

# Multinational Firms, FDI Flows and Imperfect Capital Markets

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# Motivation (1)

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Great interest in contracting environments influence on financing and investment patterns

Exclusive theoretical and empirical emphasis on firms that are presumed to be entirely local – raising money locally, operating locally.

Contradicts reality of high levels of global integration - eg. shares of profits/investment from abroad for developed country firms and reliance of institutionally fragile economies on FDI

# Motivation (2)

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Two distinct literatures on MNCs and FDI that emphasize either *capital flows* or *patterns of firm activity*

- Macro literature on financial flows asks why more capital does not flow to emerging markets
  - IO and International Trade literature on MNC activity emphasizes the role of proprietary assets to explain where firms base activity
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- To our knowledge, there is no integrated explanation of how MNC operational and financial decisions are linked
  - Recent studies suggests that credit market imperfections and other institutional features play a role in shaping capital flows

# Question and Approach

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How are FDI flows and MNC firm activity interrelated? Particularly, in a world with frictions in financial contracting and variations in capital market development?

- A model of how firms jointly make operating, financial & investment decisions in a setting where financial frictions play a central role
  - Follow Holmstrom and Tirole (1998)'s moral hazard approach to modelling financial frictions; monitoring helps alleviate financial frictions.
- Key Idea: Inventors (MNC firms) wanting to deploy technology abroad have comparative advantage in monitoring its use relative to other funders (i.e, external investors)
  - Consistent with managerial literature
    - Dunning (1970) notes that MNCs provide “informal managerial or technical guidance,...the dissemination of valuable knowledge and/or entrepreneurship in the form of research and development, production technology, marketing skills, managerial expertise, and so on...”

# Findings (1)

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The optimal exploitation of the technology in a foreign country will generally be associated with monitoring by the “inventor” (or parent firm)

When is monitoring associated with equity participation?

- Not when monitoring is verifiable - then, inventor provides technology and monitoring without investing and simply receives licensing fees
- When monitoring is nonverifiable, optimal contract stipulates that inventor takes a stake in the project to ensure an incentive to monitor; in addition, the inventor may be required to cofinance the investment (through FDI flows)
- External investors demand equity participation and cofinancing by inventor to induce monitoring

Mechanism generating MNC activity is not risk of expropriation of technology by a local partner but the demands of external investors who want to maximize the value of their investment

# Findings (2)

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Empirical predictions of model receive support in tests using detailed firm-level BEA data that permit inclusion of parent-year f.e.'s

- FDI vs. Licensing: firms are more likely to exploit technologies through licensing in countries with stronger investor protections
- Financing: share of affiliate assets financed by parent is a decreasing function of investor protections –these effects are more pronounced for technology intensive firms
- Ownership: share of affiliate equity owned by the parent is a decreasing function of investor protections – again, these effects are more pronounced for technology intensive firms
- Scale of activity: liberalizations of ownership restrictions have larger effects in countries with poorly developed capital markets

# Agenda

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Literature Review

Describe model and theoretical findings

Intuition behind empirical predictions

Empirical approach and results

Conclusions and Further Directions

# Brief Literature Review (1)

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Large, growing literature on quality of contracting institutions and firm financing and investment decisions – results on market capitalization, ownership structures, and industrial structures

This literature all abstracts entirely from firm activity *across* borders

Some attention to cross-listing decisions and contracting institutions but no notion of cross-border activity by firms...Gertler & Rogoff (1990), Boyd and Smith (1997) and Shleifer and Wolfenzon (2004) take first steps by introducing open economy setting with heterogeneity in contracting institutions



# Brief Literature Review (2)

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Two very distinct literatures on flows and MNC activity

Macroeconomic literature on capital flows

Lucas (1990) Paradox: why capital does not flow to poor countries given large presumed rate of return differentials => human-capital externalities; Reinhart and Rogoff (2004), Alfaro et al (2004) point to credit markets and political risk

IO and international trade literature on patterns of activity– Discuss patterns of MNC activity emphasizing transportation costs, EOS & proprietary assets

Horizontal FDI – Transport costs and tariffs lead to local production

Vertical FDI – Fragmented production worldwide to take advantage of relative advantages

No unification of explanations of flows and activity

# Model: The Inventor

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Home Country

Inventor



Endowed with technology to produce differentiated good and with wealth  $W$

Preferences and technology at Home such that inventor earns gross return  $\beta > 1$  for each unit invested there

Good is prohibitively costly to trade—use horizontal type investment in Foreign

Needs to find local agent (referred to as foreign entrepreneur)

