\infty} R'(x) = 0$. These properties of the revenue function can be derived from preferences featuring a constant (and higher-than-one) elasticity of substitution across (a continuum of) differentiated goods produced by different firms. In such case, the elasticity of $R(x)$ with respect to $x$ is constant and given by a parameter $\alpha \in (0, 1)$.

Foreign production is managed by the foreign entrepreneur, who can privately choose to *behave* or *misbehave*. When the manager behaves, the project performs with probability $p_H$, in the sense that when $x$ workers are employed in production, revenue is equal to $R(x)$ with probability $p_H$ and 0 otherwise.[8] On the other hand, when the manager misbehaves, the project performs with a lower probability $p_L < p_H$ and expected revenue is $p_L R(x)$. We assume, that the manager obtains a private benefit from misbehaving and that this private benefit is proportional to the return of the project, i.e., $BR(x)$. As described below, we

[7] In Appendix A.1, we develop a multi-country version of the model.

[8] This assumes a constant-returns-to-scale technology by which each worker produces a unit of output.

will relate this private benefit to the stage of financial development in Foreign as well as to the extent to which the entrepreneur is monitored. The idea is that countries with better investor protection tend to enforce laws that limit the ability of managers to divert funds from the firm or, more in line with the model, to enjoy private benefits (perks) from running production. Below we capture the notion that, when investor protection is weak, monitoring by third agents is helpful in reducing the extent to which managers are able to divert funds or enjoy private benefits.

We assume throughout that it is always socially optimal to induce the foreign entrepreneur to behave, in the sense that

$$p_H R(x) - x > p_L R(x) - x + BR(x).$$

Below, we shall provide conditions that ensure that this is the case in equilibrium.

Following Holmstrom and Tirole (1997), we introduce a monitoring technology that reduces the private benefit of the foreign entrepreneur when he misbehaves. As argued in the introduction, it is natural to assume that the inventor has a comparative advantage in monitoring the behavior of the foreign entrepreneur. We capture this in a stark way by assuming that no other agent in the economy can productively monitor the foreign entrepreneur. Conversely, when the inventor incurs an effort cost $CR(x)$ in monitoring, the private benefit for the local entrepreneur is reduced by a fraction $\delta(C)$, with $\delta'(C) > 0$, $\delta''(C) < 0$, $\delta(0) = 0$, $\lim_{C\to\infty} \delta(C) = 1$, $\lim_{C\to 0} \delta'(C) = \infty$, and $\lim_{C\to\infty} \delta'(C) = 0$.[9]

We shall also relate the private benefit to the financial development of the host country which we index by $\gamma \in (0, 1)$. In particular, we specify that

$$B(C; \gamma) = (1 - \gamma)(1 - \delta(C)). \tag{1}$$

Note that this formulation implies that $\partial B(\cdot)/\partial\gamma < 0$, $\partial B(\cdot)/\partial C < 0$, and $\partial^2 B(\cdot)/\partial C\partial\gamma = \delta'(C) > 0$. In words, the private benefit is decreasing in both financial development and monitoring, and furthermore monitoring has a relatively larger effect on the private benefit in less financially developed countries.

### Contracting

We consider contracting between three sets of agents: the inventor, the foreign entrepreneur and foreign external investors. On the one hand, the inventor and the foreign entrepreneur negotiate a contract that stipulates the terms under which the entrepreneur will exploit

[9] These conditions are necessary to ensure that the optimal contract is unique and satisfies the second-order conditions.

the technology developed by the inventor. We allow such contract to include two types of payments from the entrepreneur to the inventor: (i) an initial lump-sum payment $P$; and (ii) a payment contingent on the return of the investment. When $P > 0$, the noncontingent payment can be thought of as the price or royalties paid for the use of the technology, while when $P < 0$, we can think of the inventor as *cofinancing* the project in the Foreign country. As for the contingent payment, in our setup with risk neutrality and limited liability, we can express this payoff as a share $\phi_I$ of the return generated by the project accruing to the inventor.[10] When this payment is positive, the inventor becomes an equity holder in the entrepreneur's production facility, and when the share is large enough, this production facility becomes a *subsidiary* of the inventor's firm. We also assume that the inventor is able to invest the initial lump-sum transfer $P$ at Home and obtain a gross rate of return $\beta$ on it, while the expected dividends in the foreign country $p_H \phi_I R(x)$ are not pledgeable to domestic external investors.[11]

The contract between the inventor and the entrepreneur also stipulates the number of workers $x$ to be employed by the foreign entrepreneur. Conversely, it assumed that the managerial and monitoring efforts of the entrepreneur and inventor, respectively, are unverifiable and thus cannot be part of the contract. To build intuition, we will however consider in section 2.2 the case in which monitoring is verifiable.

Consider next contracting between the foreign entrepreneur and foreign external investors. In particular, the foreign entrepreneur and external investors sign a financial contract under which the cashless entrepreneur borrows an amount of funds $E$ from the external investors in return for a share $\phi_E$ of the revenue generated by the investment. Again, given risk neutrality and limited liability, these are characteristics of any optimal contract.

We consider the optimal contract from the point of view of the inventor and allow the contract between the inventor and the entrepreneur to stipulate the terms of the financial contract between the entrepreneur and foreign external investors. We rule out financial contracts between the inventor and foreign external investors. This is justified within the model in Appendix A.1

Figure 1 provides a visual representation of the main elements of the model.

[10] More formally, in our setup the optimal contract is such that the agent undertaking the nonverifiable action obtains a payoff equal to zero when the project fails, and equal to a positive amount when the project succeeds. Because the size of the investment (and thus cash flow) is contractible, there is no loss of generality in expressing this positive payoff as a fraction of cash flows. Although we focus on this "equity"-like interpretation of payoffs, the model is not rich enough to distinguish our optimal contract from a standard debt contract. Our results would survive in a model in which agents randomized between using equity and debt contracts. In any case, we bear this in mind in the empirical section of the paper, where we test the predictions of the model.

[11] This assumption generates a preference for the noncontingent payment over the contingent payment. A similar preference could be rationalized by assuming that the inventor is risk averse or relatively impatient.

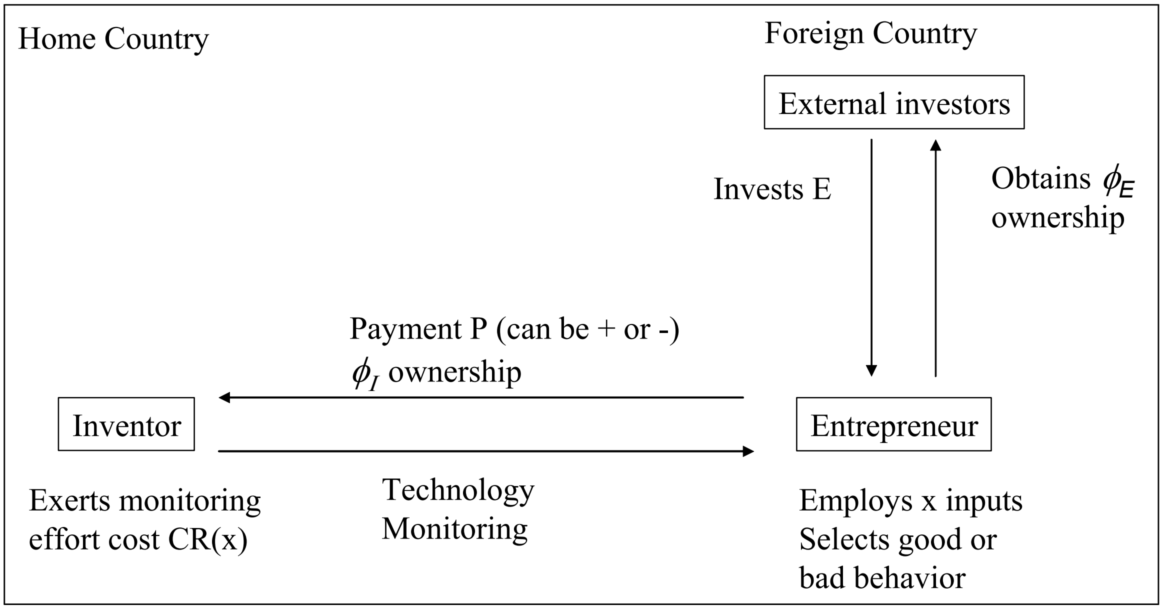


Figure 1: A Simple Picture of the Model

## 2.2 Optimal Financial Contract with Verifiable Monitoring

We consider first the case in which monitoring is verifiable and thus can be specified in the contract. The optimal contract that induces the entrepreneur to behave is given by the tuple $\left\{\tilde{P}, \tilde{\phi}_I, \tilde{x}, \tilde{\phi}_E, \tilde{E}, \tilde{C}\right\}$ that solves the following program:

$$\begin{array}{lll} \max\limits_{P,\phi_I,x,\phi_E,E,C} & \Pi_I = \phi_I p_H R(x) + (W+P)\beta - CR(x) & \\ s.t. & x \leq E - P & \text{(i)} \\ & p_H \phi_E R(x) \geq E & \text{(ii)} \\ & p_H (1-\phi_E-\phi_I) R(x) \geq 0 & \text{(iii)} \\ & (p_H - p_L)(1-\phi_E-\phi_I) R(x) \geq (1-\gamma)(1-\delta(C)) R(x) & \text{(iv)} \\ & \phi_I \geq 0 & \text{(v)} \end{array} \quad \text{(P1)}$$

The objective function represents the payoff of the inventor. The first term represents the inventor's fraction of the foreign production facility's cash flow rights. The second term represents the gross return from investing his wealth plus the noncontingent payment $P$ in the Home market. The last term represents the monitoring costs.

Moving to the constraints, the first one is a financing constraint. Since the local entrepreneur has no wealth, his ability to hire workers is limited by whatever is left from the external investors' financing $E$ after satisfying the payment $P$ to the inventor. The second inequality is the participation constraint of external investors, who need to earn at least an expected gross return on their investments equal to 1. Similarly, the third inequality is the participation constraint of the foreign entrepreneur (given his zero outside option). The fourth inequality is the local entrepreneur's incentive compatibility constraint. This presumes that it is in the interest of the inventor to design a contract in a way that induces the foreign entrepreneur to behave.[12] The final inequality is a non-negativity constraint on the fraction of cash flow rights held by the inventor.[13]

It is obvious from the program above that constraint (iii) will never bind. Intuitively, as is standard in incomplete information problems, the incentive compatibility constraint of the entrepreneur demands that this agent obtains some informational rents in equilibrium, and thus his participation constraint is slack.

On the other hand, it is also straightforward to show that the other four constraints will bind in equilibrium. This is intuitive for the financing constraint (i), the participation constraint of investors (ii), and the incentive compatibility constraint (iv). In addition, the fact that constraint (v) binds immediately implies that the equilibrium equity share of the inventor satisfies

$$\tilde{\phi}_I = 0, \tag{2}$$

and thus the reward of the inventor is *not* contingent on the outcome of the project. The intuition for the result is that with verifiable monitoring, equity shares are a dominated vehicle for transferring utility from the entrepreneur to the inventor. It may appear that a positive $\phi_I$ may be attractive because it reduces the required lump-sum price for the technology $P$ and thus encourage investment in (i). Nevertheless, inspection of constraint (iii) reveals that a larger $\phi_I$ will also decrease the ability of the entrepreneur to borrow from external investors, as it reduces his pleadgeable income. Overall, one can show that whether utility is transferred through an equity share or a lump-sum payment has no effect on leverage. On the other hand, it is clear from the objective function that the inventor strictly prefers an initial lump-sum transfer since it can use these funds in his domestic investments and obtain a gross rate of return $\beta > 1$ on them.[14]

Manipulation of the first-order conditions of the problem also delivers the optimal amount of monitoring, which is implicitly given by:

$$\delta'\left(\tilde{C}\right) = \frac{p_H - p_L}{(1-\gamma)\,\beta p_H}. \tag{3}$$

[12] Below we derive conditions under which this choice is optimal.

[13] We assume throughout that $W$ is large enough to ensure that $W + P \geq 0$ in equilibrium.

[14] As noted above, an alternative way to generate a preference for noncontingent payments over contingent payments would be to assume that the inventor is risk averse or relatively impatient.

Because $\delta''(\cdot) < 0$, we find that monitoring $\tilde{C}$ is relatively higher when the entrepreneur resides in a country with a lower level of financial development (low $\gamma$) or when the inventor has a relatively high shadow value of cash (high $\beta$). Both cases correspond to situations in which the entrepreneur is relatively more constrained, so the marginal benefit of monitoring is especially high in those cases.

With the equilibrium value for monitoring, the remaining values for the optimal contract can easily be derived. In particular, straightforward manipulation of the first order conditions delivers (see Appendix):

$$R'(\tilde{x}) = \frac{1}{p_H\left(1 - \frac{(1-\gamma)\left(1-\delta\left(\tilde{C}\right)\right)}{p_H - p_L} - \frac{\tilde{C}}{\beta p_H}\right)}. \tag{4}$$

Making use of equation (3) and the concavity of $R(x)$, one can show (see Appendix) that $\tilde{x}$ is necessarily increasing in $\gamma$, that is, output and sale revenue is higher in host countries with better financial development. In the limit in which $\gamma \to 1$, we find that $\tilde{C} \to 0$ and $R'(\tilde{x}) = 1/p_H$, which corresponds to the first-best level of investment. Similarly, we can show that output and sale revenue are strictly increasing in $\beta$, the shadow value of cash of the inventor. Intuitively, the larger is $\beta$, the larger is the incentive to use monitoring to reduce inefficiencies and generate a larger $P$ that can be invested in the domestic economy.

