Multinational Firms, FDI Flows and Imperfect Capital Markets

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Abstract

This paper examines how costly financial contracting and weak investor protection influence the cross-border operational, financing and investment decisions of firms. We develop a model in which product developers can play a useful role in monitoring the deployment of their technology abroad. The analysis demonstrates that when firms want to exploit technologies abroad, multinational firm (MNC) activity and foreign direct investment (FDI) flows arise endogenously when monitoring is nonverifiable and financial frictions exist. 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 demonstrates that weak investor protections limit the scale of multinational firm activity, increase the reliance on FDI flows and alter the decision to deploy technology through FDI as opposed to arm's length licensing. Several distinctive predictions for the impact of weak investor protection on MNC activity and FDI flows are tested and confirmed using firm-level data.

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1 Introduction

Firms globalizing their operations and the associated capital flows have become major features of the world economy. These cross-border activities and capital flows span institutional settings with varying investor protections and levels of capital market development. While the importance of institutional heterogeneity in dictating economic outcomes has been emphasized, existing analyses typically ignore the global firms and the capital flows that are now commonplace. Investigating how global firms make operational and financing decisions in a world of heterogenous institutions promises to provide a novel perspective on observed patterns of flows and firm activity.

This paper develops and tests a model of the operational and financial decisions of firms as they exploit their technologies in countries with differing levels of investor protections. The model demonstrates that multinational firm (MNC) activity and foreign direct investment (FDI) arise endogenously in settings characterized by financial frictions. Furthermore, the model generates several predictions regarding the use of arm's length licensing to transfer technology, the degree to which multinational firm activity is financed by capital flows, the extent to which multinationals take ownership in foreign projects, and the scale of operations abroad. These predictions are tested using firm-level data on U.S. multinational firms.

The model considers the problem of a firm that has developed a proprietary technology that it is seeking to deploy abroad with the help of a local entrepreneur. A variety of alternative arrangements, including licensing the technology or directly owning the entity, are considered. External investors are a potential source of funding, but they are concerned with managerial misbehavior, particularly in settings where investor protections are weak. The central premise of the model is that developers of technologies are particularly useful monitors for ensuring that local entrepreneurs are pursuing value maximization. The concerns of external funders regarding managerial misbehavior lead to optimal contracts in which the developer of the technology holds an ownership claim and capital flows from the developer of the technology to the entrepreneur.[1] As such, multinational firms and FDI flows arise endogenously in response to concerns over managerial misbehavior and

[1] The experience of Disney in Japan, as documented in Misawa (2005), provides one example of the mechanism that drives the behavior of external investors. In 1997, Disney was evaluating how to structure a new opportunity with a local partner in Japan. Japanese banks expressed a strong preference for equity participation by Disney over a licensing agreement in order to ensure that Disney had strong incentives to monitor the project and ensure value maximization. The concerns of these lenders and the intuition that Disney would have a unique ability to monitor local partners are reflective of the central ideas of the model.

weak investor protections. Extending the model to allow for a similar form of monitoring by external investors does not vitiate the primary results.

The characterization of multinational firms as developers of technologies has long been central to models explaining multinational firm activity. In contrast to those models that emphasize the risk of technology expropriation, the model in this paper emphasizes financial frictions, a cruder form of managerial opportunism and the role of external funders. 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. Our emphasis on monitoring builds on the theory presented in Holmstrom and Tirole (1997) which captures how monitoring is critical to understanding financial intermediation.[2]

In deriving our theoretical results, we find it useful to first develop a benchmark in which monitoring is verifiable. In this setting, we show that when the developer of a technology wants to deploy that technology abroad, the developer chooses to license this technology to a host country entrepreneur who obtains financing from external investors. Under these circumstances, the entrepreneur can exploit technology without giving a financial claim on the project to the developer, who simply obtains a flat fee for the use of its proprietary technology. When monitoring is verifiable, weak investor protections still limit the scale of projects because these environments require more monitoring and this inflates the marginal cost of production.

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. Under the optimal contract in this setting, external investors require that inventors own equity in the project in order to ensure that inventors have proper incentives to engage in monitoring. This requirement increases the *effective* cost of obtaining capital from external investors and can induce the parent firm to provide funds for investment. Hence, as is standard in financial contracting models, informational frictions make the use of internal capital relatively more attractive than the use of external capital even though external capital providers earn lower rates of return on their invested capital. We also show that while simple revenue-sharing agreements may also induce inventors to exert positive levels of monitoring in the deployment of their technologies, this type of contract is generally not optimal as it will provide an inefficiently low level of punishment to the inventor when the project does not perform well.

The case of nonverifiable monitoring delivers several novel predictions about the na-

[2] 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.

ture of FDI and patterns of multinational firm activity. First, the model predicts that technology will be exploited through unrelated party licensing rather than through affiliate activity in countries where investor protections are stronger. 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. The model also 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. Better investor protections reduce the need for monitoring and therefore allow for a larger scale of activity.

We test these predictions using the most comprehensive available data on the activities of U.S. multinational firms. These data provide details on the world wide operations of U.S. multinationals and include measures of parental ownership, financing and operational decisions. These data enable the use of parent-year fixed effects that implicitly control for a variety of unobserved attributes.

The analysis indicates that the likelihood of using arm's length licensing to serve a foreign market increases with measures of investor protections, as suggested by the model. The predictions on parent financing and ownership decisions are also confirmed to be a function of the quality of investor protections and the depth of capital markets. The model also suggests that these effects should be most pronounced for technologically advanced firms because these firms are most likely to be able to provide valuable monitoring services. The empirical evidence indicates a differential effect for such firms.

Settings where ownership restrictions are liberalized provide an opportunity to test the final prediction of the model. The model implies that these liberalizations should have a particularly large effect on multinational affiliate activity in countries with weak investor protections because, in those countries, ownership restrictions limit multinational firm activity the most. Our empirical analysis confirms that affiliate activity increases by larger amounts after liberalizations in countries with weaker investor protections.

This paper extends the large and growing literature on the effects of investor protection and capital market development on economic outcomes to an open economy setting where firms make operational and financial decisions across borders. La Porta, Lopez-de-Silanes, Shleifer and Vishny (1997, 1998) relate investor protections to the concentration of ownership and the depth of capital markets. A large literature, including King and

Levine (1993), Levine and Zervos (1998) Rajan and Zingales (1998), Wurgler (2000), and Acemoglu, Johnson and Mitton (2005), has shown that financial market conditions influence firm investment behavior, economic growth and industrial structure.

By exclusively emphasizing firms with local investment and financing, this literature has neglected how cross-border, intrafirm activity responds to institutional variations. The open economy dimensions of institutional variations have been explored, but only in the context of arms-length cross-border lending as in Gertler and Rogoff (1990), Boyd and Smith (1997) and Shleifer and Wolfenzon (2002).[3] The model in this paper demonstrates how both multinational activity and capital flows respond to heterogeneity in institutional settings. In short, we show that weak financial institutions decrease the scale of multinational firm activity but simultaneously increase the reliance on capital flows from the parent. As such, observed patterns of capital flows reflect these two distinct and contradictory effects. The empirical investigations of micro-data provided in the paper indicate that both effects are operative.

By jointly considering the determinants of MNC activities and the flows of capital that support these activities, the paper also links two literatures – the international trade literature on multinationals and the macroeconomic literature on capital flows. Industrial organization and international trade scholars characterize multinationals as having proprietary assets and emphasize the role of market imperfections, such as transport costs and market power, in determining patterns of multinational activity. Recent work on multinational firms investigates "horizontal" or "vertical" motivations[4] for foreign direct investment and explores why alternative productive arrangements, such as whole ownership of foreign affiliates, joint ventures, exports or arm's length contracts, are employed.[5]

Such analyses of multinational firm activity typically do not consider associated capital flows.[6] Research on capital flows typically abstracts from firm activity and has focused

[3]Gertler and Rogoff (1990) show how arms-length 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. In contrast, Kraay et al. (2005) emphasize the role of sovereign risk in shaping the structure of world capital flows.

[4]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.

[5]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.