# Model: The Entrepreneur

Foreign Country

Entrepreneur



Endowed with no wealth

Preferences and technology such that cash flows earned from the sale of differentiated goods can be expressed as a strictly increasing and concave function of quantity produced:  $R(x)$

Foreign entrepreneur **privately** chooses to behave or misbehave:

	<u>Behave</u>	<u>Misbehave</u>
Expected Cash Flow	$p_H R(x)$	$p_L R(x)$
Private Benefit	$0$	$BR(x)$

# Model: Private Benefits and Monitoring

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Monitoring reduces the private benefit of the foreign entrepreneur

- Inventor has comparative advantage in monitoring
- When inventor incurs a **private** effort cost  $CR(x)$  in monitoring, the private benefit of the foreign entrepreneur is magnified by a factor  $\delta(C)$  (this function is strictly decreasing and strictly convex)
- Private benefit is also decreasing in the level of financial development in the foreign country, indexed by  $\gamma \in (0, 1)$

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

# Model: The External Investors

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Foreign Country

External investors



There is a continuum of external investors

They are a source of capital for the entrepreneurs who are working with the inventor's technology

Each has access to technology that gives them a gross rate of return equal to 1

# Model: Contracting

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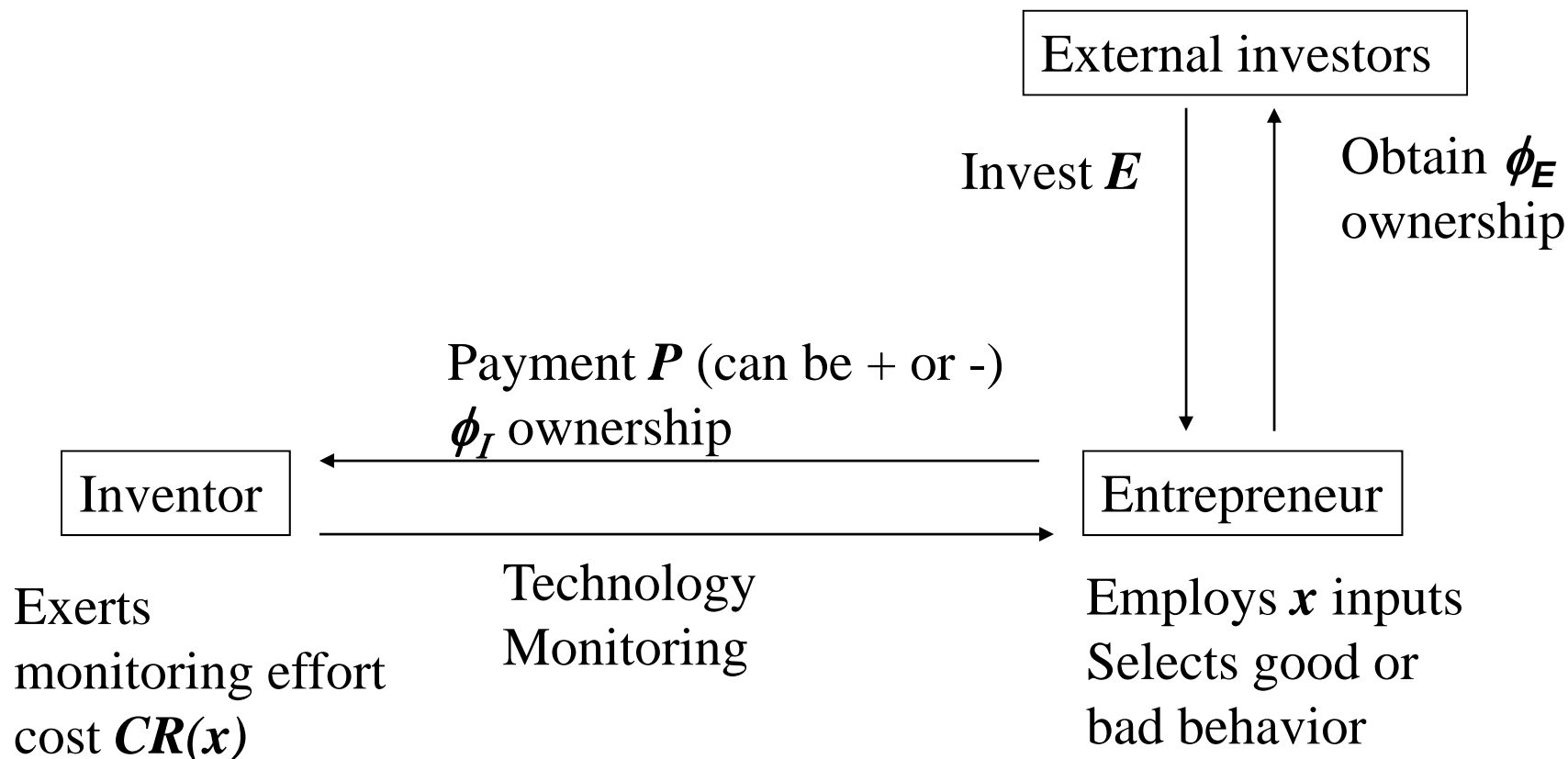
We consider the optimal contract between three set of agents from the point of view of the inventor given that managerial and monitoring efforts of the entrepreneur and inventor are unverifiable