Using constraints (i), (ii), and (iii), one can obtain the equilibrium values of $\tilde{\phi}_E$ and $\tilde{E}$ in terms of $\tilde{C}$ and $\tilde{x}$ :

$$\tilde{\phi}_E = 1 - \frac{(1-\gamma)\left(1-\delta\left(\tilde{C}\right)\right)}{p_H - p_L} \tag{5}$$

$$\tilde{E} = p_H \tilde{\phi}_E R(\tilde{x}). \tag{6}$$

In addition, straightforward manipulation delivers

$$\tilde{P} = \left(\frac{R(\tilde{x})}{R'(\tilde{x})\,\tilde{x}} - 1\right)\tilde{x} + \frac{1}{\beta}\tilde{C}R(\tilde{x}) > 0, \tag{7}$$

where the sign follows from $R(\tilde{x})/\tilde{x} > R'(\tilde{x}) > 1$ given the concavity of $R(\tilde{x})$ and $R(0) = 0$.

Hence, the optimal contract is such that the inventor does not take a positive stake in the entrepreneurs' production facility and simply receives a positive lump-sum fee for the exploitation of the technology. Finally, we can compute the net payoff of the inventor, which is given by

$$\tilde{\Pi}_I = \beta W + \beta\left(\frac{R(\tilde{x})}{R'(\tilde{x})\,\tilde{x}} - 1\right)\tilde{x}.$$

We summarize the main results in this section in the following proposition (see the Appendix for a formal proof):

**Proposition 1 (Verifiable Monitoring)** There exist a unique tuple $\left\{\tilde{P}, \tilde{\phi}_I, \tilde{x}, \tilde{\phi}_E, \tilde{E}, \tilde{C}\right\}$ that solves program (P1). Furthermore, the optimal contract that induces the entrepreneur to behave is characterized by equations (2)-(7) and is such that:

*1.* The inventor does not take an equity stake in the local entrepreneur's production facility ($\tilde{\phi}_I = 0$).

*2.* The inventor receives a positive lump-sum transfer ($\tilde{P} > 0$) for the use of the technology.

*3.* Output and sale revenue are increasing in the financial development of Foreign $\gamma$ and the inventor's shadow value of cash $\beta$.

*4.* Monitoring is decreasing in $\gamma$ and increasing in $\beta$.

***Proof.*** See Appendix. ■

So far we have ignored the possibility that the inventor simply "gives up" inducing the entrepreneur to behave. In the Appendix, we show that the inventor in that case would obtain a payoff equal to

$$\tilde{\Pi}_I^L = \beta W + \beta \left( \frac{R\left(\tilde{x}^L\right)}{R'\left(\tilde{x}^L\right)\tilde{x}^L} - 1 \right) \tilde{x}^L$$

where $\tilde{x}^L$ is implicitly defined by

$$R'\left(\tilde{x}^L\right) = \frac{1}{p_L}. \tag{8}$$

It is thus clear that as long as $\tilde{x} > \tilde{x}^L$, the contract described in Proposition 1 will indeed be the optimal contract. Given that when $\gamma \to 1$, $R'\left(\tilde{x}\right) \to 1/p_H < 1/p_L = R'\left(\tilde{x}^L\right)$, good behavior will necessarily be induced whenever $\gamma$ is sufficiently high.

## 2.3 Nonverifiable Monitoring and the Emergence of Foreign Direct Investment

We next consider the case in which monitoring is not verifiable and thus cannot be specified in the contract. In this subsection, we will focus on a characterization of the optimal contract in this case. We delay a discussion of the main comparative statics to the next subsection.

In particular, we consider the case in which, after the initial contract is signed, the inventor privately sets the a level of monitoring $\breve{C}$, after which the entrepreneur observes his private benefit from misbehaving $B\left(\breve{C}\right)$ and decides whether to behave or misbehave. In such case, the contract has to be such that the inventor finds it *privately* optimal to exert monitoring effort. It is straightforward to see that the contract specified in the previous section will not accomplish this. In particular, notice that whenever $\tilde{\phi}_I = 0$, the payoff of the inventor is independent of the behavior of the entrepreneur, and thus the inventor will not have any incentive to monitor the entrepreneur. Hence, given the contract in Proposition 1, the inventor would set $\breve{C} = 0$, which would of course imply that the entrepreneur's private benefit from misbehaving will be $B(0) > B\left(\tilde{C}\right)$, and his incentive compatibility will be violated. In general, as long as the inventor's payoff is noncontingent on the return of the investment, the inventor will *not* exert a positive monitoring effort. External investors will of course anticipate this and they will be less willing to lend to the entrepreneur. In particular, assuming that $\phi_I = 0$, the contract offered by the inventor would be as described above with $\tilde{C} = 0$ in equations (4) through (7). But if $\gamma$ is sufficiently small (so that the private benefit without monitoring is sufficiently high), the inventor will altogether give up implementing good behavior on the part of the entrepreneur.[15]

Consider now the case in which equity shares are positive and the inventor tries to implement good behavior on the part of the entrepreneur. In such case, the inventor will set the minimum monitoring level $\breve{C}$ such that the entrepreneur's incentive compatibility constraint is satisfied. This implies that this monitoring cost will be implicitly given by:

$$(p_H - p_L)(1 - \phi_E - \phi_I) = (1 - \gamma)\left(1 - \delta\left(\breve{C}\right)\right).$$

But in order for this positive monitoring effort to be credible, the initial contract will need to satisfy the following incentive compatibility constraint *for the inventor:*

$$\phi_I p_H R(x) - \breve{C} R(x) \geq \phi_I p_L R(x).$$

In words, the inventor's payoff should be higher when exerting the positive monitoring level $\breve{C}$ than when shirking, which necessarily leads the entrepreneur to misbehave.

It follows from the above discussion that the optimal contract that induces the entrepreneur to behave is now given by the tuple $\left\{\hat{P}, \hat{\phi}_I, \hat{x}, \hat{\phi}_E, \hat{E}, \hat{C}\right\}$ that solves the following

[15] A sufficient condition for this is $\gamma < (p_H - p_L)^2 / p_H$.

program:[16]

$$\begin{array}{lll}
\max\limits_{P,\phi_I,x,\phi_E,E,C} & \Pi_I = \phi_I p_H R(x) + (W+P)\beta - CR(x) & \\
s.t. & x \leq E - P & \text{(i)} \\
& p_H \phi_E R(x) \geq E & \text{(ii)} \\
& p_H (1-\phi_E-\phi_I) R(x) \geq 0 & \text{(iii)} \\
& (p_H - p_L)(1-\phi_E-\phi_I) R(x) = (1-\gamma)(1-\delta(C)) R(x) & \text{(iv)} \\
& (p_H - p_L)\phi_I R(x) \geq CR(x) & \text{(v')}
\end{array} \quad \text{(P2)}$$

This program is identical to (P1) except for the inclusion of the new incentive compatibility constraint (v') for the inventor.[17] We show in the Appendix that it is again the case that, except for constraint (iii), the remaining constraints all bind in an optimal contract. This immediately implies that the optimal contract entails the inventor taking a stake in the project undertaken by the foreign entrepreneur. In particular, from constraint (v'), we immediately obtain

$$\hat{\phi}_I = \frac{\hat{C}}{p_H - p_L}, \tag{9}$$

which will be positive as long as $\hat{C}$ is positive. In addition, the level of monitoring is now implicitly given by the expression (see Appendix for details)

$$\delta'\left(\hat{C}\right) = \frac{\beta p_H - p_L}{(1-\gamma)\beta p_H}. \tag{10}$$

Direct comparison of (3) and (10) reveals that $\delta'\left(\hat{C}\right) > \delta'\left(\tilde{C}\right)$ and thus $\hat{C} < \tilde{C}$. In words, when monitoring is nonverifiable, it will be underprovided. Next, working with the first-order conditions of program (P2), the level of output will be implicitly given by:

$$R'(\hat{x}) = \frac{1}{p_H\left(1 - \frac{(1-\gamma)\left(1-\delta\left(\hat{C}\right)\right)}{p_H - p_L} - \left(\frac{\beta p_H - p_L}{p_H - p_L}\right)\frac{\hat{C}}{\beta p_H}\right)}. \tag{11}$$

As in the case with verifiable monitoring, whenever $\gamma \to 1$, we have that $\hat{C} \to 0$ and $\hat{x}$ is set at the first-best level implicitly defined by $R'(\hat{x}) = 1/p_H$.

[16] We assume that $W$ is high enough such that the constraint $W + P \geq 0$ never binds.

[17] To be precise, it differs also in the fact that the private choice of $C$ ensures that (iv) will bind. But this is immaterial since that constraint was binding in program (P1) as well.

The terms of the financial contract with external investors are now given by:

$$\begin{aligned}\hat{\phi}_E &= 1-\frac{(1-\gamma)\left(1-\delta\left(\hat{C}\right)\right)}{p_H-p_L}-\frac{\hat{C}}{p_H-p_L} \qquad (12)\\ \hat{E} &= p_H\hat{\phi}_E R(\hat{x}). \qquad (13)\end{aligned}$$

In addition, straightforward manipulation delivers an optimal lump-sum initial transfer equal to:

$$\hat{P}=\left(\frac{R(\hat{x})}{R'(\hat{x})\,\hat{x}}-1\right)\hat{x}-\frac{p_L}{\beta(p_H-p_L)}\hat{C}R(\hat{x}). \qquad (14)$$

Comparing this initial lump-sum transfer with that under verifiable monitoring, we note that provided that $\alpha(x)\equiv R(x)/(R'(x)\,x)$ is nondecreasing in $x$, it will necessarily be the case that $\hat{P}<\tilde{P}$, and the initial transfer is lower with nonverifiable monitoring. As mentioned above, when preferences feature a constant elasticity of substitution across a continuum of differentiated goods produced by different firms, $\alpha(x)$ will in fact be independent of $x$, and $R(x)$ can be written as $R(x)=Ax^{\alpha}$, where $A>0$ and $\alpha\in(0,1)$. In such case, the initial lump-sum transfer can be written as

$$\hat{P}=\left(\frac{1-\alpha}{\alpha}\right)\hat{x}-\frac{p_L}{\beta(p_H-p_L)}\hat{C}A(\hat{x})^{\alpha}.$$

Notice that not only we obtain $\hat{P}<\tilde{P}$, but also it is no longer the case that this initial transfer is necessarily positive. In particular, given the concavity of $R(x)$, if the optimal output level $\hat{x}$ is low enough, $R(\hat{x})/\hat{x}$ will be large, and $\hat{P}$ will be negative.

To summarize, the model illustrates how the nonverifiability of monitoring transforms a transaction which very much looked like a "market transaction" (the payment of a flat fee for the use of a technology) into something that very much looks like foreign direct investment. In particular, now the inventor optimally decides to take a stake in the project run by the foreign entrepreneur, and instead of charging a positive price for the use of the technology, it may now decide instead to cofinance the foreign operations by initially providing some cash (a negative $\hat{P}$) to the entrepreneur. In sum, we have shown (see the Appendix for formal proofs) that:

**Proposition 2 (Nonverifiable Monitoring)** There exist a unique tuple $\left\{\hat{P},\hat{\phi}_I,\hat{x},\hat{\phi}_E,\hat{E},\hat{C}\right\}$ that solves program (P2). Furthermore, the optimal contract that induces the entrepreneur to behave is characterized by equations (9)-(14) and is such that:

*1.* The inventor takes a positive equity stake in the local entrepreneur's production facility ($\hat{\phi}_I>0$).

2. Depending on parameter values, the entrepreneur may receive a positive lump-sum transfer ($\hat{P} > 0$) for the use of the technology or it may instead cofinance the project via an initial capital transfer ($\hat{P} < 0$).

***Proof.*** See Appendix. ■

Before we move to an analysis of the comparative statics, let us again discuss the possibility that the inventor decides not to implement good behavior on the part of the foreign entrepreneur. We show in the Appendix, that this will never be optimal provided that $\hat{x} > \tilde{x}^L$, where $\tilde{x}^L$ was defined in equation (8). Because as $\gamma \to 1$, $R'(\hat{x}) \to 1/p_H$, we can conclude again that inducing the foreign entrepreneur to behave will indeed be optimal whenever $\gamma$ is sufficiently high.

**Numerical Example**

It may be useful to briefly illustrate the workings of the model with a numerical example. In particular, assume that revenue is given by $R(x) = Ax^{\alpha}$ and that the monitoring function $\delta(C)$ is characterized by $\delta(C) = C^{\rho}/(C^{\rho} + \theta)$. It is straightforward to show that $R(x)$ and $\delta(C)$ satisfy the conditions we placed on them above. We seek to illustrate how the optimal contract varies with $\gamma$ for given values of the other parameters. For that purpose, assume that $A = 1$, $\alpha = 0.9$, $\theta = 0.05, \beta = 1.05, p_H = 0.9$, $p_L = 0.5$, and $W = 1$. In such case, we find that implementing the good project is optimal for virtual all $\gamma$ (in fact, $\gamma \geq 0.04$). Furthermore, the optimal investor's stake in the project smoothly falls in $\gamma$ from $\hat{\phi}_I = 0.286$ when $\gamma = 0.04$ to $\hat{\phi}_I = 0$ when $\gamma = 1$. This is depicted in Figure 2. The figure also illustrates that, if we let $\hat{\phi}_I = 0.1$ be the threshold value over which the transaction entails FDI and under which it is a standard licensing transaction (as is dictated by traditional balance of payments definitions of FDI), then we have that FDI emerges only for $\gamma < 0.76$. Next, the lump-sum transfer $\hat{P}$ is positive for $\gamma > 0.62$, but is negative when $\gamma < 0.62$. This implies that for low enough $\gamma$, the inventor cofinances the project. Finally, we can compute the share of investment $\hat{x}$ that is financed by the investor, i.e, $-\hat{P}/\hat{x}$. This ranges from 0.198 when $\gamma = 0.04$ to $-0.111$ when $\gamma = 1$. This is again depicted in Figure 2, where the level of investment $\hat{x}$ is also displayed.