[6]Several studies linking levels of MNC activity and FDI flows are worth noting. First, high frequency

on the paradox posed by Lucas (1990) of limited capital flows from rich to poor countries in the face of large presumed rate of return differentials. While Lucas (1990) emphasizes human-capital externalities to help explain this paradox, Reinhart and Rogoff (2004) review subsequent research on aggregate capital flows and conclude that credit market conditions and political risk play significant roles. By examining firm behavior in a setting of heterogenous institutional setting, this paper attempts to unify an investigation of multinational firm activity and FDI flows.

The rest of the paper is organized as follows. Section 2 lays out the model, 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 empirical analysis and Section 5 concludes.

2 Theoretical Framework

We begin this section by describing a partial equilibrium model of financing that builds on and extends the work of Holmstrom and Tirole (1997).[7] 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.

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 (forthcoming)) 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 (forthcoming)). 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 and 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 show to be supported by U.S. data.

[7] Our model generalizes the setup in Holmstrom and Tirole (1997) by allowing for diminishing returns to investment and for variable monitoring levels. The scope of the two papers is also very distinct: Holmstrom and Tirole (1997) study the monitoring role of banks in a closed-economy model, while our focus is on multinational firms.

2.1 A 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. Consumers in two countries, Home and Foreign, derive utility from consuming this differentiated good.[8] The good, however, is 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 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. There are three periods, a date 0 contracting stage, a date 1 investment stage, and a date 2 production/consumption stage.

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 at date 2 the inventor obtains a constant gross return $\beta > 1$ for each unit of wealth he invests in production at Home at date 1. We refer to this gross return as the inventor's *shadow value of cash*. In the Appendix, the value of β is endogenously derived in a multi-country version of the model where consumer preferences, technology and financial contracting in all countries are fully specified. The provision that $\beta > 1$ does not imply that the *effective* cost of capital provided by external investors is always lower than the *effective* cost of capital provided by the inventor, as informational frictions may drive a wedge between returns earned and the costs borne by the relevant parties.

We assume that Foreign preferences are such that cash flows or profits 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, $R(q)$, with $R'(q) > 0$ and $R''(q) \leq 0$. We also assume the standard conditions $R(0) = 0$, $\lim_{q\to 0} R'(q) = +\infty$, and $\lim_{q\to\infty} R'(q) = 0$. These properties of $R(q)$ can be derived from preferences featuring a constant (and higher-than-one) elasticity of substitution across (a continuum of) differentiated goods

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

produced by different firms. In such case, the elasticity of $R(q)$ with respect to q is constant and given by a parameter $\alpha \in (0,1)$.

Foreign production is managed by the foreign entrepreneur, who at date 1 can privately choose to *behave* and enjoy no private benefits, or *misbehave* and take private benefits. When the manager behaves, the project performs with probability p_H, in the sense that when an amount x is invested at date 1, project cash flows at date 2 are equal to $R(x)$ with probability p_H and 0 otherwise.[9] When the manager misbehaves, the project performs with a lower probability $p_L < p_H$ and expected cash flows are $p_L R(x)$. We assume that the private benefit a manager obtains from misbehaving is proportional to the return of the project, i.e., $BR(x)$.

Managerial misbehavior and the associated private benefits can be manifest by choosing to implement the project in a way that generates perquisites for the manager or his associates, in a way that requires less effort, or in a way that is more fun or glamorous. As described below, we will relate the ability to engage in such private benefits to the level of investor protections in Foreign as well as to the extent to which the entrepreneur is monitored. The idea is that countries with better investor protections tend to enforce laws that limit the ability of managers to divert funds from the firm or to enjoy private benefits or perquisites. This interpretation parallels the logic in Tirole (2006, p. 359).

When investor protections are not perfectly secure, monitoring by third agents is helpful in reducing the extent to which managers are able to divert funds or enjoy private benefits. Following Holmstrom and Tirole (1997), we introduce a monitoring technology that reduces the private benefit of the foreign entrepreneur when he misbehaves. It is reasonable to assume that the inventor can play a particularly useful role in monitoring the behavior of the foreign entrepreneur because the inventor is particularly well informed about how to manage the production of output using its technology. Intuitively, the developer of a technology is particularly well situated to determine if project failure is assocated with managerial actions or bad luck.[10] We capture this in a stark way by assuming that no other agent in the economy can productively monitor the foreign entrepreneur, though

[9] This assumes that, when the project succeeds, each unit invested results in a unit of output ($q = x$), while when the project fails, output is zero ($q = 0$). We shall relax the latter assumption in section 2.5 below.

[10] An alternative way to interpret monitoring is as follows. Suppose that the foreign entrepreneur can produce the good under a variety (a continuum, actually) of potential techniques indexed by $z \in [0, B]$. Technique 0 entails a probability of success equal to p_H and a zero private benefit. All techniques with $z > 0$ are associated with a probability of success equal to p_L and a private benefit equal to z. Clearly, all techniques with $z \in (0, B)$ are dominated from the point of view of the foreign entrepreneur, who will thus effectively (privately) choose either $z = 0$ or $z = B$, as assumed in the main text. Under this interpretation, we can think of monitoring as reducing the upper bound of $[0, B]$.

we will discuss a more general setup in section 2.5 below. On the other hand, when the inventor incurs an effort cost $CR(x)$ in monitoring at date 1, the private benefit for the local entrepreneur is multiplied by a factor $\delta(C)$, with $\delta'(C) < 0$, $\delta''(C) > 0$, $\delta(0) = \bar{\delta}$, $\lim_{C\to\infty} \delta(C) = 0$, $\lim_{C\to 0} \delta'(C) = -\infty$, and $\lim_{C\to\infty} \delta'(C) = 0$.[11]

The scope of private benefits is related to the level of investor protection of the host country by an index $\gamma \in (0, 1)$. In particular, we specify that

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

Note that this formulation implies that $\partial B(\cdot)/\partial\gamma < 0$, $\partial B(\cdot)/\partial C < 0$, and $\partial^2 B(\cdot)/\partial C\partial\gamma = -\delta'(C) > 0$. This formulation captures the intuition that the scope for private benefits is decreasing in both investor protection and monitoring, and that monitoring has a relatively larger effect on private benefits in countries with poor legal protection of investors.

Contracting

We consider optimal contracting between three sets of agents: the inventor, the foreign entrepreneur and foreign external investors. At date 0, the inventor and the foreign entrepreneur negotiate a contract that stipulates the terms under which the entrepreneur will exploit the technology developed by the inventor. This contract includes a date-0 transfer P from the entrepreneur to the inventor, as well as the agents' date-2 payoffs contingent on the return of the project.[12] When $P > 0$, the date-0 payment can be thought of as the price or upfront royalties paid for the use of the technology, which the inventor can invest in the Home market at date 1. When $P < 0$, we can think of the inventor as *cofinancing* the project in the Foreign country. The contract between the inventor and the entrepreneur also stipulates the date-1 scale of investment x, while 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 consider in Section 2.2 the case in which monitoring is verifiable.

Also at date 0, the foreign entrepreneur and external investors sign a financial contract under which the entrepreneur borrows an amount E from the external investors at date 0 in return for a date-2 payment contingent on the return of the project.

We consider an optimal contract from the point of view of the inventor and allow the

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

[12] For simplicity, we assume that the inventor's date-2 return in its Home market is not pleadgeable in Foreign.