- Parties are risk neutral and are protected by limited liability
- Contract stipulates:
  - An initial lump-sum payment  $P$  from the entrepreneur to the inventor (e.g, a “price” or royalties for the use of the technology);
  - A payment contingent on the return of the investment - this will necessarily take the form of a share  $\phi_I$  of the return of the project;
  - The terms of financial contract between foreign entrepreneur and foreign external investors (amount of funds  $E$  provided by external investors in exchange for a share  $\phi_E$  of the revenue)

# A Simple Picture of the Model

Home Country

Foreign Country



# Program with Verifiable Monitoring

The optimal contract that induces the entrepreneur to behave is given by the tuple  $\{\tilde{P}, \tilde{\phi}_I, \tilde{x}, \tilde{\phi}_E, \tilde{E}, \tilde{C}\}$  that solves the program:

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

Funding constraint, external investor participation constraint, participation constraint of entrepreneur, incentive compatibility constraint for entrepreneur



# Optimal Contract with Verifiable Monitoring

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**Proposition 1 (Verifiable Monitoring)** There exist a unique tuple  $\{\tilde{P}, \tilde{\phi}_I, \tilde{x}, \tilde{\phi}_E, \tilde{E}, \tilde{C}\}$  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 ( $\gamma$ ) and in the inventor's shadow value of cash ( $\beta$ ).
4. Monitoring is decreasing in  $\gamma$  and increasing in  $\beta$ .

# Nonverifiable Monitoring

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Consider the case in which, after signing the contract and cashing  $P$ , the inventor privately sets a level of monitoring  $C$ .

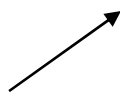
- After  $C$  is chosen, the foreign entrepreneur observes his private benefit and decides whether to behave or misbehave
- Note that with the previous contract,  $\phi_I = 0$ , and the inventor has no incentive to monitor
- A contract that implements positive monitoring effort by the inventor will now need to satisfy

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

# Program with Nonverifiable Monitoring

The optimal contract that induces the entrepreneur to behave is given by the tuple  $\{\tilde{P}, \tilde{\phi}_I, \tilde{x}, \tilde{\phi}_E, \tilde{E}, \tilde{C}\}$ , that solves the program:

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



New incentive compatibility constraint for inventor

# Optimal Contract with Nonverifiable Monitoring

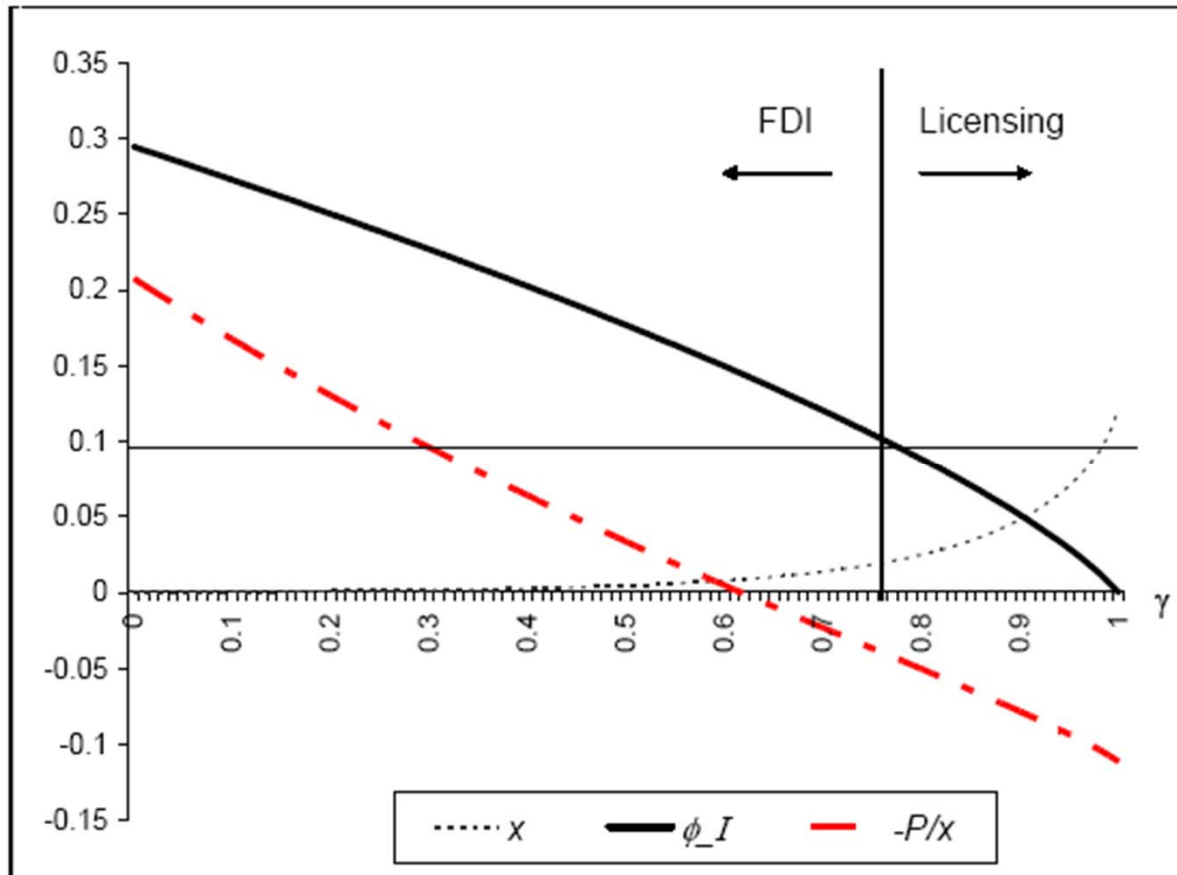
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**Proposition 2 (Noncontractible Monitoring)** There exist a unique tuple  $\{\hat{P}, \hat{\phi}_I, \hat{x}, \hat{\phi}_E, \hat{E}, \hat{C}\}$  that solves program (P2). Furthermore, the optimal contract that induces the entrepreneur to behave is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

1. The inventor takes a positive equity stake in the local entrepreneur's production facility ( $\hat{\phi}_I > 0$ ).
2. Depending on parameter values, the entrepreneur may receive a positive lump-sum transfer ( $\hat{P} > 0$ ) for the use of the technology or it may instead cofinance the project via an initial capital transfer ( $\hat{P} < 0$ ).

# Numerical Example – Figure 2

For a reasonable set of values –  $A = 1$ ,  $\alpha = 0.9$ ,  $\theta = 0.05$ ,  $\beta = 1.05$ ,  $p_H = 0.9$ ,  $p_L = 0.5$ , and  $W = 1$  we see how FDI arises endogenously as a function of credit market conditions



# Firm Level Predictions (1)

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**Lemma 1:** The amount of monitoring  $C$  is decreasing both in financial development  $\gamma$  in Foreign and in inventor's shadow value of cash  $\beta$ .

- Marginal benefit of monitoring is decreasing in  $\gamma$
- Shadow marginal cost of monitoring is increasing in  $\beta$  (because of increased preference for  $P$  over  $\phi_I$ )

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

**Corollary 1:** Licensing for large enough  $\gamma$ .

# Firm Level Predictions (2)

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**Proposition 4:** Output and cash flows in Foreign are increasing in financial development in Foreign and decreasing in the inventor's shadow value of cash .

- Monitoring costs and costs of compensating foreign entrepreneur increase with scale of operation, and hence so does the marginal cost of investing.

**Proposition 5:** Provided that  $a(x)$  does not increase in  $x$  too quickly, the share of inventor (parent) financing in total financing ( $F/x$ ) is decreasing in financial development  $\gamma$ .

- Cofinancing alleviates financial friction of entrepreneur and also helps inventor commit to monitoring.