## 2.4 Comparative Statics: Firm-Level Empirical Predictions

In order to guide the empirical analysis in section 4, in this subsection we investigate in more detail some of the predictions that the model generates for the characteristics of the

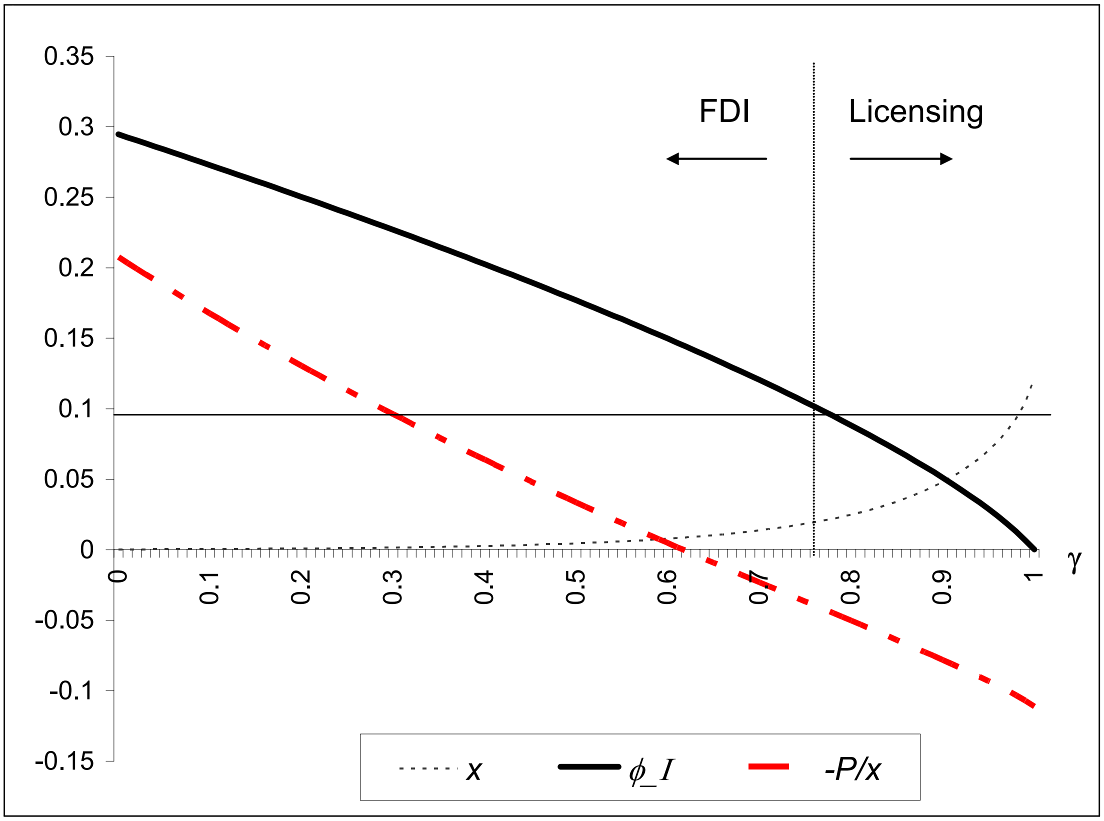


Figure 2: Numerical Example

production facility in the Foreign country. We will test these predictions with firm-level data on the operations of foreign affiliates of U.S. multinational firms in different countries. With this in mind, this subsection will highlight the effects of financial development $\gamma$ in Foreign on the following characteristics of foreign affiliates: (i) their scale of operation; (ii) their sources of financing (external investors versus inventor or parent firm); and (iii) the share of equity held by the inventor (or parent firm). Along the way, we will also describe the effects of the shadow value of cash $\beta$ on all these objects. Because our estimation makes use of parent-firm fixed effects, we will however not test these predictions in section 4 (more on this below).

As is clear from equations (9), (11) and (14), in order to understand the effects of $\gamma$ and $\beta$ on the main observable components of the optimal contract, we first have to investigate the effect of these parameters on the optimal amount of monitoring. Straightforward differentiation of equation (10) together with the concavity of the function $\delta(\cdot)$ produces the following result:

**Lemma 1** The amount of monitoring $\hat{C}$ is decreasing in both financial development $\gamma$ in

Foreign and in the inventor's shadow value of cash $\beta$.
***Proof.*** See Appendix. ■

The first result is analogous to the case with verifiable monitoring. In particular, given our specification of the private benefit function $B(\cdot)$ in (1), the marginal benefit from monitoring is larger the less developed is the financial system in Foreign (the lower is $\gamma$). Since the marginal cost of monitoring is independent of $\gamma$, in equilibrium $C$ and $\gamma$ are negatively correlated.

Conversely, the effect of the shadow value of cash $\beta$ on monitoring is quite distinct from the case with verifiable monitoring, where monitoring was in fact increasing in $\beta$. The intuition for this divergence stems from the that the incentive compatibility constraint of the inventor becomes tighter the larger is the amount of monitoring in equilibrium. In particular, the larger is monitoring, the larger is the required equity share $\phi_I$ that the inventor needs to take, and this is costly since for $\beta > 1$, the inventor would like to "upload" the foreign entrepreneur's payments as much as possible. The larger is $\beta$, the higher is the *shadow* cost of monitoring working through the incentive compatibility constraint, and the lower is the optimal amount of monitoring.

We next study the implications of our theory for the share of equity held by the inventor. From equation (9), it is obvious that the share $\phi_I$ is proportional to the level of monitoring and thus is affected by the parameters $\gamma$ and $\beta$ in the same way as is monitoring. This simply reflects that equity shares emerge in our model to incentivate the inventor to monitor the foreign entrepreneur. As a result, we can establish that:

**Proposition 3** The share of equity held by the inventor is decreasing both in financial development $\gamma$ in Foreign and in the inventor's shadow value of cash $\beta$.
***Proof.*** Proof in text. ■

An immediate corollary of this result is:

**Corollary 1** Suppose that a transaction is recorded as an FDI transaction if $\hat{\phi}_I \geq \underline{\phi_I}$ and as a licensing transaction if $\hat{\phi}_I < \underline{\phi_I}$. Then, there exist a threshold financial development $\gamma^* \in [0, 1]$ over which the optimal contract will entail licensing and under which the optimal contract will entail FDI.

With these results at hand, we can also differentiate equation (11), which implicitly defines the equilibrium output $\hat{x}$ and sales $R(\hat{x})$, and conclude that:

**Proposition 4** Output and sales in Foreign are increasing in financial development $\gamma$ in Foreign and decreasing in the inventor's shadow value of cash $\beta$.
***Proof.*** See Appendix. ■

The intuition for the effect of financial development is straightforward. Despite the fact that the inventor's monitoring reduces financial frictions and enhances investment, when choosing the investment level, the inventor will internalize the fact that both the foreign entrepreneur's compensation (as dictated by his incentive compatibility constraint (iv)) and monitoring costs are increasing in the scale of operation. In countries with worse financial systems, the perceived marginal cost of investment will thus tend to be higher and this will translate into lower equilibrium levels of investment and "affiliate" sales.

Finally, our model also generates predictions for the sources of financing of the foreign production facility. To see this, let us focus on the case in which the ex-ante payment $\hat{P}$ is actually negative and so it can be interpreted as the inventor cofinancing production. Define the amount of financing provided by the inventor by $F \equiv -P$. The share of investment financed by the inventor is then given by

$$\frac{\hat{F}}{\hat{x}} = \frac{p_L}{\beta\left(p_H - p_L\right)}\hat{C}\frac{R\left(\hat{x}\right)}{\hat{x}} - \left(\frac{1-\alpha\left(\hat{x}\right)}{\alpha\left(\hat{x}\right)}\right),$$

where $\alpha\left(\hat{x}\right) \equiv R\left(\hat{x}\right)/\left(R'\left(\hat{x}\right)\hat{x}\right)$. Notice that this expression increasing in $\hat{C}$. Furthermore, provided that $\alpha\left(\hat{x}\right)$ does not increase in $\hat{x}$ too quickly, the ratio $\hat{F}/\hat{x}$ will also be decreasing in $\hat{x}$, due to the concavity of $R\left(\cdot\right)$. It thus follows from Lemma 1 and Proposition 4 that:

$$\frac{\hat{F}}{\hat{x}} = \frac{p_L}{\beta\left(p_H - p_L\right)}\hat{C}\frac{R\left(\hat{x}\right)}{\hat{x}} - \left(\frac{R\left(\hat{x}\right)}{R'\left(\hat{x}\right)\hat{x}} - 1\right). \tag{15}$$

**Proposition 5** Provided that $\alpha\left(\hat{x}\right)$ does not increase in $\hat{x}$ too quickly, the share of inventor (parent) financing in total financing $(\hat{F}/\hat{x})$ is decreasing in financial development $\gamma$.
***Proof.*** Proof in text. ■

The intuition behind the result is as follows. In countries with weak financial development, monitoring by inventors has a relatively high marginal product. To induce the inventor to monitor, the optimal contract will thus specify a relatively "steeper" payment schedule, with a relatively higher contribution by the inventor ex-ante (a higher $\hat{F}/\hat{x}$) in anticipation of a higher share of the cash flows generated by the project (a higher $\phi_I$).

Conversely, the effect of the shadow value of cash on the ratio $\hat{F}/\hat{x}$ is ambiguous. A larger $\beta$ is associated with a lower monitoring level $\hat{C}$ (Lemma 1), but also with a lower output level $\hat{x}$ and thus a higher ratio $R\left(\hat{x}\right)/\hat{x}$ (Proposition 4). In addition, $\beta$ has an additional direct negative effect on the ratio. The overall effect is in general ambiguous.

In section 4, we will formally test the empirical validity of Propositions 3, 4, and 5, and Corollary 1. We will exploit variation in the location of affiliates of U.S. multinational firms and will study the effect of financial development on empirical counterparts of our variables $\hat{x}$, $\hat{\phi}_I$, and $\hat{F}/\hat{x}$. We will identify our inventor in the model with a parent firm and will control for other parameters of the model, such as the shadow value of cash $\beta$, the concavity of the revenue function $R(x)$, the monitoring function $\delta(C)$ and the probabilities $p_H$ and $p_L$ through parent-firm fixed effects, industry fixed effects and a wide range of host-country controls.

# 3 Data and Descriptive Statistics

The empirical work presented in section 4 is based on the most comprehensive available data on the activities of American multinational firms. The Bureau of Economic Analysis (BEA) annual survey of U.S. Direct Investment Abroad from 1982 through 1999 provides a panel of data on the financial and operating characteristics of U.S. firms operating abroad.[18] U.S. direct investment abroad is defined as the direct or indirect ownership or control by a single U.S. legal entity of at least ten percent of the voting securities of an incorporated foreign business enterprise or the equivalent interest in an unincorporated foreign business enterprise. A U.S. multinational entity is the combination of a single U.S. legal entity that has made the direct investment, called the U.S. parent, and at least one foreign business enterprise, called the foreign affiliate. The survey covers all countries and industries, classifying affiliates into industries that are roughly equivalent to three digit SIC code industries. As a result of confidentiality assurances and penalties for noncompliance, BEA believes that coverage is close to complete and levels of accuracy are high.

The foreign affiliate survey forms that U.S. multinational enterprises are required to complete vary depending on the year, the size of the affiliate, and the U.S. parent's percentage of ownership of an affiliate. The most extensive data for the period examined in this study are available for 1982, 1989, 1994, and 1999 when BEA conducted Benchmark Surveys. For 1982, 1989 and 1994, all affiliates with sales, assets, or net income in excess of \$3 million in absolute value and their parents were required to file extensive reports; in 1999, the exemption limit increased to \$7 million. In non-benchmark years, exemption levels were higher and less information was collected.[19] Accordingly, the analysis is restricted to benchmark years except when the annual frequency of the data is critical – in the analysis of scale and liberalizations of ownership restrictions.

In order to analyze arm's length licensing activity, measures of royalty payments and

[18] Coverage and methods of the BEA survey are described in Desai, Foley and Hines (2002).

[19] >From 1983 to 1988, data on affiliates with sales, assets, or net income greater than \$10 million were collected, and this cutoff rose to \$15 million for 1990-1993 and \$20 million for 1995-1999.

licensing fees received by U.S. MNC parents from unaffiliated foreign persons are drawn from the results of BEA's annual BE-93 survey. These data are merged with the operating and financial data of U.S. MNCs, but since they have been collected only since 1986, data used in the analysis of licensing activity cover only 1989, 1994, and 1999. Table I provides descriptive statistics for the variables employed in the analysis and distinguishes between the variables used in analysis employing the benchmark year data (Panel A) and analysis employing the full panel (Panel B).