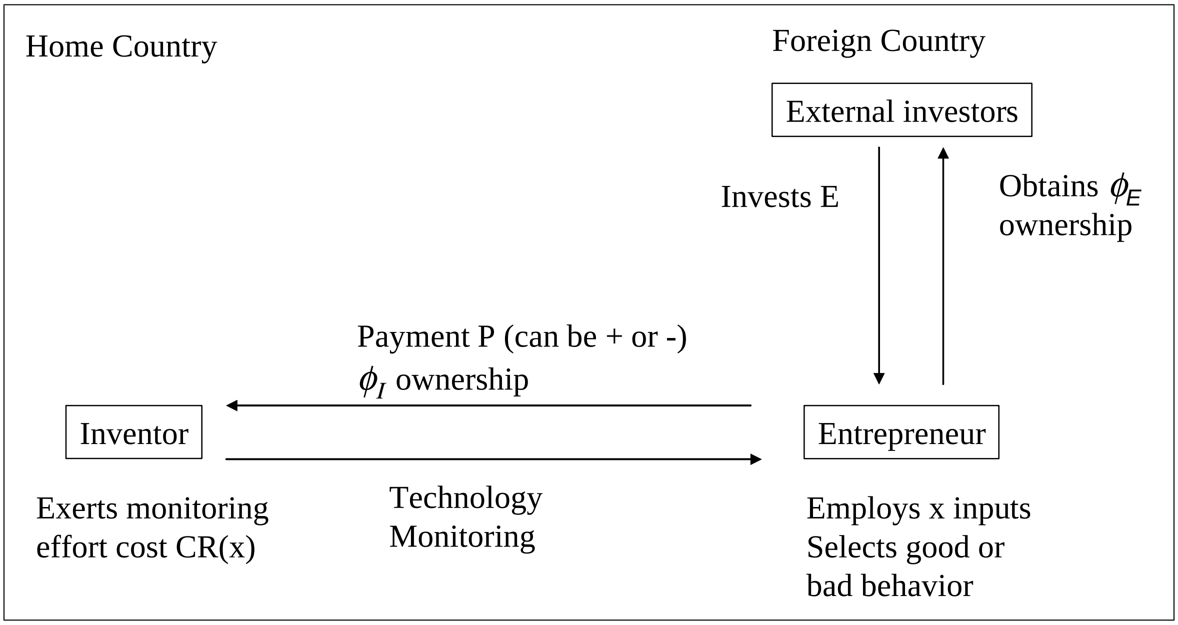

Figure 1: A Simple Picture of the Model

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 "direct" financial contracts between the inventor and foreign external investors. This is justified in the extension of the model developed in the Appendix, where the inventor's shadow value of cash β is endogenized.

Given the payoff structure of our setup and our assumptions of risk neutrality and limited liability, it is straightforward to show that an optimal contract is such that all date-2 payoffs can be expressed as shares of the return generated by the project.[13] When an agent's share of the date-2 return is positive, this agent thus becomes an equity holder in the entrepreneur's production facility.[14] We define ϕ_I and ϕ_E as the equity shares held by the inventor and external investors, respectively, with the remaining share $1 - \phi_I - \phi_E$ accruing to the foreign entrepreneur. Notice that when ϕ_I is large enough, the entrepreneur's production facility becomes a *subsidiary* of the inventor's firm.

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

[13] More formally, in our setup the optimal contract is such that all agents obtain a payoff equal to zero when the project fails (that is when the return is zero), and a nonnegative payoff when the project succeeds (in which case cash flows are positive).

[14] We focus on an interpretation of payoffs resembling the payoffs of an equity contract, but 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.

2.2 Optimal Financial Contract with Verifiable Monitoring

We first consider the case in which monitoring is verifiable and thus can be specified in the contract. An 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:

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

The objective function represents the payoff of the inventor. The first term represents the inventor's dividends from the expected cash flows of the foreign production facility. The second term represents the gross return from investing his wealth W plus the date-0 transfer P in the Home market. The last term represents the monitoring costs.

The first constraint is a financing constraint. Since the local entrepreneur has no wealth, his ability to invest at date 1 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 foreign 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.[15] The final inequality is a non-negativity constraint on the share of equity held by the inventor.[16]

In the program above, 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.

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

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

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

the equilibrium equity share of the inventor satisfies

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

and thus the overall payoff of the inventor is *not* contingent on the outcome of the project. The intuition for this result is that with verifiable monitoring, equity shares are not an optimal mechanism for transferring utility from the entrepreneur to the inventor. It may appear that a positive ϕ_I is attractive because it reduces the required lump-sum price for the technology P and thus encourages investment. However, inspection of constraint (iii) reveals that a larger ϕ_I decreases 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 date-0 lump-sum payment has no effect on the scale of the project. In addition, it is clear from the objective function that the inventor strictly prefers a date-0 lump-sum transfer since he can use these funds to invest domestically and obtain a gross rate of return $\beta > 1$ on them. Hence, $\tilde{\phi}_I = 0$ is optimal.

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

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

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 investor protection (low γ) or when the inventor has a relatively high shadow value of cash (high β). 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):

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

Making use of equation (3) and the concavity of $R(x)$, one can show (see Appendix) that $\tilde{x}$ is necessarily increasing in γ, that is, output and cash flows are higher in host countries with better investor protections. 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 cash flows are strictly increasing in β, the shadow value of cash of the inventor. Intuitively, the larger is β, 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 $\tilde{x}$:

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

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

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 $R(0) = 0$.

In sum, 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, an 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 cash flows are increasing in investor protection in Foreign (γ) and in the inventor's shadow value of cash (β).

4. Monitoring is decreasing in γ and increasing in β.

Proof. See Appendix. ■

So far we have ignored the possibility that the inventor does not induce the entrepreneur to behave. In the Appendix, we show that if the entrepreneur misbehaves, the inventor 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 then straightforward to show that as long as $\tilde{x} > \tilde{x}^L$, the contract described in Proposition 1 is the optimal contract (see Appendix). Furthermore, given that when $\gamma \to 1$, $R'(\tilde{x}) \to 1/p_H < 1/p_L = R'\left(\tilde{x}^L\right)$, good behavior is necessarily induced whenever γ 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. Specifically, we consider the case in which, at date 1, the inventor privately sets the 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 this 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 does 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 at date 1. Hence, given the contract in Proposition 1, the inventor would set $\breve{C} = 0$, which would imply that the entrepreneur's private benefit from misbehaving is $\lim_{C \to 0} B(C) = (1-\gamma)\bar{\delta}$, and for large enough $\bar{\delta}$, his incentive compatibility is violated. In sum, as long as the inventor's payoff is not contingent on the return of the investment, the inventor will *not* exert a positive monitoring effort, and, for large enough $\bar{\delta}$, the entrepreneur misbehaves.

We next show that the inventor may improve upon this outcome by modifying the previous contract in a way that induces good behavior on the part of the entrepreneur. This requires the inventor's equity stake to be positive. It is still the case, however, that the inventor has an incentive to set the *minimum* monitoring level $\check{C}$ such that the entrepreneur's incentive compatibility constraint is satisfied. This implies that this monitoring cost is implicitly given by:

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

In order for this positive monitoring effort to be credible, the initial contract needs to satisfy the following incentive compatibility constraint *for the inventor:*

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

This condition corresponds to the intuition that the inventor's payoff should be higher when exerting the positive monitoring level $\check{C}$ than when not doing so.[17]

It follows from the above discussion that an 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 program:

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

This program is identical to (P1) except for the inclusion of the new incentive compatibility constraint (v') for the inventor.[18] 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 solution to (P2) entails the inventor taking a positive equity stake in the project undertaken by the foreign entrepreneur. In particular,

[17] Our derivation of this IC constraint assumes that if the inventor deviates from $\check{C}$, it does so by setting $C = 0$. This is without loss of generality because any other deviation $C > 0$ is dominated.

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

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 is underprovided. Next, working with the first-order conditions of program (P2), the level of output is implicitly given by:

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

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 $R'(\hat{x}) = 1/p_H$.

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

$$\hat{\phi}_E = 1 - \frac{(1-\gamma)\delta\left(\hat{C}\right)}{p_H - p_L} - \frac{\hat{C}}{p_H - p_L} \tag{12}$$

$$\hat{E} = p_H \hat{\phi}_E R(\hat{x}). \tag{13}$$

Straightforward manipulation delivers an optimal lump-sum date-0 transfer equal to:

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

Comparing this initial lump-sum transfer with the result of verifiable monitoring, we note that, provided that $\alpha(x) \equiv xR'(x)/R(x)$ 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, $\alpha(x)$ is in fact 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 the initial transfer payment is also not necessarily positive in this case. In particular, given the concavity of $R\,(x)$, if the optimal level of $\hat{x}$ is low enough, $R\,(\hat{x})\,/\hat{x}$ will be large, and $\hat{P}$ will be negative.

To summarize, introducing the nonverifiability of monitoring transforms a transaction that has the properties of a market transaction – the payment of a flat fee for the use of a technology– into something that has the properties of foreign direct investment. When monitoring is nonverifiable, it is optimal for the inventor to take an equity stake in the project and instead of charging a positive price for the use of the technology, the inventor may now decide instead to cofinance the foreign operations by setting a negative $\hat{P}$ at date 0. 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, an 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 moving to an analysis of the comparative statics, it is important to consider 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 is never optimal provided that $\hat{x} > \tilde{x}^L$, where $\tilde{x}^L$ is 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 is optimal whenever γ is sufficiently high.