Implementing empirical tests of the model requires mapping the variables of the model to reasonable measurements in the data. Corollary 1 addresses the choice of an inventor to deploy technology through an arm's length licensing agreement or through an entity in which it holds a substantial ownership stake. In order to study this choice empirically, the analysis uses a dummy variable that is defined at the country/year level. This dummy is equal to one if the parent receives an arm's length royalty payment and it is equal to zero if the parent only serves the country through affiliate activity in a particular year. Proposition 5 makes predictions concerning the share of inventor financing in total financing – $\hat{F}/\hat{x}$. In the data, this variable is defined as the share of affiliate assets financed by the multinational parent. Specifically, this share is the ratio of the sum of parent provided equity and net borrowing by affiliates from the parent to affiliate assets. Proposition 3 considers the determinants of the share of equity held by the inventor, and this variable, $\phi_I$, is measured in the data as the share of affiliate equity owned by the multinational parent. Indicators of the scale of affiliate activity are required to test Proposition 4, and the log of affiliate assets is used for this purpose. Two other affiliate level control variables are also included as control variables and are described in Table I. The log of affiliate employment is the log of the number of affiliate employees, and affiliate net PPE/assets is the ratio of affiliate net property, plant and equipment to affiliate assets.

Table I also provides descriptive statistics for a number of measures of host country institutional environments and other control variables. Two measures of capital market development are used in the analysis below. The first is creditor rights, and it is drawn from Djankov, McLiesh, and Shleifer (2005), which extends the sample studied in La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) to cover a broader sample of countries over the 1982-1999 period on an annual basis. Creditor rights is an index taking values between 0 and 4 and measures the extent of legal protections given to creditors. The second measure is the annual ratio of private credit provided by deposit money banks and other financial institutions to GDP that is drawn from Beck, Demirguc-Kunt, and Levine (1999).

Since credit market development may be correlated with other measures of economic and institutional development, additional controls for other institutional characteristics are also employed. A number of countries impose restrictions on the extent to which foreign firms can own local ones. Shatz (2000) documents these restrictions using two distinct measures that capture restrictions on greenfield FDI and cross-border mergers and acquisition activity. The FDI Ownership Restriction dummy used below is equal to one if both these measures are above three and zero otherwise. Data on the log of GDP per capita, a measure of a country's overall level of development, comes from the World Development Indicators. Corporate tax rates are imputed from the BEA data by taking the median tax rate paid by affiliates in a particular country and year.[20] Ginarte and Park (1997) provide a measure of the strength of patent protections, and the Index of Economic Freedom provides a measure of more general property rights. The International Country Risk Guide is the source of two other measures of institutional development. Rule of law is an assessment of the strength and impartiality of a country's legal system, and Risk of Expropriation is an index of the risk of outright confiscation or forced nationalization faced by foreign investors. For these measures, higher values indicate stronger rule of law and lower risks.

Since the BEA data are a panel of affiliate level data, they allow for the inclusion of parent-year fixed effects. These fixed effects help control for other parameters of the model that are likely to be specific to particular firms at particular points in time, such as the shadow value of cash $\beta$, the concavity of the revenue function $R(x)$, the monitoring function $\delta(C)$ and the probabilities $p_H$ and $p_L$. The inclusion of these fixed effects imply that effects of credit market conditions are identified off of within firm variation in the characteristics of host countries in which the firm has affiliates. While such an empirical setting does offer a number of advantages, it is worth noting two shortcomings. First, the sample only includes foreign affiliates in which the parent owns at least 10% of affiliate equity as this threshold corresponds to traditional balance of payment definitions for FDI. Therefore, the sample does not include foreign firms in which U.S. firms have lower ownership stakes or no ownership. Second, the sample does not include information concerning decisions not to invest or sell technology in particular locations. If firms completely avoid extremely poor institutional settings, this avoidance is not reflected in the data. Since the propositions make claims concerning the relative shares of financing activity and scale across countries, it is unlikely that the identification approach will yield misleading results.

# 4 Empirical Results

The model provides predictions that relate the quality of host country capital markets to the scale of multinational operations and to the financing and ownership of foreign affiliates. The

[20] Affiliates with negative net income are excluded for the purposes of calculating country tax rates.

use of licensing as opposed to foreign investment and the financing and ownership of foreign affiliates are considered first by pooling cross-sections from the benchmark years where data is most complete. These regressions employ a variety of controls for country, parent and affiliate characteristics that test the robustness of the explanatory power of our measures of the quality of capital markets. Investigating the effect on scale requires an alternative setup as controlling for the many unobservable characteristics that might determine firm size is problematic. Fortunately, the model provides a stark prediction with respect to scale that can be tested by analyzing within-affiliate and within-country responses to the easing of ownership restrictions.

## 4.1 Licensing and Affiliate Activity

In the model, inventors take ownership stakes in foreign firms so that they have the incentive to engage in monitoring, and the marginal benefits of monitoring are lower for activity in countries with high levels of financial development. As a consequence, the model predicts that inventors need not take a large ownership stake in foreign firms exploiting their technology in countries with high levels of financial development. Therefore, given that a foreign firm is counted as an affiliate in the BEA data only if it is at least ten percent owned by a U.S. firm, technology may be exploited in countries with high levels of financial development through what appears to be unrelated party licensing as opposed to through affiliate activity. The tests presented in Table II consider this possibility. The dependent variable in these tests, the Arm's Length Licensing Dummy, is defined for country/year pairs in which a parent has an affiliate or from which a parent recieves a royalty payment from an unaffiliated foreign person. This dummy is equal to one if the parent receives a royalty payment from an unaffiliated foreign person, and it is otherwise equal to zero.

Several controls are employed in these regressions in order to isolate the effect of the quality of capital markets on patterns of activity. Foreign ownership restrictions exist in many countries during the sample period, so all specifications presented in the table include a measure of the existence of such restrictions. Measures of credit market development may simply reflect other factors related to economic development; specifications include the log of GDP per capita to address this concern. Host country tax rates can also influence the desirability of foreign ownership so host country tax rates are also included in all specifications. Additionally, the inclusion of parent-year fixed effects controls for a variety of unobservable firm characteristics that might otherwise conflate the analysis. Standard errors are heteroskedasticity-consistent and are clustered at the country/year level.[21]

[21] The specifications presented in Table II are linear probability models. These are used in order to incorpo-

The coefficient on creditor rights in column 1 is positive and significant, indicating that multinationals are more likely to serve countries with higher levels of financial development through licensing as opposed to only through a foreign affiliate. This results is consistent with Corollary 1 of the model. The results also indicate that parents are more likely to engage in technology licensing as opposed to just affiliate activity in countries that impose ownership restrictions, have that higher corporate tax rates, and that have higher levels of economic development.

The predictions of the model relate to credit market development but the measure of creditor rights may be correlated with more general variation in the institutional environment. The specification presented in column 2 includes additional proxies for the quality of other host country institutions. Specifically, the analysis includes indices of patent rights, property rights, the strength and impartiality of the overall legal system, and the risk of expropriation as control variables. The coefficient on creditor rights is little changed by the inclusion of these additional controls.

The specification presented in column 3 provides a more subtle test of the model and the particular mechanism that gives rise to FDI as opposed to licensing. In the model described in section 2, MNCs are assumed to have a comparative advantage in monitoring local entrepreneurs because of their familiarity with their technology. The relative value of MNC monitoring should be more pronounced for more R&D-intensive firms as these firms are more likely to be deploying novel technologies that require the unique monitoring ability of multinational parents. More crudely, multinational firms with limited technological capabilities are less likely to be important to external funders as monitors, and the effects of capital market development on the choice to serve a country through licensing or affiliate activity should be less pronounced for these kinds of firms.

To test for this differential effect, the specification presented in Column 3 uses the log of parent R&D as a proxy for the degree to which firms are technologically advanced. Since this specification includes parent-year fixed effects, this variable does not enter on its own, but is interacted with creditor rights. The positive coefficient on the interaction term is consistent with the prediction that the value of creating incentives to monitor through ownership in countries with weak financial development is highest for technologically advanced firms.

The specifications presented in columns 4-6 of Table II repeat those presented in columns

rate parent/year fixed effects and simultaneously to correct standard errors for clustering at the country/year level. As a robustness check, these specifications have been run as conditional logit specifications. The resulting coefficients on the measures of financial development and these measures interacted with the log of parent R&D are of the same sign and statistical significance as those presented in the table, except for the interaction of creditor rights and the log of parent R&D. The coefficient on this variable is positive, but it is not statistically different from zero at conventional levels.

1-3 replacing creditor rights with private credit as a measure of financial development. The positive and significant coefficients on private credit in columns 4 and 5 are consistent with the findings in columns 1 and 2 and illustrate that countries with higher levels of financial development are more likely to be served through unaffiliated party licensing as opposed to just affiliate activity. The positive and significant coefficient on private credit interacted with the log of parent R&D presented in column 6 indicates that the effects of capital markets on the licensing decision are most pronounced for firms that are R&D intensive.

## 4.2 The Financing and Ownership of Foreign Affiliates

Another central prediction of the model is that affiliates located in countries with poorly functioning credit markets should be financed more extensively with parent provided capital. Since the ability to monitor and the need for monitoring is associated with the firm's use of technology, this effect of capital market development should be most pronounced for firms that are R&D intensive. The specifications presented in Table III test these predictions. Parent capital can take the form of equity claims or net intercompany loans from the parent to the affiliate. The dependent variable employed is the ratio of the sum of net borrowing from the parent and parent equity provisions (including both paid-in-capital and retained earnings) to affiliate assets.

The specification presented in column 1 of Table III includes the log of GDP per capita to control for the level of host country economic development, ownership restrictions to control for laws that might limit the ability of a parent to provide capital to its affiliate, and the corporate tax rate to control for incentives to use debt and repatriate earnings created by tax considerations. The negative coefficient on creditor rights in column 1 indicates that the share of affiliate assets financed by the parent is higher in countries that do not provide creditors with extensive legal protections, but this coefficient is only marginally significant. This result is consistent with the prediction contained in Proposition 5. The coefficients on the controls in this specification are also sensible. The negative and significant coefficient on FDI Ownership Restrictions is consistent with the hypothesis that such restrictions limit parent capital provisions, and the negative and significant coefficient on the tax rate mirrors the finding in Desai, Foley and Hines (2004) on the sensitivity of borrowing to local tax conditions.[22]

The specification in column 2 includes the set of other institutional variables used in Table II to ensure that proxies for financial development are not proxying for some other kind of institutional development. In addition, this specification also controls for affiliate

[22] The model's predictions relate to overall parent capital provision. As such, these specifications differ from the analysis in Desai, Foley and Hines (2004) where only borrowing decisions are analyzed.

characteristics that the corporate finance literature suggests might influence the availability of external capital. Harris and Raviv (1991) and Rajan and Zingales (1995) find that larger firms and firms with higher levels of tangible assets are more able to obtain external debt. Two proxies for affiliate size—the log of affiliate sales and the log of affiliate employment—and a proxy for the tangibility of affiliate assets—the ratio of affiliate net property, plant and equipment to affiliate assets—are included.

In the specification in column 2, the -0.0199 coefficient on creditor rights is slightly larger than the coefficient on this variable in specification 1, and it is statistically significant. This result implies that the share of affiliate assets financed by the affiliate's parent is 9.6% of its mean value higher for affiliates in countries in the 25th percentile of creditor rights relative to the 75th percentile of creditor rights. None of the unreported coefficients on affiliate characteristics are significant. Previous theoretical work stressing how concerns over technology expropriation might give rise to multinational activity does not make clear predictions concerning the share of affiliate assets financed by the parent, but it is worth noting that the indices of patent protection and property rights are negative and significant in the specification in column 2. Only the results on patent protections are consistent across specifications in the table. These results indicate that parents provide affiliates with more capital in countries with weak patent protections and weak property rights.

If parent financing creates incentives for monitoring and the effects of monitoring are strongest for firms with more technology, then the effects documented in column 2 should be most pronounced for R&D intensive firms. The specification in column 3 tests for a differential effect of creditor rights on financing by using the log of parent research and development expenditures (R&D) as a proxy for the degree to which firms are technologically advanced. The negative and significant coefficient on this interaction term indicates that more technologically advanced firms finance a higher share of affiliate assets in countries with weak credit markets. This finding is not implied by other many intuitions for why capital market development might affect parental financing provisions.

The specifications presented in columns 4-6 of Table III repeat the analysis presented in columns 1-3 substituting measures of private credit for creditor rights. In columns 4 and 5, the coefficient on private credit is negative and significant. In the specification in column 6, the interaction of private credit and the log of parent R&D is significant. The results obtained when using private credit are therefore also consistent with the prediction of Proposition 5 and provide further evidence that the effects of credit market conditions are especially pronounced for technologically advanced firms.

The results presented in Table III are robust to a number of concerns. First, it may be the case that the share of affiliate assets financed by the parent is lower for older affiliates and these affiliates may be more likely to be located in countries with well developed credit markets. Including proxies for affiliate age in the specifications presented in columns 1, 2, 4, and 5 does not affect the results of interest and suggests that, if anything, the share of affiliate assets financed by the parent is increasing in affiliate age.[23]

Second, it is useful to consider if the results on the interaction of creditor market conditions and the log of parent R&D raises are robust to the inclusion of similar interaction terms with other institutional variables. Specifically, the results on these interaction terms may reflect an alternative effect better captured by interacting log of parent R&D with the measure of country protection of intellectual property. When the log of parent R&D interacted with the patent protection index is included in the specifications presented in columns 3 and 6, the coefficient on this interaction term is insignificant and the interactions featuring proxies for credit market development remain significant.