2.4 Comparative Statics: Firm-Level Empirical Predictions

In order to guide the empirical analysis, we outline the predictions that the model generates concerning patterns of multinational firm activity and financing flows. This subsection highlights the effects of investor protection γ in Foreign on: (i) the scale of activity; (ii) the extent of inventor ownership; and (iii) the share of capital provided by the inventor. We also describe the effects of the shadow value of cash β on each of these. Because our estimation employs parent-firm fixed effects, we do not test these predictions about β.

As is clear from equations (9), (11) and (14), in order to understand the effects of γ and β 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 convexity of the function $\delta(\cdot)$ produces the following result:

Lemma 1 The amount of monitoring $\hat{C}$ is decreasing in both investor protection γ in Foreign and in the inventor's shadow value of cash β.

Proof. See Appendix. ■

The effect of investor protection on monitoring is similar to the effect described in the case of verifiable monitoring. 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 γ). Since the marginal cost of monitoring is independent of γ, in equilibrium C and γ are negatively correlated.

The effect of the shadow value of cash β on monitoring is quite distinct from the case with verifiable monitoring, where monitoring is increasing in β. The intuition for this divergence is that the incentive compatibility constraint of the inventor becomes tighter as the amount of monitoring in equilibrium increases. In particular, a higher level of monitoring requires a larger equity share ϕ_I. This is costly because for $\beta > 1$, the inventor would like to receive a larger share of the the foreign entrepreneur's payments upfront. The larger is β, the higher is the *shadow* cost of monitoring working through the incentive compatibility constraint, and the lower is the optimal amount of monitoring.

Our theory has implications for the share of equity held by the inventor that relate closely to the implications for monitoring. From equation (9), it is obvious that the share ϕ_I is proportional to the level of monitoring and thus is affected by the parameters γ and β in the same way as is monitoring. This reflects that equity shares emerge in our model as incentives for 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 investor protection γ in Foreign and in the inventor's shadow value of cash β.

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 investor protection $\gamma^* \in [0, 1]$ over which the optimal contract entails licensing and under which the optimal contract entails FDI.

With these results at hand, differentiation of equation (11), which implicitly defines the equilibrium level of $\hat{x}$ and $R(\hat{x})$, yields the conclusion that:

Proposition 4 Output and cash flows in Foreign are increasing in investor protection γ in Foreign and decreasing in the inventor's shadow value of cash β.
Proof. See Appendix. ■

The intuition for the effect of investor protection is straightforward. Despite the fact that the inventor's monitoring reduces financial frictions, 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 weaker investor protections, the perceived marginal cost of investment is higher, thus reducing equilibrium levels of investment.

Finally, our model also generates predictions for the sources of financing of the foreign production facility. To see this, focus on the case in which the date-0 payment $\hat{P}$ is actually negative and can be interpreted as the inventor cofinancing Foreign activity. 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

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

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

Proposition 5 Provided that $\alpha(\hat{x})$ does not increase in $\hat{x}$ too quickly, the share of inventor financing in total financing $(\hat{F}/\hat{x})$ is decreasing in investor protection γ.
Proof. Proof in text. ■

The intuition behind the result is that monitoring by inventors has a relatively high marginal product in countries with weak financial institutions. To induce the inventor to monitor, the optimal contract specifies a relatively steeper payment schedule, with a relatively higher contribution by the inventor at date 0 (a higher $\hat{F}/\hat{x}$) in anticipation of a higher share of the cash flows generated by the project at date 2 (a higher ϕ_I).

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

In section 4, we present empirical tests of Propositions 3, 4, and 5, and Corollary 1. These tests exploit variation in the location of affiliates of U.S. multinational firms and analyze the effect of investor protections on proxies for $\hat{x}$, $\hat{\phi}_I$, and $\hat{F}/\hat{x}$.[19] We identify the inventor in the model as being a parent firm and control for other parameters of the model, such as the shadow value of cash β, the concavity of $R(x)$, the monitoring function $\delta(C)$ and the probabilities p_H and p_L by using fixed effects for each parent in each year and controlling for a wide range of host-country variables.

2.5 Generalizations

The model above does not explicitly consider the role of either alternative licensing arrangements that split revenue or monitoring by the local lenders. These alternatives would appear to be important qualifications to the results obtained above so it is useful to consider the relevance of such arrangements to the primary results.

With respect to the usefulness of alternative licensing arrangements, assumptions about revenue amounts under project failure are critical as they implicitly define punishment for misbehavior. In our model above, we assumed that when the project fails it delivers a level of revenue equal to zero. Such an assumption greatly enhances tractability but suggests that revenue sharing contracts may provide similar benefits to equity arrangements. More generally, however, revenue-sharing contracts are not optimal when the project delivers a *positive* level of revenue in case of failure. In fact, a simple contract in which external investors are issued secured (or risk-free) debt and the inventor and entrepreneur take equity stakes is optimal.[20] To see the intuition for this, consider the

[19] Although we have developed our model in a two-country setup, we show in the Appendix that Propositions 3, 4, and 5 continue to apply in a multi-country version of the model in which the statements not only apply to changes in the parameter γ, but also to cross-sectional variation in investor protections.

[20] A contract in which entrepreneur issues debt to external investors appears to have empirical validity because most capital provided to affiliates from local sources takes the form of debt.

same setup as in section 2.1 but now assume that, when the project does not perform, it yields a level of revenue equal to $\underline{R}(x) \in (0, R(x))$. As is standard in moral hazard problems with risk-neutral agents, the optimal contract calls for the agents undertaking nonobservable actions (e.g., effort decisions) to be maximally punished (subject to the limited liability constraint) whenever a failure of the project is observed. In our particular setup, this would imply that the optimal contract yields both the inventor and the entrepreneur a payoff of 0 whenever a project failure is observed. The entire revenue stream $\underline{R}(x)$ should accrue to external investors. A straightforward way to implement such a contract is for the entrepreneur to issue an amount of secure debt equal to $\underline{R}(x)$ to external investors and for the inventor and entrepreneur to be equity holders. Once the debt is paid, the inventor and entrepreneur receive a share of 0 in case of project failure and a share of the amount $R(x) - \underline{R}(x)$ in case of project success. The determination of their optimal shares is analogous to that in section 2.1 with $R(x) - \underline{R}(x)$ replacing $R(x)$ (details available upon request). In this more general setting, it is not possible to implement this optimal allocation of payoffs across agents through simple revenue-sharing arrangements. As such, the model can explain why equity arrangements tend to dominate both *fixed-fee and revenue-sharing* arrangements in financially underdeveloped countries. The intuition is that such contracts entail an inefficiently low punishment to the inventor when the project does not perform well.

Local external investors (e.g., banks) may also be able to provide some useful monitoring, the productivity of which may also be higher in countries with worse investor protections. In the Appendix we develop an extension of the model which incorporates monitoring by external investors that, as with the monitoring by the inventor, is subject to declining marginal benefits. Although the optimal contract is now more complicated, we show that the incentive compatibility constraint for the inventor will continue to bind in equilibrium, implying that the inventor's equity stake moves proportionally with its level of monitoring. Furthermore, provided that the level of investor protection γ is sufficiently high, the analysis remains qualitatively unaltered by the introduction of local monitoring. The reason for this is that for low values of γ, the optimal contract already allocates equity stakes ϕ_E to external investors that are large enough to induce them to monitor the entrepreneur.[21] As a result, although certain details of the optimal contract change with the possibility of local monitoring, the comparative static results derived in

[21]When the level of investor protection is below a certain threshold, then the incentive compatibility for external investors becomes binding, in which case the analysis becomes more complicated. Without imposing particular functional forms on the monitoring functions, it becomes impossible to derive sharp comparative static results (see Appendix).

section 2.4 continue to hold in this more general model.

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.[22] 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. In non-benchmark years, exemption levels were higher and less information was collected.[23] Accordingly, the analysis is restricted to benchmark years except when the annual frequency of the data is critical – in the analysis of scale in section 4.3 that uses the liberalizations of ownership restrictions.

In order to analyze arm's length licensing activity, measures of royalty payments and licensing fees received by U.S. MNC parents from unaffiliated foreign persons are drawn from the results of BEA's annual BE-93 survey. Because these data have been collected 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

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

[23] 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. 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.

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.[24] Proposition 3 considers the determinants of the share of equity held by the inventor, and this variable, ϕ_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 sales is used for this purpose.

Table I also provides descriptive statistics for a number of other variables. Two measures of investor protections and capital market development are used in the analysis below. As the model emphasizes the decisions of local lenders, the first measure is creditor rights. This measure is drawn from Djankov, McLiesh, and Shleifer (2007), 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 of the ability to access local lenders is the annual ratio of private credit provided by deposit money banks and other financial institutions to GDP, and it is drawn from Beck, Demirguc-Kunt, and Levine (1999).[25]

Since credit market development may be correlated with other measures of economic

[24]In the model, we have interpreted all sources of financing as equity financing, but as explained in footnote 14, our setup is not rich enough to distinguish equity financing from debt financing. Hence, our empirical tests of Proposition 5 include both.

[25]It is possible to employ a measure of shareholder rights to measure investor protections. Creditor rights and private credit are used to measure investor protections for several reasons. First, shareholder rights are only available for a single year near the end of our sample. Second, in our data, there is very little local ownership of affiliate equity, but affiliates do make extensive use of debt borrowed from local sources. As such, using creditor rights and private credit allows us to capitalize on some time series variation in investor protections and more closely corresponds empirically to the financing choices of affiliates.

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 either of these measures is below three and zero otherwise. Workforce schooling measures the average schooling years in the population over 25 years old, and this variable is provided in Barro and Lee (2000). Data on the log of GDP and the log of GDP per capita, measures of a country's size and overall level of development, come 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.[26] 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 a 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 β, the concavity of $R(x)$, the monitoring function $\delta(C)$ and the probabilities p_H and p_L. The inclusion of these fixed effects imply that the effects of investor protections are identified off of within firm variation in the characteristics of countries in which the firm is active.

While such an empirical setting does offer a number of advantages, it is worth noting two shortcomings. First, the sample only includes multinational firms; firms that only deploy technology abroad through licensing are not in our data. If there are a large number of these firms that are active in countries with either weak or strong investor protections, our results would be biased and our approach of identifying effects off of within firm variation would be misleading because of selection bias.[27] Second, the model does not consider cases in which a firm neither invests nor licenses technology in a particular location. As a consequence, we do not consider these cases empirically although there

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

[27] Aggregate 1994 BEA estimates indicate that U.S. multinational parents received 89.8% of royalty payments and licensing fees received by U.S. firms, so this concern is unlikely to create significant bias.

could be valuable information in them.

4 Empirical Results

The predictions on the 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. 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

The tests presented in Table II examine the prediction that inventors need not take large ownership stakes in foreign firms exploiting their technology if they operate in countries with high levels of investor protection. 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 receives 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.[28]

Several controls are employed in these regressions in order to isolate the effect of the quality of capital markets on patterns of activity. All specifications presented in the table include a measure of the existence of foreign ownership restrictions. Measures of credit market development may simply reflect other factors related to economic development so specifications include workforce schooling and the log of GDP per capita. Larger markets may be more likely to attract both foreign investment and licensing activity so the log of GDP is used to control for market size. 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

[28]Approximately 15% of the sample in Table II is comprised of observations in which the parent receives a royalty from an unaffiliated foreign person. In 39% of these cases, the parent has an affiliate in the country from which it receives the royalty from an unaffiliated foreign person. In 1999, aggregate royalties paid by unaffiliated foreign persons to U.S. multinational parents exceed $9.7 billion, or about 5% of aggregate affiliate profits.

of unobservable firm characteristics that might otherwise conflate the analysis. Standard errors are heteroskedasticity-consistent and are clustered at the country/year level. The specifications presented in Table II are linear probability models. These are used in order to incorporate parent/year fixed effects and simultaneously to correct standard errors for clustering at the country/year level.[29]

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 result is consistent with the prediction in Corollary 1 of the model. The results also indicate that parents are more likely to engage in arm's length licensing as opposed to just affiliate activity in countries that have a more educated workforce, that are larger, and that have higher corporate tax rates.

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 protections, 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, and it implies that capital market conditions play an economically significant role relative to other host country institutions. The effect of a one standard deviation change in creditor rights is approximately one and a half times as large as the effect of a one standard deviation change in patent protections, which is also positive and significant in explaining the use of arm's length licensing.

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 the ability to monitor local entrepreneurs because of their familiarity with their technology. The relative value of MNC monitoring should be more pronounced for firms that conduct more research and development (R&D) because these firms are more likely to be deploying novel technologies that require the unique monitoring ability of multinational parents. More crudely, multinational firms

[29] Given the limited time dimension of our dataset, our linear specification avoids the incidental parameter problem inherent in the estimation of a large number of fixed effects. 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.

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 it 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 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

The specifications presented in Table III investigate if affiliates located in countries with poorly functioning credit markets are financed more extensively with capital provided by the parent. Since the ability to monitor 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 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 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 to repatriate earnings created by tax considerations. It also includes the log of GDP, the log of GDP per capita, and workforce schooling to control for the size of the host country market and some measures of the level of host country economic development. Fixed effects for each parent in each year control for differences across firms, even those that vary year to year. The negative and significant 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. This result is consistent with the prediction contained in Proposition 5.

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 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 -0.0164 coefficient on creditor rights implies that the share of affiliate assets financed by the affiliate's parent is 0.0327, or 7.9% of its mean value, higher for affiliates in countries in the 25th percentile of creditor rights relative to the 75th percentile of creditor rights. 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 log of GDP suggests that affiliates located in smaller markets are more reliant on their parents for capital. When affiliates borrow, they primarily borrow from external sources, and Desai, Foley and Hines (2004b) shows that affiliates borrow more in high tax jurisdictions. These facts could explain the negative coefficient on the corporate tax rate in explaining the share of assets financed by the parent.[30] 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 in the specification in column 2. None of the unreported coefficients on affiliate characteristics are significant.

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 including creditor rights interacted

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

with the log of parent R&D. 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 many other 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 it is significant in column 4 but only marginally significant in column 5. 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 model also predicts that multinational parents should hold larger ownership stakes in affiliates located in countries with weak investor protections. Table IV presents results of using the share of affiliate equity owned by the parent as the 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 ordinary least squares models that include parent/year fixed effects and that allow standard errors to be clustered at the country/year level.[31] 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 bigger, countries that are less well-developed, and countries with higher corporate tax rates. If equity ownership decisions placed strong emphasis on the protection of technology and ownership substituted for weak patent protections, the coefficient on the Patent Protections variable should be negative and significant. While the estimated coefficient is negative, it is only marginally significant in some specifications.

[31] Wholly-owned affiliate comprise 77.2% of all observations. 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 presented in Tables II, III, and IV are robust to a number of concerns. First, the estimates of coefficients on capital market conditions interacted with the log of parent R&D may reflect the effect of similar interactions with alternative 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 of the three tables, the interactions featuring proxies for credit market development remain significant in all of the tests except for the one in column 3 of Table II. It may also be the case that the share of affiliate assets financed by the parent and parent ownership levels are 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 the specifications presented in Tables III and IV does not affect the results of interest.[32]

4.3 The Scale of Multinational Activity

The model predicts that multinational activity will be greatest in countries with stronger investor protections. Because 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.[33] It is difficult to include a set of controls sufficiently extensive to distinguish between alternative theories.

Given this difficulty, 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 should be larger in host countries with weak investor protections. The intuition for this prediction is that in countries with weak investor protections, ownership restrictions are more likely to bind because ownership is most critical for maximizing the value of the enterprise in these settings. As such, the relaxation of an ownership constraint should have muted effects for affiliates in countries with deep capital markets and more pronounced effects for affiliates in countries with weaker capital

[32] 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.

[33] Appendix Table I presents the results of such an exercise. Although the coefficients on both the creditor rights variables and private credit variables are usually positive in explaining the log of affiliate sales in the specifications presented in columns 1, 2, 4, and 5, as Proposition 3 predicts, none of the coefficients on these variables is significant.