The model also predicts that multinational parents should hold larger ownership stakes in affiliates located in countries with weak credit markets (Proposition 3). This prediction is similar to the prediction regarding the share of affiliate funding provided by the parent as the theory does not distinguish between debt and equity claims. Investigating the determinants of equity claims offers another perspective on the model as the contingent nature of equity ownership provides a payoff that may more closely map to the contingent payoffs emphasized in the model. Table IV presents results of using this dependent variable in specifications that are similar to those presented in Table III.

Although parent equity shares are bounded between 0 and 1, and there is a large grouping of affiliates with equity that is 100% owned by a single parent firm, the specifications presented in Table IV are OLS specifications. These models are advantageous when estimating a large number of fixed effects and allowing standard errors to be clustered at the country/year level. In the specifications presented in columns 1, 2, 4, and 5, the proxy for credit market development is negative and significant. Parent companies own higher shares of affiliate equity when affiliates are located in countries where protections extended to creditors are weaker and private credit is scarcer, as predicted by the model. In the specifications presented in columns 3 and 6, the negative and significant coefficients on the interaction terms indicate that these results are also more pronounced for technologically advanced firms.

The results in Table IV also indicate that equity ownership shares are lower in countries with ownership restrictions, countries that are less well-developed, and countries with low corporate tax rates. If equity ownership decisions placed strong emphasis on the protection

[23] The proxies for age are the number of years since an affiliate first reported data to BEA and a dummy equal to one if the affiliate first reported in 1982 and zero otherwise.

of technology and ownership substituted for weak patent protections, the coefficient on the Patent Protection variable should be negative and significant. While the estimated coefficient is negative, it is not statistically significant.

These results are robust to using an alternative estimation technique. Conditional logit specifications that use a dependent variable that is equal to one for wholly owned affiliates and zero for partially owned affiliates yield similar results. The results are also robust to controlling for affiliate age, and the interaction terms in the specifications presented in columns 3 and 6 remain significant if the log of parent R&D interacted with the patent protection index is also included.

## 4.3 The Scale of Multinational Activity

The model predicts that multinational activity will be greatest in countries with well-developed capital markets. Since there are many theories for the determinants of FDI activity, using specifications similar to those presented in Tables II, III, and IV to explore scale is problematic.[24] It is difficult to include a set of controls sufficiently extensive to distinguish between alternative theories.

Given these difficulties, the analysis below investigates a subtler and more precise prediction of the model by investigating the role of liberalizations of ownership restrictions on the scale of multinational firm activity. Specifically, the model suggests that the response to ownership liberalizations will be larger in host countries with weak capital markets. The intuition for this prediction is that in countries with weak capital markets, ownership restrictions will be more likely to bind on the activity of multinational firms as this is where ownership is most critical for maximizing the value of the enterprise. As such, the relaxation of an ownership constraint will have muted effects for affiliates in countries with deep capital markets and more pronounced effects for affiliates in countries with weaker capital markets.

The specifications presented in Table V investigate if such differential effects are indeed present. Liberalizations are defined as the first year in which the index of ownership restrictions, described above, falls below 3.[25] The dependent variable in columns 1 and 2 is the

[24] Appendix Table I presents the results of such an exercise. Although the coefficients on both the creditor rights variables and private credit variables are positive in explaining the log of affiliate sales in the specifications presented in columns 1, 2, 4, and 5, as Proposition 3 predicts, only the coefficients on private credit are significant. In addition, coefficients on some of the control variables are puzzling indicating the difficulties of testing scale in such a manner.

[25] The countries experiencing a liberalization are Argentina (1990), Australia (1987), Colombia (1992), Ecuador (1991), Finland (1990), Honduras (1993), Japan (1993), Malaysia (1987), Mexico (1990), Norway (1995), Peru (1992), Philippines (1992), Portugal (1987), Sweden (1992), Trinidad and Tobago (1994), and Venezuela (1990). Since control variables measuring the development of institutions other than credit markets do not vary much (if at all) through time and are unavailable for six of the sixteen reforming countries, these controls are not included in the anaylsis of liberalizations. The affiliate fixed effects implicitly control

log value of affiliate sales and the sample consists of the full panel from 1982 to 1999. Given the limited data requirements of these specifications (relative to the variables investigated in Tables III and IV) and the desire to investigate changes within affiliates, the full panel provides a more appropriate setting for these tests. These specifications include affiliate and year fixed effects and the standard errors are clustered at the country level. The sample includes all countries so affiliate activity in countries that do not liberalize help to identify the year effects and the coefficients on the income variables, but the results are robust to using sample drawn only from reforming countries.

The specifications in columns 1 and 2 include controls for log GDP per capita and the post-liberalization dummy. The coefficient on log GDP per capita is positive and significant indicating that rising incomes are associated with larger affiliate activity. The coefficient of interest in column 1 is the coefficient on the interaction of the post-liberalization dummy and a dummy set equal to one if the country is at or below the median value of the creditor rights index in the year of liberalization. This positive and significant coefficient indicates that affiliates in weak creditor rights countries grow quickly after liberalizations and this effect is negligible and statistically insignificant for affiliates in high creditor rights countries. In column 2, this same result is obtained for the measure of private credit and its interaction with the liberalization dummy. At the affiliate level, the model's predictions regarding how the scale of activity relates to capital market depth are validated using tests that, through the use of affiliate fixed effects and the emphasis on the interaction term, are difficult to reconcile with alternative theories.

It is possible that the results presented in columns 1 and 2 inaccurately capture the effects of the liberalizations by only measuring activity on the intensive margin and failing to capture responses on the extensive margin. For example, entry or exit might accompany these liberalizations that might amplify or dampen these results. In order to consider this possibility, the specifications provided in columns 3 and 4 employ a dependent variable that is the log value of the aggregate value of all sales of U.S. multinational affiliates within a country-year cell. These specifications substitute country fixed effects for affiliate fixed effects but are otherwise similar to the regressions provided in columns 1 and 2.

In column 3, the coefficient on the interaction term for the creditor rights variables is again positive and significant indicating that including activity on the extensive margin does not appear to contradict the earlier result. In column 4, the coefficient on the interaction term is again positive but only marginally significant. Taken together, the results suggest that the scale of activity is positively related to the level of capital market development and these results hold when incorporating the effects of entry and exit.

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for time invariant country characteristics so this is unlike to pose a significant problem.

# 5 Conclusions

Efforts to understand patterns of multinational firm activity have typically emphasized aspects of technology transfer rather than constraints imposed by weak capital markets. Specifically, the risk of expropriation of proprietary technology has been thought to be central. In the model presented in this paper, the exploitation of technology is critical to understanding multinational firm activity but the critical constraint is the nature of capital market development and investor protections in host countries. These constraints determine the scale of activity as entrepreneurs must raise capital to fund projects and external funders are aware of their reduced protections from opportunistic entrepreneurs. The comparative advantage of multinational firms in monitoring the appropriate use of technology alleviates this constraint but only in the presence of MNC ownership and FDI flows to ensure ongoing monitoring. As such, capital markets frictions drive the need for multinational ownership and FDI flows, and these effects are more pronounced in countries with weak investor protections.

By placing financial frictions at the center of understanding patterns of activity and flows, the model delivers novel predictions on licensing, financing and investment decisions by multinational firms that are validated in firm-level analysis. Specifically, previous findings that weak host country capital markets are associated with reduced FDI flows reflect two opposing forces. The weak capital markets both limit the scale of the enterprise but also result in greater parent provision of capital and more ownership of the affiliate's equity. In the process, the model provides an integrated explanation for patterns of MNC activity and FDI flows that have previously only been considered separately.

Further consideration of the role of financial frictions on multinational firm activity may prove fruitful on a variety of dimensions. First, the model presented effectively rules out exports to unrelated parties as a means of serving the foreign markets. Incorporating the tradeoff between exports and production abroad in a world of financial frictions may yield additional predictions that would help explain the export or FDI decision. Second, exploring the implications of financial frictions for intrafirm trade may help explain how inputs in a vertically fragmented production process are distributed around the world in response to the demands of external funders in weak institutional environments. Finally, given the central role of foreign ownership in reducing diversion, it may be interesting to consider how industrial activity in weaker institutional environments is distributed between local firms and multinational affiliates and how these types of firms compete in host economies.

# A Appendix

## A.1 The Shadow Cost of Cash

In the main text, we have treated the shadow value of cash $\beta$ as exogenous. In this Appendix we briefly illustrate how to endogenize it and show how it relates to characteristics of the Home country, and in particular to its level of financial development.

For this purpose, we generalize the setup described in section 2.1 and consider the situation in which there are $J-1$ Foreign countries, each associated with a level of financial development $\gamma^j$ and a revenue function $R^j\left(x^j\right)$.[26] The inventor contracts with each of $J-1$ foreign entrepreneurs and, as a result of the optimal contracting described above, has an amount of cash equal to $W+\sum_{j\neq H}\hat{P}^j$ to invest in the Home country.

Preferences and technology at Home are such that the revenue obtained from the sale of the differentiated good at Home can be expressed as a strictly increasing and concave function of the quantity produced, $R^H\left(x\right)$, satisfying the same properties as the revenue function in other countries. Home production is managed by the inventor, who can also privately choose to *behave* or *misbehave*, with consequences identical to those discussed above: if the inventor behaves, the project performs with probability $p_H$, but if he misbehaves, the project performs with a lower probability $p_L$. In the latter case, however, the inventor obtains a private benefit equal to a fraction $1-\gamma^H$ of revenue, where $\gamma^H$ is an index of financial development at Home.

The inventor sells cash flow rights to a continuum of external investors at Home, who can obtain a rate of return equal to one in an alternative investment opportunity. We consider the optimal financial contract between the inventor and external investors in which the inventor is granted the ability to make take-it-or-leave-it offers, just as in the previous sections. The optimal contract specifies the scale of operation $x^H$, the amount of cash $W_x$ that the inventor invests in the project, the share of equity $\phi_E^H$ sold to external investors, and the amount of cash $E^H$ provided by external investors.

Taking the contracts signed with foreign individuals as given, the optimal financial contract with external investors at Home that induces the inventor to behave is given by the tuple $\left\{\hat{x}^H,\hat{W}_x,\hat{\phi}_E^H,\hat{E}^H\right\}$ that solves the following program:

$$
\begin{aligned}
\max_{x^H,W_x,\phi_E^H,E^H}\quad & \Pi_I=\sum_{j\neq H}\left(\phi_I^j p_H-C^j\right)R^j\left(x^j\right)+p_H\left(1-\phi_E^H\right)R^H\left(x^H\right)+W+\sum_{j\neq H}P^j-W_x\\
s.t.\quad & x^H\leq E^H+W_x\\
& W_x\leq W+\sum_{j\neq H}P^j\\
& p_H\phi_E^H R^H\left(x^H\right)\geq E^H\\
& \left(p_H-p_L\right)\left(1-\phi_E^H\right)R^H\left(x^H\right)\geq\left(1-\gamma^H\right)R^H\left(x^H\right)
\end{aligned}
\tag{P3}
$$

[26] With some abuse of notation we use $J$ to denote both the *number* of countries as well as the *set* of these countries.

It is straightforward to show that provided that $\gamma^H$ is low enough (i.e, provided that financial frictions at Home are large enough), all constraints in program (P3) will bind in equilibrium, and the profits of the entrepreneur can be expressed

$$\Pi_I = \sum\nolimits_{j \neq H} \left( \phi_I^j p_H - C^j \right) R^j \left( x^j \right) + \widehat{\beta} \left( W + \sum\nolimits_{j \neq H} \hat{P}^j \right) \tag{16}$$

where

$$\hat{\beta} = \frac{\frac{1-\gamma^H}{(p_H - p_L)}}{\frac{1-\gamma^H}{p_H - p_L} - \left( 1 - \frac{\hat{x}^H}{p_H R^H (\hat{x}^H)} \right)} > 1. \tag{17}$$

Notice that the resulting profit function (16) is closely related to that considered in program (P3) in section 2.3, where $\hat{\beta}$ now replaces $\beta$. There are however two important differences between the two profit functions.

First, the formulation in (16) considers the case in which the inventor obtains revenue from the exploitation of the technology in *multiple* countries. Nevertheless, notice that for a given $\hat{\beta}$, the profit function features separability between these different sources of revenue. As a result, for a given $\hat{\beta}$, the optimal contract with the entrepreneur and external investors in each country $j$ is as described in section 2.3.[27] Hence, Propositions 3, 4, and 5 continue to apply and their statements not only apply to changes in the parameter $\gamma$, but also to cross-sectional (cross-country) variation in financial development. In this sense, the tests performed in section 4 are well defined.

The second important difference between the profit function in (16) and in program (P3) is that the shadow value of cash $\hat{\beta}$ is in fact *endogenous*, in the sense that it is a function of the scale of operation at Home $x^H$, which in turn will depend on the optimal contracts in the other $J$ countries through the transfers $\hat{P}^j$ for $j \neq H$ (as is clear from program (P3)). Hence, $\hat{\beta}$ will in general be a function of the vector of country financial development levels $\boldsymbol{\gamma} \equiv \left( \gamma^1, ..., \gamma^{J-1}, \gamma^H \right)$. Notice, however, that for large enough $J$, the effect of a particular financial development level $\gamma^j$ ($j \neq H$) on the overall shadow value of cash $\hat{\beta}$ will tend to be negligible, and thus the comparative static results in section 2.4 will continue to apply.