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 FDI ownership restriction dummy described above changes from 1 to 0.[34] The dependent variable in columns 1 and 2 is the 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 II, 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 helps identify the year effects and the coefficients on the income variables, but the results are robust to using a sample drawn only from reforming countries.

The specifications in columns 1 and 2 include controls for log GDP, 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 levels of affiliate activity. The coefficient of interest in column 1 is the coefficient on the interaction of the post-liberalization dummy and a dummy that is equal to one if the country is at or below the median value of the creditor rights index in the year of liberalization. The positive and significant coefficient indicates that affiliates in weak creditor rights countries grow quickly after liberalizations. The coefficient on the post-liberalization dummy on its own indicates that the effect of liberalizations is negligible and statistically insignificant for affiliates in high creditor rights countries. In column 2, these same results are obtained when the measure of private credit is used as the proxy for financial development. 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 because they only measure activity on the intensive margin and fail to capture responses on the extensive margin. For example, entry or exit might accompany liberalizations and might amplify or dampen these results. In order to consider

[34] 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 analysis of liberalizations. The affiliate fixed effects implicitly control for time invariant country characteristics so this is unlike to pose a significant problem.

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 including the creditor rights variable 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 and significant. Taken together, the results suggest that the scale of activity is positively related to the quality of investor protections and capital market development, and these results persist when incorporating the effects of entry and exit.

5 Conclusions

Efforts to understand patterns of multinational firm activity have typically emphasized aspects of technology transfer rather than the constraints imposed by weak investor protections and shallow capital markets. In the prior literature, multinational firms arise because of the risk of a partner expropriating a proprietary technology. In the model presented in this paper, the exploitation of technology is central to understanding multinational firm activity but the critical constraint is the nature of capital market development and investor protections in host countries. Entrepreneurs must raise capital to fund projects, and external investors are aware of the possibility that these entrepreneurs might behave opportunistically. Inventors can alleviate financial frictions because they have privileged knowledge of their technology and can thus play a role in monitoring entrepreneurs. As a result, multinational firm activity and capital flows arise endogenously to ensure that monitoring occurs. External investors demand higher levels of multinational parent firm financial participation 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 about the use of arm's length licensing and about the financial and investment decisions of multinational firms that are validated in firm-level analysis. The use of arm's length licensing to deploy technology is more common in countries with strong investor protections and deep capital markets. Previous findings that FDI flows to developing countries are limited reflect two opposing forces. Weak investor protections and shallow capital markets limit the efficient scale of enterprise but also result in greater parent provision of capital and more parent ownership of affiliate equity. The effects of the institutional setting are more prounced for R&D intensive firms as parental monitoring is particularly valuable for the investments of these firms. By jointly considering operational and financial decisions, the theory and empirics provide an integrated explanation for patterns of MNC activity and FDI flows that have typically been considered separately.

Further consideration of the role of financial frictions on multinational firm activity along several dimensions may prove fruitful. First, the model presented effectively rules out exports to unrelated parties as a means of serving foreign markets. Incorporating the tradeoff between exports and production abroad in a world with financial frictions may yield additional predictions that would help explain the choice between exporting and FDI. Second, exploring the implications of financial frictions for intrafirm trade may help explain how the demands of external funders in weak institutional environments affect the fragmentation of production processes across borders. 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.

A Appendix

A.1 The Shadow Cost of Cash

In the main text, we have treated the shadow value of cash β 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 investor protection.

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 γ^j and a cash flow function $R^j\left(x^j\right)$.[35] 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 cash flows obtained from the sale of the differentiated good at Home can be expressed as a strictly increasing and concave function of the quantity produced, $R^H(q)$, satisfying the same properties as the cash flow 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 cash flows, where γ^H is an index of investor protection at Home.

The inventor sells domestic 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.[36] We consider an 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 main text. 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 ϕ_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, an 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:

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

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

[36]For simplicity, we assume that the inventor cannot pleadge foreign cash flow rights to its external investors.

It is straightforward to show that provided that γ^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

$$\Pi_I = \sum\nolimits_{j \neq H} \left(\phi_I^j p_H - C^j \right) R^j \left(x^j \right) + \widehat{\beta} \left(W + \sum\nolimits_{j \neq H} \hat{P}^j \right) \tag{15}$$

where

$$\hat{\beta} = \frac{\frac{1-\gamma^H}{(p_H - p_L)}}{\frac{1-\gamma^H}{p_H - p_L} - \left(1 - \frac{\hat{x}^H}{p_H R^H (\hat{x}^H)} \right)} > 1. \tag{16}$$

Notice that the resulting profit function (15) is closely related to that considered in program (P3) in section 2.3, where $\hat{\beta}$ now replaces β. There are however two important differences between the two profit functions.

First, the formulation in (15) considers the case in which the inventor obtains cash flow 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 dividends. 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.[37] Hence, Propositions 3, 4, and 5 continue to apply and their statements not only apply to changes in the parameter γ, but also to cross-sectional (cross-country) variation in investor protection. In this sense, the tests performed in section 4 are well defined.

The second important difference between the profit function in (15) 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 date-0 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 investor protections $\boldsymbol{\gamma} \equiv \left(\gamma^1, ..., \gamma^{J-1}, \gamma^H \right)$. Notice, however, that for large enough J, the effect of a particular investor protection level γ^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.

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.

[37] 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 multiple of his pleadgeable income (wealth plus date-0 payments). 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.

A.2 Proof of Proposition 1

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

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

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

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

Straightforward manipulation of these conditions delivers

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

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

Next plugging the value of λ_4 into (A2) delivers

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

while plugging the values of λ_1, λ_2, and λ_3 into (A1) delivers

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

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

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

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

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

A.3 Optimal Contract Implementing Bad Behavior

It is clear that in this case the inventor has no incentive to exert monitoring effort. It is also immediate that even when the entrepreneur does not obtain any share of the cash flows, her participation constraint will be satisfied, and thus we have that $\tilde{\phi}_I^L+\tilde{\phi}_E^L=1$. The program can then be written as

$$\begin{aligned} \max_{P,\phi_I,x,E} \quad & \Pi_I=\phi_I p_L R(x)+(W+P)\beta \\ s.t. \quad & x\leq E-P && \text{(i)} \\ & p_L(1-\phi_I)R(x)\geq E && \text{(ii)} \\ & \phi_I\geq 0 && \text{(iii)} \end{aligned} \qquad (\text{P1}_L)$$

The corresponding Lagrangian is

$$\mathcal{L}=\phi_I p_L R(x)+(W+P)\beta+\lambda_1(E-P-x)+\lambda_2(p_L(1-\phi_I)R(x)-E)+\lambda_3\phi_I.$$

The first-order conditions are

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

Note that

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

Hence, all constraints bind, which implies $\tilde{\phi}_I^L = 0$. Plugging the values of the multipliers, as well as $\tilde{C}^L = \tilde{\phi}_I^L = 0$ in (A3) 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 Π_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 $R''\left(x\right) < 0$, we can conclude that good behavior will be implemented whenever

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

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

A.4 Proof of Proposition 2

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

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

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

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

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

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

Moreover, constraint (v') now implies that $\hat{\phi}_I = \hat{C}/(p_H - p_L)$. Plugging the values of the multipliers 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 (A1) – which applies here as well – yields

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

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 γ, 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 γ and decreasing in β, while the left-hand is decreasing in $\hat{C}$ (given the convexity of $\delta(\cdot)$).

A.6 Proof of Proposition 4

Let

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

Using equation (10), we can establish that:

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

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

A.7 Introducing Local Monitoring

In this Appendix, we consider the case in which (local) external investors can also serve a monitoring role. In particular, if external investors exert an unverifiable effort cost $MR(x)$, the private benefit is now:

$$B(C, M; \gamma) = (1-\gamma)\left(\delta(C) + \mu(M)\right).$$

with $\mu(\cdot)$ satisfying similar the same properties as $\delta(\cdot)$ above, namely, $\mu'(M) < 0$, $\mu''(M) > 0$, $\mu(0) = \bar{\mu}$, $\lim_{M\to\infty}\mu(M) = 0$, $\lim_{M\to 0}\mu'(M) = -\infty$, and $\lim_{M\to\infty}\mu'(M) = 0$. Because local monitoring is not verifiable, the program that determines the optimal contract will need to include a new incentive compatibility constraint for external investors. In particular, an optimal contract that induces the entrepreneur to behave is now given by the tuple $\left\{\hat{P}, \hat{\phi}_I, \hat{x}, \hat{\phi}_E, \hat{E}, \hat{C}, \hat{M}\right\}$ that solves the following program:

$$\begin{aligned}
\max_{P,\phi_I,x,\phi_E,E,C,M} \quad & \Pi_I = \phi_I p_H R(x) + (W+P)\,\beta - CR(x) \\
s.t. \quad & x \le E - P && \text{(i)} \\
& p_H \phi_E R(x) - MR(x) \ge E && \text{(ii)} \\
& p_H\left(1 - \phi_E - \phi_I\right) R(x) \ge 0 && \text{(iii)} \\
& (p_H - p_L)\left(1 - \phi_E - \phi_I\right) \ge (1-\gamma)\left(\delta(C) + \mu(M)\right) && \text{(iv)} \\
& \phi_I \ge C/(p_H - p_L) && \text{(v)} \\
& \phi_E \ge M/(p_H - p_L) && \text{(vi)}
\end{aligned}$$

Manipulating the first-order conditions of the program, we obtain that:

$$\lambda_5 = (\beta - 1)\, p_H R'(\hat{x}) + \lambda_6,$$

which immediately implies that constraint (v) continues to bind even in the case with local monitoring. Consequently, inventor (or parent firm) equity shares continues to move proportionately with the amount of monitoring undertaken by the inventor.

Furthermore, provided that the level of investor protection is sufficiently high, the analysis in the main text goes through essentially unaltered. The reason for this is that in such a case constraint (vi) is not binding ($\lambda_6 = 0$) and we obtain that $\hat{C}$ and $\hat{M}$ being determined by:

$$-\delta'\left(\hat{C}\right) = \frac{\beta p_H - p_L}{(1-\gamma)\,\beta p_H}, \tag{A5}$$

which is identical to (10), and

$$-\mu'\left(\hat{M}\right) = \frac{(p_H - p_L)}{(1-\gamma)\,p_H}. \tag{A6}$$

From the convexity of the monitoring functions, we thus obtain that both $\hat{C}$ and $\hat{M}$ are decreasing functions of γ. Furthermore, manipulating the first-order conditions it can also be easily shown that (i) the investment levels (and thus) sale revenue continue to be increasing in γ, and (ii) the ratio $\hat{F}/\widehat{x}$ is still increasing in γ provided that $\alpha\left(\hat{x}\right)$ does not increase in $\hat{x}$ too quickly, just as in the main text (details available upon request).

Note that equations (A5) and (A6) also imply that $-\delta'(\hat{C}) > -\mu'(\hat{M})$, and if the functions $\delta\left(\cdot\right)$ and $\mu\left(\cdot\right)$ are sufficiently similar we will have $\hat{M} > \hat{C}$. Intuitively, a disproportionate amount of local monitoring may be optimal because it is "cheaper", since external investors have a lower shadow cost of getting remunerated through equity shares. Still, as long as the equilibrium level of $\hat{M}$ is sufficiently low (or γ is sufficiently high), the above analysis suggests that inventor equity shares comoves with investor protection in the same manner than in our simpler model with only inventor monitoring.

For low enough values of γ, however, the above optimal contract leads to $\hat{M} > (p_H - p_L)\,\widehat{\phi}_E$, which violates constraint (vi). In such a case, we have $\lambda_6 > 0$. Manipulating the first-order conditions, one can show that $\hat{C}$ and $\hat{M}$ are implicitly defined by the system:

$$\begin{aligned} \frac{1+(1-\gamma)\,\mu'\left(\hat{M}\right)}{1+(1-\gamma)\,\delta'\left(\hat{C}\right)} &= \beta \\ p_H - p_L - \hat{C} - \hat{M} &= (1-\gamma)\left(\delta\left(\hat{C}\right) + \mu\left(\hat{M}\right)\right). \end{aligned}$$

Unfortunately, without imposing particular functional forms for the functions $\delta\left(\cdot\right)$ and $\mu\left(\cdot\right)$, it becomes impossible to characterize how $\hat{C}$ (and thus $\hat{\phi}_I$) vary with γ.

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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
Workforce Schooling	8.1385	8.5330	2.1739
Log of GDP	26.8002	26.9816	1.4252
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 receives 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 (2007); 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. Workforce Schooling is the average schooling years in the population over 25 years old provided in Barro and Lee (2000). 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 strength of property rights drawn from the 1996 *Index of Economic Freedom*. Rule of Law is an assessment of the strength 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 enterprise, 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	0.0097	0.0148	0.0023			
	(0.0026)	(0.0029)	(0.0039)			
Creditor Rights*Log of Parent R&D			0.0016			
			(0.0005)			
Private Credit				0.0321	0.0342	-0.0606
				(0.0148)	(0.0168)	(0.0133)
Private Credit*Log of Parent R&D						0.0117
						(0.0020)
FDI Ownership Restrictions	0.0121	0.0080	0.0079	0.0007	0.0028	0.0020
	(0.0100)	(0.0097)	(0.0094)	(0.0105)	(0.0099)	(0.0097)
Workforce Schooling	0.0078	0.0138	0.0134	0.0075	0.0110	0.0103
	(0.0022)	(0.0020)	(0.0020)	(0.0029)	(0.0024)	(0.0025)
Log of GDP	0.0274	0.0274	0.0268	0.0243	0.0249	0.0242
	(0.0037)	(0.0039)	(0.0038)	(0.0036)	(0.0040)	(0.0039)
Log of GDP per Capita	-0.0167	-0.0140	-0.0144	-0.0203	-0.0205	-0.0223
	(0.0045)	(0.0068)	(0.0066)	(0.0053)	(0.0077)	(0.0077)
Corporate Tax Rate	0.1452	0.1830	0.1777	0.1614	0.1602	0.1588
	(0.0492)	(0.0470)	(0.0453)	(0.0490)	(0.0445)	(0.0438)
Patent Protections		0.0142	0.0127		0.0176	0.0158
		(0.0054)	(0.0052)		(0.0065)	(0.0066)
Property Rights		0.0253	0.0254		0.0101	0.0086
		(0.0069)	(0.0067)		(0.0065)	(0.0066)
Rule of Law		-0.0023	-0.0022		-0.0037	-0.0040
		(0.0045)	(0.0043)		(0.0049)	(0.0046)
Risk of Expropriation		-0.0087	-0.0081		-0.0092	-0.0080
		(0.0051)	(0.0049)		(0.0057)	(0.0055)
Constant	-0.5747	-0.6965	-0.6685	-0.4600	-0.4967	-0.4438
	(0.1000)	(0.1062)	(0.1053)	(0.0951)	(0.0998)	(0.0974)
Parent/Year Fixed Effects?	Y	Y	Y	Y	Y	Y
No. of Obs.	33,004	31,906	30,954	30,678	30,079	29,238
R-Squared	0.5993	0.6006	0.6062	0.5995	0.6024	0.6105