It is also interesting to discuss the effect of Home country financial development $\gamma^H$ on the shadow value of cash $\hat{\beta}$. As is clear from equation (17), the effect works through two channels: a direct one (the terms in $\gamma^H$ in the equation) and an indirect one (through the effect of $\gamma^H$ on $x^H$). To isolate the first effect, consider the extreme case in which the function $R^H \left( x^H \right)$ is linear, i.e., $R^H \left( x^H \right) = \varphi x$. In that case, it is straightforward to show that $\hat{\beta}$ is a constant (as assumed in

[27] Notice also that when $\hat{\beta} > 1$, the inventor is financially constrained at Home, in the sense that external investors at Home are only willing to lend to him a multiplier over his pleadgeable income (wealth plus lump-sum fees). If external investors were to lend a larger amount, the inventor's incentive compatibility constraint would be violated. The same would of course apply to external investors in foreign countries. This helps rationalize our assumption in section 2.1 that the inventor does not sign *bilateral* financial contracts with external investors in host countries.

section 2.3) and is necessarily increasing in $\gamma^H$.[28] Hence, if the Home country has a relatively better financial system, the inventor will have a relative high shadow value of cash. The intuition for the result is that a larger $\gamma^H$ relaxes the incentive compatibility constraint of the inventor, allowing him to borrow a larger multiplier of his wealth, and thus obtaining a larger return on his wealth.

When $R^H\left(x^H\right)$ is strictly concave, however, matters are more complicated. In particular, for given transfers $\hat{P}^j$ for $j = 1, .., J$, it can be shown that the incentive compatibility constraint in program (P3) implies a positive relationship between $x^H$ and $\gamma^H$. In words, holding constant the scale of operations abroad (and thus the transfers $\hat{P}^j$'s), the scale of operation at Home is increasing in Home financial development $\gamma^H$. Given the concavity of $R^H\left(x^H\right)$, $\hat{\beta}$ in equation (17) will be decreasing in $x^H$, and thus also in $\gamma^H$ on account of this indirect channel. Furthermore for a sufficiently high concavity of the domestic revenue function, this second effect may dominate and the shadow value of cash may actually be decreasing in the financial development of the Home country. Intuitively, with enough concavity, the marginal return from investing at Home will be significantly large when $x^H$ is low, that is, when $\gamma^H$ is low.

To sum up, this Appendix has illustrated that a higher-than-one shadow value of cash can easily be rationalized in a simple extension of our initial partial-equilibrium model, in which not only foreign entrepreneurs, but also the inventor faces financial constraints. We have seen that endogenizing the shadow value of cash may affect the solution of the optimal contract in subtle ways, but that if the number of host countries in which the inventor exploits his technology is large enough, the comparative static results in section 2.4 remain qualitatively valid. Furthermore, whether a relatively high shadow value of cash $\beta$ is related to a high or low level financial development at Home very much depends on the characteristics of preferences and technology at Home, as captured by the concavity of the revenue function $R^H(x)$.[29]

## A.2 Proof of Proposition 1

Let us start by writing the Lagrangian corresponding to program (P1). Letting $\lambda_k$ denote the multiplier corresponding to correspond to constraint $k = 1, 2, 4, 5$ (remember constraint (iii) cannot bind), we have

$$\begin{aligned}\mathcal{L} &= \phi_I p_H R(x) + (W + P)\beta - CR(x) + \lambda_1 (E - P - x) + \lambda_2 (p_H \phi_E R(x) - E) \\ &\quad + \lambda_4 ((p_H - p_L)(1 - \phi_E - \phi_I) R(x) - (1 - \gamma)(1 - \delta(C)) R(x)) + \lambda_5 \phi_I.\end{aligned}$$

[28] In particular, we find

$$\hat{\beta} = \frac{\frac{p_H\left(1-\gamma^H\right)}{(p_H - p_L)}\varphi}{\frac{p_H(1-\gamma^H)}{(p_H - p_L)}\varphi - (p_H\varphi - 1)},$$

which is increasing in $\gamma^H$ provided that $p_H\varphi > 1$, that is provided that the project has a positive expected present value.

[29] See also Stein (2003) for more on the subtleties behind the link between the cash-flow sensitivity of investment and the size of financial constraints.

The first-order conditions of this program (apart from the standard complementarity slackness conditions) are:

$$
\begin{aligned}
\frac{\partial \mathcal{L}}{\partial P} &= \beta - \lambda_1 = 0 \\
\frac{\partial \mathcal{L}}{\partial \phi_I} &= p_H R(\tilde{x}) - \lambda_4 (p_H - p_L) R(\tilde{x}) + \lambda_5 = 0 \\
\frac{\partial \mathcal{L}}{\partial x} &= \tilde{\phi}_I p_H R'(\tilde{x}) - \tilde{C} R'(\tilde{x}) - \lambda_1 + \lambda_2 p_H \tilde{\phi}_E R'(\tilde{x}) \\
&\quad + \lambda_4 \left[ (p_H - p_L) \left(1 - \tilde{\phi}_E - \tilde{\phi}_I\right) - (1-\gamma)\left(1 - \delta\left(\tilde{C}\right)\right)\right] R'(\tilde{x}) = 0 \qquad \text{(A1)} \\
\frac{\partial \mathcal{L}}{\partial \phi_E} &= \lambda_2 p_H R(\tilde{x}) - \lambda_4 (p_H - p_L) R(\tilde{x}) = 0 \\
\frac{\partial \mathcal{L}}{\partial E} &= \lambda_1 - \lambda_2 = 0 \\
\frac{\partial \mathcal{L}}{\partial C} &= -R(\tilde{x}) + \lambda_4 (1-\gamma) \delta'\left(\tilde{C}\right) R(\tilde{x}) = 0. \qquad \text{(A2)}
\end{aligned}
$$

Straightforward manipulation of these conditions delivers

$$
\begin{aligned}
\lambda_1 &= \lambda_2 = \beta > 0 \\
\lambda_4 &= \frac{p_H}{p_H - p_L} \lambda_2 = \frac{p_H}{p_H - p_L} \beta > 0 \\
\lambda_5 &= (\beta - 1) p_H R(\tilde{x}) > 0,
\end{aligned}
$$

from which we conclude that all constraints bind, as claimed in the main text.

Next plugging the value of $\lambda_4$ into (18) delivers

$$
\delta'\left(\tilde{C}\right) = \frac{p_H - p_L}{(1-\gamma)\beta p_H},
$$

while plugging the values of $\lambda_1$, $\lambda_2$, and $\lambda_3$ into (18) delivers

$$
R'(\tilde{x}) = \frac{1}{p_H \left(1 - \frac{(1-\gamma)\left(1-\delta\left(\tilde{C}\right)\right)}{p_H - p_L} - \frac{\tilde{C}}{\beta p_H}\right)}.
$$

These correspond to equations (3) and (4) in the main text. The comparative statics related to $\tilde{C}$ follow directly from the concavity of $\delta(\cdot)$. As for the comparative statics related to $\tilde{x}$, it suffices to note that:

$$
\begin{aligned}
\frac{d\left(\frac{(1-\gamma)\left(1-\delta\left(\tilde{C}\right)\right)}{p_H-p_L}+\frac{\tilde{C}}{\beta p_H}\right)}{d\gamma} &= -\frac{\left(1-\delta\left(\tilde{C}\right)\right)}{p_H-p_L}-\frac{(1-\gamma)\,\delta'\left(\tilde{C}\right)}{p_H-p_L}\frac{d\widetilde{C}}{d\gamma}+\frac{1}{\beta p_H}\frac{d\widetilde{C}}{d\gamma}=-\frac{1-\delta\left(\tilde{C}\right)}{p_H-p_L}<0; \\
\frac{d\left(\frac{(1-\gamma)\left(1-\delta\left(\tilde{C}\right)\right)}{p_H-p_L}+\frac{\tilde{C}}{\beta p_H}\right)}{d\beta} &= -\frac{(1-\gamma)\,\delta'\left(\tilde{C}\right)}{p_H-p_L}\frac{d\widetilde{C}}{d\beta}+\frac{1}{\beta p_H}\frac{d\widetilde{C}}{d\beta}-\frac{\tilde{C}}{\beta^2 p_H}=-\frac{\tilde{C}}{\beta^2 p_H}<0.
\end{aligned}
$$

Hence, $R'(\tilde{x})$ falls in $\gamma$ and $\beta$, and thus $\tilde{x}$ increases in these two parameters.

## A.3 Optimal Contract Implementing Bad Behavior

The program in this can be written as

$$
\begin{array}{lll}
\max\limits_{P,\phi_I,x,\phi_E,E,C} & \Pi_I=\phi_I p_L R(x)+(W+P)\,\beta-CR(x) & \\
s.t. & x\leq E-P & \text{(i)} \\
 & p_L\phi_E R(x)\geq E & \text{(ii)} \\
 & p_L\left(1-\phi_E-\phi_I\right)R(x)\geq 0 & \text{(iii)} \\
 & \phi_I\geq 0 & \text{(iv)} \\
 & C\geq 0 & \text{(v)}
\end{array}
\tag{P1$_L$}
$$

The corresponding Lagrangean is

$$
\begin{aligned}
\mathcal{L} &= \phi_I p_L R(x)+(W+P)\,\beta-CR(x)+\lambda_1(E-P-x)+\lambda_2\left(p_L\phi_E R(x)-E\right) \\
&\quad +\lambda_3\left(p_L\left(1-\phi_E-\phi_I\right)R(x)\right)+\lambda_4\phi_I+\lambda_5 C.
\end{aligned}
$$

The first-order conditions are

$$
\begin{aligned}
\frac{\partial\mathcal{L}}{\partial P} &= \beta-\lambda_1=0 \\
\frac{\partial\mathcal{L}}{\partial\phi_I} &= p_L R\left(\tilde{x}^L\right)-\lambda_3 p_L R\left(\tilde{x}^L\right)+\lambda_4=0 \\
\frac{\partial\mathcal{L}}{\partial x} &= \tilde{\phi}_I^L p_L R'\left(\tilde{x}^L\right)-\tilde{C}^L R'\left(\tilde{x}^L\right)-\lambda_1+\lambda_2 p_L\tilde{\phi}_E^L R'\left(\tilde{x}^L\right)+\lambda_3 p_L\left(1-\tilde{\phi}_E^L-\tilde{\phi}_I^L\right)R'\left(\tilde{x}^L\right)=0 \qquad \text{(A3)} \\
\frac{\partial\mathcal{L}}{\partial\phi_E} &= \lambda_2 p_L R\left(\tilde{x}^L\right)-\lambda_3 p_L R\left(\tilde{x}^L\right)=0 \\
\frac{\partial\mathcal{L}}{\partial E} &= \lambda_1-\lambda_2=0 \\
\frac{\partial\mathcal{L}}{\partial C} &= -R\left(\tilde{x}^L\right)+\lambda_5=0.
\end{aligned}
$$

Note that

$$\begin{aligned}\lambda_1 &= \lambda_2 = \lambda_3 = \beta \\ \lambda_4 &= (\beta - 1) p_L R\left(\tilde{x}^L\right) > 0 \\ \lambda_5 &= R\left(\tilde{x}^L\right) > 0.\end{aligned}$$

Hence, all constraints bind. Plugging the values of the multipliers, as well $\tilde{C}^L = \tilde{\phi}_I^L = 0$, in (18) we obtain:

$$p_L R'\left(\tilde{x}^L\right) = 1,$$

which corresponds to equation (8) in the main text. Note also that plugging the constraints in the objective function delivers:

$$\tilde{\Pi}^L = \beta W + \beta \left( \frac{R\left(\tilde{x}^L\right)}{R'\left(\tilde{x}^L\right)} - \tilde{x}^L \right),$$

as claimed in the main text.

Note that from the definition of $\Pi_I$ in the main text, $\Pi_I > \tilde{\Pi}^L$ if and only if

$$\frac{R\left(\tilde{x}\right)}{R'\left(\tilde{x}\right)} - \tilde{x} > \frac{R\left(\tilde{x}^L\right)}{R'\left(\tilde{x}^L\right)} - \tilde{x}^L.$$

But since $\frac{R(x)}{R'(x)} - x$ is strictly increasing in $x$ whenever $R''(x) < 0$, we can conclude that good behavior will be implemented whenever

$$\tilde{x} > \tilde{x}^L.$$

Note also that $\tilde{x}$ is increasing in $\gamma$, while $\tilde{x}^L$ is independent of $\gamma$. Furthermore, when $\gamma \to 1$, it is necessarily the case that $\tilde{x} > \tilde{x}^L$. Hence, there exist a threshold $\gamma$ over which it is optimal to implement good behavior from the part of the entrepreneur.

## A.4 Proof of Proposition 2

Let us start by writing the Lagrangian corresponding to program (P2). Letting $\lambda_k$ denote the multiplier corresponding to correspond to constraint $k = 1, 2, 4, 5$ (remember constraint (iii) cannot bind), we can write this as:

$$\begin{aligned}\mathcal{L} &= \phi_I p_H R(x) + (W + P)\beta - CR(x) + \lambda_1 (E - P - x) + \lambda_2 (p_H \phi_E R(x) - E) \\ &\quad + \lambda_4 ((p_H - p_L)(1 - \phi_E - \phi_I) R(x) - (1 - \gamma)(1 - \delta(C)) R(x)) + \lambda_5 \left(\phi_I - \frac{C}{(p_H - p_L)}\right).\end{aligned}$$

It is then straightforward to see that the same first-order conditions as in program (P1) apply, except for the partial $\partial\mathcal{L}/\partial C$, which is now given by

$$\frac{\partial \mathcal{L}}{\partial C} = -R(\hat{x}) + \lambda_4 (1-\gamma)\,\delta'\left(\hat{C}\right) R(\hat{x}) - \frac{\lambda_5}{(p_H - p_L)} = 0. \tag{A4}$$

Straightforward manipulation again delivers from which we conclude that all constraints bind, as claimed in the main text.