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 receives 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 (2007); 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. Workforce Schooling is the average schooling years in the population over 25 years old provided in Barro and Lee (2000). 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 strength of property rights drawn from the 1996 *Index of Economic Freedom* . Rule of Law is an assessment of the strength 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 enterprise, 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	-0.0166	-0.0164	-0.0079			
	(0.0054)	(0.0051)	(0.0055)			
Creditor Rights*Log of Parent R&D			-0.0010			
			(0.0003)			
Private Credit				-0.0632	-0.0384	-0.0084
				(0.0195)	(0.0215)	(0.0220)
Private Credit*Log of Parent R&D						-0.0031
						(0.0012)
FDI Ownership Restrictions	-0.0406	-0.0426	-0.0426	-0.0323	-0.0358	-0.0358
	(0.0146)	(0.0154)	(0.0155)	(0.0171)	(0.0160)	(0.0162)
Workforce Schooling	0.0200	0.0110	0.0115	0.0199	0.0151	0.0157
	(0.0057)	(0.0042)	(0.0043)	(0.0060)	(0.0048)	(0.0049)
Log of GDP	-0.0224	-0.0179	-0.0180	-0.0157	-0.0148	-0.0148
	(0.0055)	(0.0070)	(0.0071)	(0.0062)	(0.0084)	(0.0085)
Log of GDP per Capita	-0.0327	-0.0066	-0.0073	-0.0285	0.0027	0.0030
	(0.0112)	(0.0153)	(0.0154)	(0.0136)	(0.0167)	(0.0169)
Corporate Tax Rate	-0.1288	-0.2135	-0.2061	-0.1135	-0.1803	-0.1732
	(0.0777)	(0.0763)	(0.0764)	(0.0743)	(0.0742)	(0.0745)
Patent Protections		-0.0392	-0.0388		-0.0434	-0.0436
		(0.0113)	(0.0114)		(0.0119)	(0.0120)
Property Rights		-0.0111	-0.0110		0.0097	0.0113
		(0.0113)	(0.0115)		(0.0103)	(0.0106)
Rule of Law		0.0058	0.0062		0.0065	0.0068
		(0.0078)	(0.0079)		(0.0080)	(0.0080)
Risk of Expropriation		0.0010	0.0007		0.0009	0.0003
		(0.0090)	(0.0091)		(0.0092)	(0.0094)
Constant	1.2571	1.0376	1.0386	1.0444	0.7810	0.7653
	(0.1083)	(0.1511)	(0.1527)	(0.1479)	(0.1701)	(0.1735)
Parent/Year Fixed Effects?	Y	Y	Y	Y	Y	Y
Affiliate Controls?	N	Y	Y	N	Y	Y
No. of Obs.	51,060	41,232	40,297	48,183	38,911	38,016
R-Squared	0.3013	0.3105	0.3071	0.3076	0.3167	0.3134

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 (2007); 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. Workforce Schooling is the average schooling years in the population over 25 years old provided in Barro and Lee (2000). 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 strength of property rights drawn from the 1996 *Index of Economic Freedom*. Rule of Law is an assessment of the strength 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 enterprise, 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	-0.0091	-0.0101	-0.0010			
	(0.0028)	(0.0035)	(0.0031)			
Creditor Rights*Log of Parent R&D			-0.0010			
			(0.0003)			
Private Credit				-0.0506	-0.0481	0.0078
				(0.0135)	(0.0174)	(0.0144)
Private Credit*Log of Parent R&D						-0.0057
						(0.0009)
FDI Ownership Restrictions	-0.0728	-0.0637	-0.0611	-0.0622	-0.0560	-0.0529
	(0.0126)	(0.0133)	(0.0134)	(0.0117)	(0.0122)	(0.0122)
Workforce Schooling	0.0005	-0.0048	-0.0043	0.0007	-0.0030	-0.0026
	(0.0024)	(0.0024)	(0.0025)	(0.0026)	(0.0026)	(0.0026)
Log of GDP	-0.0157	-0.0116	-0.0115	-0.0110	-0.0079	-0.0079
	(0.0037)	(0.0046)	(0.0045)	(0.0035)	(0.0046)	(0.0046)
Log of GDP per Capita	0.0309	0.0358	0.0362	0.0381	0.0402	0.0416
	(0.0064)	(0.0132)	(0.0132)	(0.0078)	(0.0143)	(0.0144)
Corporate Tax Rate	-0.2634	-0.3456	-0.3391	-0.2778	-0.3249	-0.3179
	(0.0638)	(0.0712)	(0.0701)	(0.0584)	(0.0582)	(0.0564)
Patent Protections		-0.0142	-0.0137		-0.0127	-0.0122
		(0.0073)	(0.0072)		(0.0078)	(0.0077)
Property Rights		-0.0054	-0.0043		0.0001	0.0014
		(0.0072)	(0.0075)		(0.0071)	(0.0072)
Rule of Law		0.0005	0.0012		0.0009	0.0017
		(0.0061)	(0.0061)		(0.0061)	(0.0060)
Risk of Expropriation		0.0054	0.0050		0.0069	0.0060
		(0.0068)	(0.0068)		(0.0067)	(0.0067)
Constant	1.1592	1.1096	1.0932	0.9832	0.9352	0.9072
	(0.1006)	(0.1246)	(0.1224)	(0.0947)	(0.1028)	(0.0991)
Parent/Year Fixed Effects?	Y	Y	Y	Y	Y	Y
Affiliate Controls?	N	Y	Y	N	Y	Y
No. of Obs.	51,320	41,436	40,498	48,422	39,096	38,198
R-Squared	0.3974	0.4250	0.4184	0.3998	0.4275	0.4217

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 (2007); 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. Workforce Schooling is the average schooling years in the population over 25 years old provided in Barro and Lee (2000). 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 strength of property rights drawn from the 1996 *Index of Economic Freedom*. Rule of Law is an assessment of the strength 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 enterprise, 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	0.0016	-0.0073	-0.0633	-0.1049
	(0.0684)	(0.0712)	(0.1230)	(0.1262)
Post Liberalization Dummy * Low Creditor Rights Dummy	0.3011		0.3682	
	(0.0827)		(0.1552)	
Post Liberalization Dummy * Low Private Credit Dummy		0.2947		0.3812
		(0.0899)		(0.1769)
Log of GDP	0.3886	0.3409	-0.0786	-0.1351
	(0.3888)	(0.3960)	(0.7833)	(0.7040)
Log of GDP per Capita	1.3675	1.4488	2.6620	2.8376
	(0.3720)	(0.3867)	(0.5425)	(0.6192)
Constant	-13.5818	-13.0613	-4.7847	-4.9033
	(9.2414)	(9.2484)	(22.1876)	(20.0397)
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 Liberalization 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 liberalizing 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 liberalizing 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	0.0057	0.0163	0.0332			
	(0.0235)	(0.0225)	(0.0270)			
Creditor Rights*Log of Parent R&D			-0.0020			
			(0.0015)			
Private Credit				-0.1040	0.0690	0.0711
				(0.0804)	(0.0837)	(0.1008)
Private Credit*Log of Parent R&D						0.0003
						(0.0056)
FDI Ownership Restrictions	-0.2030	-0.2874	-0.2837	-0.1850	-0.3054	-0.3039
	(0.0562)	(0.0609)	(0.0612)	(0.0640)	(0.0707)	(0.0708)
Workforce Schooling	0.0270	0.0500	0.0503	0.0305	0.0472	0.0475
	(0.0211)	(0.0173)	(0.0172)	(0.0193)	(0.0185)	(0.0185)
Log of GDP	0.2041	0.3180	0.3198	0.2168	0.3188	0.3207
	(0.0338)	(0.0231)	(0.0233)	(0.0303)	(0.0241)	(0.0242)
Log of GDP per Capita	0.0764	0.0161	0.0081	0.0937	-0.0010	-0.0082
	(0.0509)	(0.0544)	(0.0533)	(0.0579)	(0.0553)	(0.0542)
Corporate Tax Rate	0.5700	-0.5748	-0.5627	0.5923	-0.6251	-0.6222
	(0.4293)	(0.3083)	(0.3117)	(0.4313)	(0.3255)	(0.3283)
Patent Protections		-0.1100	-0.1034		-0.1077	-0.1030
		(0.0430)	(0.0430)		(0.0434)	(0.0434)
Property Rights		0.0170	0.0142		0.0078	0.0081
		(0.0517)	(0.0526)		(0.0492)	(0.0504)
Rule of Law		0.0224	0.0268		0.0206	0.0250
		(0.0322)	(0.0320)		(0.0333)	(0.0332)
Risk of Expropriation		0.0221	0.0203		0.0249	0.0228
		(0.0349)	(0.0348)		(0.0361)	(0.0359)
Constant	3.3139	1.0997	1.0512	2.8439	1.2578	1.2018
	(0.5632)	(0.6058)	(0.6151)	(0.5503)	(0.5850)	(0.5885)
Parent/Year Fixed Effects?	Y	Y	Y	Y	Y	Y
No. of Obs.	51,320	41,465	40,527	48,422	39,123	38,225
R-Squared	0.3349	0.3454	0.3400	0.3365	0.3489	0.3436

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 (2007); 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. Workforce Schooling is the average schooling years in the population over 25 years old provided in Barro and Lee (2000). 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 strength of property rights drawn from the 1996 *Index of Economic Freedom* . Rule of Law is an assessment of the strength 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 enterprise, 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.