Next plugging the value of $\lambda_4$ into (18) delivers

$$\begin{aligned}
\lambda_1 &= \lambda_2 = \beta > 0 \\
\lambda_4 &= \frac{p_H}{p_H - p_L}\lambda_2 = \frac{p_H}{p_H - p_L}\beta > 0 \\
\lambda_5 &= (\beta - 1)\, p_H R(\tilde{x}) > 0.
\end{aligned}$$

Again, all constraints bind, but this now implies that $\hat{\phi}_I = \hat{C}/(p_H - p_L)$. Plugging the values of the multiplies in in (A4) yields

$$\delta'\left(\hat{C}\right) = \frac{\beta p_H - p_L}{(1-\gamma)\,\beta p_H},$$

as claimed in equation (10) in the main text. Next, plugging the multipliers and $\hat{\phi}_I$ into (18) – which applies here as well – yields

$$R'(\hat{x}) = \frac{1}{p_H\left(1 - \frac{(1-\gamma)\left(1-\delta\left(\hat{C}\right)\right)}{p_H - p_L} - \left(\frac{\beta p_H - p_L}{p_H - p_L}\right)\frac{\hat{C}}{\beta p_H}\right)},$$

which corresponds to equation (11) in the main text. Setting the constraints to equality, we can also compute the total payoff obtained by the inventor:

$$\hat{\Pi}_I = W\beta + \beta\left(\frac{R(\hat{x})}{R'(\hat{x})} - \hat{x}\right).$$

This is analogous to the expression obtained in the case of verifiable monitoring, but with $\hat{x}$ replacing $\tilde{x}$. Because the constraints in program (P1) are tighter than in program (P2), we can conclude that $\hat{\Pi}_I < \tilde{\Pi}_I$, which given the monotonicity of $\frac{R(x)}{R'(x)} - x$ implies that $\hat{x} < \tilde{x}$.

The expression we have derived for $\hat{\Pi}_I$ can be used to analyze when it is optimal for the inventor to implement good behavior. Notice that the optimal contract that implements bad behavior is not affected by whether monitoring is verifiable or not. Hence, implementing good behavior is optimal whenever $\hat{\Pi}_I > \tilde{\Pi}_I^L$, or simply $\hat{x} > \tilde{x}^L$. Again, for sufficiently high $\gamma$, this will necessarily be satisfied.

## A.5 Proof of Lemma 1

This follows from the fact that the right-hand side of equation (10) is increasing in $\gamma$ and decreasing in $\beta$, while the left-hand is decreasing in $\hat{C}$ (given the convexity of $\delta(\cdot)$).

## A.6 Proof of Proposition 4

Let

$$F\left(\gamma, \beta, \hat{C}(\gamma, \beta)\right) = \frac{(1-\gamma)\left(1-\delta\left(\hat{C}\right)\right)}{p_H - p_L} + \left(\frac{\beta p_H - p_L}{p_H - p_L}\right)\frac{\hat{C}}{\beta p_H}.$$

Using equation (10), we can establish that:

$$\frac{dF(\cdot)}{d\gamma} = -\frac{\left(1-\delta\left(\hat{C}\right)\right)}{p_H - p_L} + -\frac{(1-\gamma)\,\delta'\left(\hat{C}\right)}{p_H - p_L}\frac{d\hat{C}}{d\gamma} + \left(\frac{\beta p_H - p_L}{p_H - p_L}\right)\frac{1}{\beta p_H}\frac{d\hat{C}}{d\gamma} = -\frac{1-\delta\left(\hat{C}\right)}{p_H - p_L} < 0;$$

$$\frac{dF(\cdot)}{d\beta} = -\frac{(1-\gamma)\,\delta'\left(\hat{C}\right)}{p_H - p_L}\frac{d\hat{C}}{d\beta} + \left(\frac{\beta p_H - p_L}{p_H - p_L}\right)\frac{1}{\beta p_H}\frac{d\hat{C}}{d\beta} + \frac{p_L \hat{C}}{(p_H - p_L)\,\beta^2 p_H} = \frac{p_L \hat{C}}{(p_H - p_L)\,\beta^2 p_H} > 0.$$

From inspection of (11) and the concavity of $R(\cdot)$, it is then clear that $\hat{x}$ is increasing in $\gamma$ and decreasing in $\beta$.

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**Table I**

**Descriptive Statistics**

| | Mean | Median | Standard Deviation |
|---|---|---|---|
| *Panel A: Benchmark Year Data for Tests in Tables II-V* | | | |
| *Multinational Firm Variables* | | | |
| Arm's Length Licensing Dummy | 0.1522 | 0.0000 | 0.3592 |
| Share of Affiliate Assets Financed by Parent | 0.4146 | 0.4235 | 0.3267 |
| Share of Affiliate Equity Owned by Parent | 0.8991 | 1.0000 | 0.2195 |
| Log of Affiliate Sales | 9.9024 | 9.8139 | 1.7218 |
| Log of Affiliate Employment | 4.7601 | 4.7362 | 1.6060 |
| Affiliate Net PPE/Assets | 0.2355 | 0.1670 | 0.2264 |
| Log of Parent R&D Expenditures | 9.0580 | 10.2140 | 4.3927 |
| *Country Variables* | | | |
| Creditor Rights | 2.1415 | 2.0000 | 1.2100 |
| Private Credit | 0.7536 | 0.8150 | 0.3891 |
| FDI Ownership Restrictions | 0.2247 | 0.0000 | 0.4174 |
| Log of GDP per Capita | 9.3995 | 9.8504 | 1.1019 |
| Corporate Tax Rate | 0.3488 | 0.3411 | 0.1060 |
| Patent Protections | 3.2287 | 3.5714 | 0.8480 |
| Property Rights | 1.6233 | 1.0000 | 0.8378 |
| Rule of Law | 9.3207 | 10.0000 | 1.4088 |
| Risk of Expropriation | 5.1398 | 6.0000 | 1.2731 |
| *Panel B: Annual Data for Tests in Table IV* | | | |
| Log of Affiliate Sales | 10.1285 | 10.2672 | 2.1426 |
| Log of Aggregated Affiliate Sales | 15.7572 | 15.5346 | 1.7018 |

Notes: Panel A provides descriptive statistics for data drawn from the 1982, 1989, 1994, and 1999 benchmark year survey and used in the analysis presented in Tables II-V. Arm's Length Licensing Dummy is defined for country/year pairs in which a parent has an affiliate or from which a parent recieves a royalty payment from an unaffiliated foreign person. This dummy is equal to one if the parent receives a royalty payment from an unaffiliated foreign person, and it is otherwise equal to zero. Share of Affiliate Assets Financed by Parents is the ratio of parent provided equity and net parent lending to total affiliate assets. Share of Affiliate Equity Ownership is the equity ownership of the multinational parent. Affiliate Net PPE/Assets is the ratio of affiliate net property plant and equipment to affiliate assets. Creditor Rights is an index of the strength of creditor rights developed in Djankov, McLiesh, and Shleifer (2005); higher levels of the measure indicate stronger legal protections. Private Credit is the ratio of private credit lent by deposit money banks to GDP, as provided in Beck et. al. (1999). FDI Ownership Restrictions is a dummy equal to one if two measures of restrictions on foreign ownership as measured by Shatz (2000) are above 3 on a scale of 1 to 5 and zero otherwise. Corporate Tax Rate is the median effective tax rate paid by affiliates in a particular country and year. Patent Protections is an index of the strength of patent rights provided in Ginarte and Park (1997). Property Rights is an index of the stregth of property rights drawn from the 1996 *Index of Economic Freedom* . Rule of Law is an assesment of the stregth and impartiality of a country's overall legal system drawn from the International Country Risk Guide. Risk of Expropriation is an index of the risk of outright confiscation or forced nationalization of private enterpirse, and it is also drawn from the International Country Risk Guide; higher values of this index reflect lower risks. Panel B provides descriptive statistics for annual data covering the 1982-1999 period that are used in the analysis presented in Table IV. Log of Aggregated Affiliate Sales is the log of affiliate sales summed across affiliates in a particular country and year.

**Table II**

**Licensing and Affiliate Activity**

| Dependent Variable: | Arm's Length Licensing Dummy | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Creditor Rights | 0.0111 | 0.0121 | -0.0005 | | | |
| | (0.0034) | (0.0037) | (0.0039) | | | |
| Creditor Rights*Log of Parent R&D | | | 0.0016 | | | |
| | | | (0.0007) | | | |
| Private Credit | | | | 0.0627 | 0.0532 | -0.0514 |
| | | | | (0.0193) | (0.0230) | (0.0156) |
| Private Credit*Log of Parent R&D | | | | | | 0.0129 |
| | | | | | | (0.0023) |
| FDI Ownership Restrictions | 0.0278 | 0.0248 | 0.0250 | 0.0115 | 0.0137 | 0.0132 |
| | (0.0139) | (0.0137) | (0.0134) | (0.0133) | (0.0132) | (0.0130) |
| Log of GDP per Capita | 0.0100 | 0.0223 | 0.0238 | 0.0001 | 0.0124 | 0.0120 |
| | (0.0051) | (0.0113) | (0.0113) | (0.0062) | (0.0109) | (0.0110) |
| Corporate Tax Rate | 0.2125 | 0.2289 | 0.2269 | 0.1869 | 0.2016 | 0.2049 |
| | (0.0709) | (0.0711) | (0.0694) | (0.0596) | (0.0579) | (0.0571) |
| Patent Protections | | 0.0001 | 0.0004 | | -0.0054 | -0.0062 |
| | | (0.0073) | (0.0071) | | (0.0079) | (0.0080) |
| Property Rights | | 0.0001 | 0.0004 | | -0.0054 | -0.0062 |
| | | (0.0073) | (0.0071) | | (0.0079) | (0.0080) |
| Rule of Law | | 0.0062 | 0.0062 | | 0.0029 | 0.0024 |
| | | (0.0056) | (0.0055) | | (0.0056) | (0.0055) |
| Risk of Expropriation | | -0.0166 | -0.0173 | | -0.0171 | -0.0172 |
| | | (0.0065) | (0.0064) | | (0.0069) | (0.0068) |
| Constant | -0.0493 | -0.1644 | -0.1696 | 0.0312 | -0.0332 | -0.0116 |
| | (0.0557) | (0.0894) | (0.0890) | (0.0505) | (0.0772) | (0.0766) |
| Parent/Year Fixed Effects? | Y | Y | Y | Y | Y | Y |
| No. of Obs. | 33,786 | 32,609 | 31,969 | 31,381 | 30,782 | 30,235 |
| R-Squared | 0.5923 | 0.5938 | 0.5935 | 0.5943 | 0.5972 | 0.5999 |

Notes: The dependent variable, the Arm's Length Licensing Dummy, is defined for country/year pairs in which a parent has an affiliate or from which a parent recieves a royalty payment from an unaffiliated foreign person. This dummy is equal to one if the parent receives a royalty payment from an unaffiliated foreign person, and it is otherwise equal to zero. Creditor Rights is an index of the strength of creditor rights developed in Djankov, McLiesh, and Shleifer (2005); higher levels of the measure indicate stronger legal protections. Private credit is the ratio of private credit lent by deposit money banks to GDP, as provided in Beck et. al. (1999). FDI Ownership Restrictions is a dummy equal to one if two measures of restrictions on foreign ownership as measured by Shatz (2000) are above 3 on a scale of 1 to 5 and zero otherwise. Corporate Tax Rate is the median effective tax rate paid by affiliates in a particular country and year. Patent Protections is an index of the strength of patent rights provided in Ginarte and Park (1997). Property Rights is an index of the stregth of property rights drawn from the 1996 Index of Economic Freedom. Rule of Law is an assesment of the stregth and impartiality of a country's overall legal system drawn from the International Country Risk Guide. Risk of Expropriation is an index of the risk of outright confiscation or forced nationalization of private enterpirse, and it is also drawn from the International Country Risk Guide; higher values of this index reflect lower risks. Each specification is an OLS specification that includes parent-year fixed effects. Heteroskedasticity consistent standard errors that correct for clustering at the country/year level appear in parentheses.

**Table III**

**Parent Financing of Affiliate Activity**

| Dependent Variable: | Share of Affiliate Assets Financed by Parent | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Creditor Rights | -0.0140 | -0.0199 | -0.0116 | | | |
| | (0.0073) | (0.0068) | (0.0071) | | | |
| Creditor Rights*Log of Parent R&D | | | -0.0010 | | | |
| | | | (0.0004) | | | |
| Private Credit | | | | -0.0707 | -0.0492 | -0.0233 |
| | | | | (0.0224) | (0.0220) | (0.0243) |
| Private Credit*Log of Parent R&D | | | | | | -0.0027 |
| | | | | | | (0.0013) |
| FDI Ownership Restrictions | -0.0527 | -0.0598 | -0.0597 | -0.0422 | -0.0521 | -0.0523 |
| | (0.0177) | (0.0157) | (0.0159) | (0.0201) | (0.0172) | (0.0175) |
| Log of GDP per Capita | -0.0155 | -0.0105 | -0.0106 | -0.0043 | 0.0077 | 0.0089 |
| | (0.0069) | (0.0139) | (0.0142) | (0.0087) | (0.0147) | (0.0152) |
| Corporate Tax Rate | -0.2188 | -0.2547 | -0.2490 | -0.1808 | -0.2100 | -0.2044 |
| | (0.0764) | (0.0749) | (0.0746) | (0.0771) | (0.0769) | (0.0774) |
| Patent Protections | | -0.0439 | -0.0440 | | -0.0512 | -0.0520 |
| | | (0.0134) | (0.0136) | | (0.0156) | (0.0158) |
| Property Rights | | -0.0285 | -0.0290 | | -0.0118 | -0.0109 |
| | | (0.0135) | (0.0136) | | (0.0121) | (0.0123) |
| Rule of Law | | 0.0018 | 0.0020 | | 0.0037 | 0.0040 |
| | | (0.0072) | (0.0073) | | (0.0076) | (0.0077) |
| Risk of Expropriation | | 0.0044 | 0.0042 | | 0.0041 | 0.0035 |
| | | (0.0090) | (0.0092) | | (0.0093) | (0.0096) |
| Constant | 0.6822 | 0.7825 | 0.7851 | 0.5848 | 0.5606 | 0.5489 |
| | (0.0599) | (0.1080) | (0.1092) | (0.0718) | (0.0942) | (0.0955) |
| Parent/Year Fixed Effects? | Y | Y | Y | Y | Y | Y |
| Affiliate Controls? | N | Y | Y | N | Y | Y |
| No. of Obs. | 52,097 | 42,144 | 41,140 | 49,095 | 39,823 | 38,859 |
| R-Squared | 0.2866 | 0.3038 | 0.3002 | 0.2943 | 0.3091 | 0.3054 |

Notes: The dependent variable is the ratio of parent provided equity and net parent lending to total assets. Creditor Rights is an index of the strength of creditor rights developed in Djankov, McLiesh, and Shleifer (2005); higher levels of the measure indicate stronger legal protections. Private credit is the ratio of private credit lent by deposit money banks to GDP, as provided in Beck et. al. (1999). FDI Ownership Restrictions is a dummy equal to one if two measures of restrictions on foreign ownership as measured by Shatz (2000) are above 3 on a scale of 1 to 5 and zero otherwise. Corporate Tax Rate is the median effective tax rate paid by affiliates in a particular country and year. Patent Protections is an index of the strength of patent rights provided in Ginarte and Park (1997). Property Rights is an index of the stregth of property rights drawn from the 1996 *Index of Economic Freedom* . Rule of Law is an assesment of the stregth and impartiality of a country's overall legal system drawn from the *International Country Risk Guide* . Risk of Expropriation is an index of the risk of outright confiscation or forced nationalization of private enterpirse, and it is also drawn from the International Country Risk Guide; higher values of this index reflect lower risks. Each specification is an OLS specification that includes parent-year fixed effects. As affiliate controls, the specifications presented in columns 2, 3, 5, and 6 include the log of affiliate sales, the log of affiliate employment, and affiliate net PPE/assets. Affiliate Net PPE/Assets is the ratio of affiliate net property plant and equipment to affiliate assets. Heteroskedasticity consistent standard errors that correct for clustering at the country/year level appear in parentheses.

**Table IV**

**Parent Ownership of Affiliate Equity**

| Dependent Variable: | Share of Affiliate Equity Owned by Parent | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Creditor Rights | -0.0102 | -0.0086 | 0.0016 | | | |
| | (0.0033) | (0.0042) | (0.0035) | | | |
| Creditor Rights*Log of Parent R&D | | | -0.0011 | | | |
| | | | (0.0003) | | | |
| Private Credit | | | | -0.0599 | -0.0495 | 0.0083 |
| | | | | (0.0172) | (0.0225) | (0.0170) |
| Private Credit*Log of Parent R&D | | | | | | -0.0059 |
| | | | | | | (0.0011) |
| FDI Ownership Restrictions | -0.0850 | -0.0793 | -0.0768 | -0.0744 | -0.0699 | -0.0673 |
| | (0.0160) | (0.0165) | (0.0165) | (0.0147) | (0.0157) | (0.0157) |
| Log of GDP per Capita | 0.0188 | 0.0172 | 0.0174 | 0.0297 | 0.0256 | 0.0268 |
| | (0.0061) | (0.0134) | (0.0135) | (0.0075) | (0.0130) | (0.0131) |
| Corporate Tax Rate | -0.2269 | -0.2699 | -0.2611 | -0.2112 | -0.2385 | -0.2291 |
| | (0.0809) | (0.0948) | (0.0938) | (0.0750) | (0.0792) | (0.0783) |
| Patent Protections | | -0.0085 | -0.0076 | | -0.0074 | -0.0065 |
| | | (0.0076) | (0.0075) | | (0.0078) | (0.0078) |
| Property Rights | | 0.0119 | 0.0121 | | 0.0137 | 0.0144 |
| | | (0.0083) | (0.0083) | | (0.0083) | (0.0083) |
| Rule of Law | | 0.0002 | 0.0007 | | 0.0020 | 0.0027 |
| | | (0.0064) | (0.0064) | | (0.0065) | (0.0064) |
| Risk of Expropriation | | 0.0102 | 0.0099 | | 0.0111 | 0.0103 |
| | | (0.0073) | (0.0074) | | (0.0070) | (0.0070) |
| Constant | 0.8441 | 0.8437 | 0.8358 | 0.7562 | 0.7409 | 0.7181 |
| | (0.0624) | (0.1062) | (0.1058) | (0.0607) | (0.0920) | (0.0906) |
| Parent/Year Fixed Effects? | Y | Y | Y | Y | Y | Y |
| Affiliate Controls? | N | Y | Y | N | Y | Y |
| No. of Obs. | 52,367 | 42,357 | 41,350 | 49,343 | 40,017 | 39,050 |
| R-Squared | 0.3912 | 0.4201 | 0.4136 | 0.3952 | 0.4231 | 0.4174 |

Notes: The dependent variable is the share of affiliate equity owned by the affiliate's parent. Creditor Rights is an index of the strength of creditor rights developed in Djankov, McLiesh, and Shleifer (2005); higher levels of the measure indicate stronger legal protections. Private credit is the ratio of private credit lent by deposit money banks to GDP, as provided in Beck et. al. (1999). FDI Ownership Restrictions is a dummy equal to one if two measures of restrictions on foreign ownership as measured by Shatz (2000) are above 3 on a scale of 1 to 5 and zero otherwise. Corporate Tax Rate is the median effective tax rate paid by affiliates in a particular country and year. Patent Protections is an index of the strength of patent rights provided in Ginarte and Park (1997). Property Rights is an index of the stregth of property rights drawn from the 1996 *Index of Economic Freedom* . Rule of Law is an assesment of the stregth and impartiality of a country's overall legal system drawn from the *International Country Risk Guide.* Risk of Expropriation is an index of the risk of outright confiscation or forced nationalization of private enterpirse, and it is also drawn from the International Country Risk Guide; higher values of this index reflect lower risks. Each specification is an OLS specification that includes parent-year fixed effects. As affiliate controls, the specifications presented in columns 2, 3, 5, and 6 include the log of affiliate sales, the log of affiliate employment, and affiliate net PPE/assets. Affiliate Net PPE/Assets is the ratio of affiliate net property plant and equipment to affiliate assets. Heteroskedasticity consistent standard errors that correct for clustering at the country/year level appear in parentheses.

**Table V**

**Scale of Affiliate Activity**

| *Dependent Variable:* | Log of Affiliate Sales | | Log of Aggregate Affiliate Sales | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Post Liberalization Dummy | 0.0042 | -0.0097 | -0.0620 | -0.0964 |
| | (0.0729) | (0.0767) | (0.1309) | (0.1506) |
| Post Liberalization Dummy * Low Creditor Rights Dummy | 0.3203 | | 0.3666 | |
| | (0.0900) | | (0.1650) | |
| Post Liberalization Dummy * Low Private Credit Dummy | | 0.3218 | | 0.3673 |
| | | (0.0955) | | (0.2163) |
| Log of GDP per Capita | 1.6721 | 1.7211 | 2.5973 | 2.7219 |
| | (0.3979) | (0.3993) | (0.9908) | (0.9796) |
| Constant | -6.0303 | -6.4869 | -6.2474 | -7.3715 |
| | (3.7384) | (3.7512) | (8.6715) | (8.5702) |
| Affiliate and Year Fixed Effects? | Y | Y | N | N |
| Country and Year Fixed Effects? | N | N | Y | Y |
| No. of Obs. | 180,796 | 181,103 | 827 | 845 |
| R-Squared | 0.8035 | 0.8040 | 0.9243 | 0.9251 |

Notes: The dependent variable in the first two columns is the log of affiliate sales, and the dependent variable in the last two columns is the log of affiliate sales aggregated across affiliates in a particular country. The data are annual data covering the 1982-1999 period. The Post Liberaliztion Dummy is equal to one for the sixteen countries that liberalize their ownership restrictions in the year of and years following liberalization of foreign ownership restrictions. The Low Creditor Rights Dummy is equal to one for observations related to countries with below median levels of creditor rights among liberalizaing countries measured in the year prior to liberalization and zero otherwise. The Low Private Credit Dummy is equal to one for observations related to countries with below median levels of private credit among liberalizaing countries measured in the year prior to liberalization and zero otherwise. Private credit is the ratio of private credit lent by deposit money banks to GDP, as provided in Beck et. al. (1999). The first two specifications are OLS specifications that include affiliate and year fixed effects, and the last two are OLS specifications that include country and year fixed effects. Heteroskedasticity consistent standard errors that correct for clustering at the country level appear in parentheses.

**Appendix Table I**

**Scale of Affiliate Activity**

| *Dependent Variable:* | Log of Affiliate Sales | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Creditor Rights | 0.0233 | 0.0448 | 0.0697 | | | |
| | (0.0304) | (0.0405) | (0.0470) | | | |
| Creditor Rights*Log of Parent R&D | | | -0.0028 | | | |
| | | | (0.0019) | | | |
| Private Credit | | | | 0.1451 | 0.3182 | 0.3359 |
| | | | | (0.0992) | (0.1156) | (0.1496) |
| Private Credit*Log of Parent R&D | | | | | | -0.0012 |
| | | | | | | (0.0067) |
| FDI Ownership Restrictions | -0.1241 | -0.0968 | -0.0932 | -0.1325 | -0.1690 | -0.1679 |
| | (0.0717) | (0.0911) | (0.0911) | (0.0875) | (0.1072) | (0.1069) |
| Log of GDP per Capita | 0.2246 | 0.3124 | 0.3096 | 0.2110 | 0.2558 | 0.2537 |
| | (0.0261) | (0.0563) | (0.0569) | (0.0373) | (0.0607) | (0.0613) |
| Corporate Tax Rate | 1.2729 | 1.1614 | 1.1739 | 1.2470 | 0.9876 | 0.9911 |
| | (0.2777) | (0.3363) | (0.3394) | (0.3235) | (0.3669) | (0.3693) |
| Patent Protections | | -0.1091 | -0.1035 | | -0.1124 | -0.1086 |
| | | (0.0621) | (0.0627) | | (0.0572) | (0.0577) |
| Property Rights | | 0.0159 | 0.0120 | | 0.0112 | 0.0098 |
| | | (0.0717) | (0.0712) | | (0.0662) | (0.0676) |
| Rule of Law | | 0.0986 | 0.1024 | | 0.0855 | 0.0890 |
| | | (0.0401) | (0.0399) | | (0.0426) | (0.0423) |
| Risk of Expropriation | | -0.0647 | -0.0688 | | -0.0660 | -0.0705 |
| | | (0.0509) | (0.0517) | | (0.0533) | (0.0540) |
| Constant | 7.3324 | 6.3040 | 6.2806 | 7.3954 | 6.8935 | 6.8686 |
| | (0.2243) | (0.5269) | (0.5261) | (0.3092) | (0.5395) | (0.5391) |
| Parent/Year Fixed Effects? | Y | Y | Y | Y | Y | Y |
| No. of Obs. | 52,367 | 42,386 | 41,379 | 49,343 | 40,044 | 39,077 |
| R-Squared | 0.3230 | 0.3280 | 0.3216 | 0.3250 | 0.3323 | 0.3260 |

Notes: The dependent variable is the log of affiliate sales. Creditor Rights is an index of the strength of creditor rights developed in Djankov, McLiesh, and Shleifer (2005); higher levels of the measure indicate stronger legal protections. Private credit is the ratio of private credit lent by deposit money banks to GDP, as provided in Beck et. al. (1999). FDI Ownership Restrictions is a dummy equal to one if two measures of restrictions on foreign ownership as measured by Shatz (2000) are above 3 on a scale of 1 to 5 and zero otherwise. Corporate Tax Rate is the median effective tax rate paid by affiliates in a particular country and year. Patent Protections is an index of the strength of patent rights provided in Ginarte and Park (1997). Property Rights is an index of the stregth of property rights drawn from the 1996 *Index of Economic Freedom*. Rule of Law is an assesment of the stregth and impartiality of a country's overall legal system drawn from the *International Country Risk Guide.* Risk of Expropriation is an index of the risk of outright confiscation or forced nationalization of private enterpirse, and it is also drawn from the International Country Risk Guide; higher values of this index reflect lower risks. Each specification is an OLS specification that includes parent-year fixed effects. Heteroskedasticity consistent standard errors that correct for clustering at the country/year level appear in parentheses.