# Empirical Tests

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- These predictions are tested using data from BEA Benchmark Survey of Direct Investment Abroad
  - To study FDI vs. licensing (Corollary 1) – Dummy variable equal to one if parent receives such a payment
  - As a proxy for  $\phi_I$ , we use the share of affiliate equity owned by the parent (Proposition 3)
  - As a proxy for  $-P/x$ , we use the share of affiliate assets financed by the parent (Proposition 5)
  - We test for scale effects by analyzing the log of affiliate sales (Proposition 4)
- We run OLS specifications that include parent-year fixed effects as well as controls for a variety of other economic and institutional factors – fe's help with firm attributes (betas, monitoring, revenue function)



# Data

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BEA's annual survey of U.S. direct investment abroad

- Foreign affiliates > 10% owned by a single U.S. entity
- Extensive operating, financial and ownership data
- Most comprehensive data collected in 1982, 1989, 1994 & 1999

Licensing data collected separately

- Include royalties and licensing fees from unaffiliated parties
- Only since 1986 so licensing tests exclude 1982

Data on institutions

- Two measures of investor protections/capital markets depth: creditor rights (Djankov et al., 2005) and private credit (Beck et al. 1999)
- Proxies for other institutions including property rights (Index of Economic Freedom), patent protection (Ginarte and Park, 1997), rule of law and expropriation risk (International Country Risk Guide)
- Shatz' (2000) measure of FDI restrictions
- Log GDP per capita (WDI) and corporate tax rates (from BEA)

# Test #1: Licensing and Affiliate Activity

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To study FDI vs. licensing (Corollary 1) – Dummy variable equal to one if parent receives such a payment – constructed at the country-year level

Control variables – ownership restrictions, tax rates, per capita income

Additional controls – alternative institutional variables

Further predictions on R&D intensive firms

Dependent Variable:	Arm's Length Licensing Dummy					
	(1)	(2)	(3)	(4)	(5)	(6)
Creditor Rights	0.0097 (0.0026)	0.0148 (0.0029)	0.0014 (0.0042)			
Creditor Rights*Log of Parent R&D			0.0017 (0.0006)			
Private Credit				0.0320 (0.0148)	0.0342 (0.0168)	-0.0694 (0.0138)
Private Credit*Log of Parent R&D						0.0127 (0.0020)
FDI Ownership Restrictions	0.0121 (0.0100)	0.0080 (0.0097)	0.0078 (0.0095)	0.0007 (0.0105)	0.0028 (0.0099)	0.0017 (0.0098)
Workforce Schooling	0.0079 (0.0022)	0.0138 (0.0020)	0.0137 (0.0020)	0.0075 (0.0029)	0.0110 (0.0024)	0.0108 (0.0024)
Log of GDP	0.0274 (0.0037)	0.0274 (0.0039)	0.0284 (0.0039)	0.0243 (0.0036)	0.0249 (0.0040)	0.0260 (0.0040)
Log of GDP per Capita	-0.0167 (0.0045)	-0.0140 (0.0068)	-0.0131 (0.0068)	-0.0203 (0.0053)	-0.0206 (0.0077)	-0.0211 (0.0079)
Corporate Tax Rate	0.1452 (0.0492)	0.1830 (0.0470)	0.1733 (0.0453)	0.1614 (0.0490)	0.1602 (0.0445)	0.1547 (0.0442)
Patent Protections		0.0142 (0.0054)	0.0134 (0.0053)		0.0176 (0.0065)	0.0164 (0.0066)
Property Rights		0.0254 (0.0069)	0.0251 (0.0069)		0.0101 (0.0065)	0.0086 (0.0066)
Rule of Law		-0.0023 (0.0045)	-0.0026 (0.0045)		-0.0037 (0.0049)	-0.0044 (0.0048)
Risk of Expropriation		-0.0087 (0.0051)	-0.0091 (0.0050)		-0.0092 (0.0057)	-0.0091 (0.0056)
Constant	-0.5747 (0.1000)	-0.6967 (0.1063)	-0.7157 (0.1057)	-0.4601 (0.0951)	-0.4973 (0.0998)	-0.4947 (0.0984)
Parent/Year Fixed Effects?	Y	Y	Y	Y	Y	Y
No. of Obs.	33,004	32,609	31,969	31,381	30,782	30,235
R-Squared	0.5993	0.5938	0.5935	0.5943	0.5972	0.5999

Parents are more likely to exploit technologies at arm's length (i.e., through licensing) in countries with stronger credit markets

Results more pronounced for technology intensive firms

# Test #2: Share of Affiliate Assets Financed by Parent

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Dependent Variable:	Share of Affiliate Assets Financed by Parent					
	(1)	(2)	(3)	(4)	(5)	(6)
Creditor Rights	-0.0166 (0.0054)	-0.0164 (0.0051)	-0.0080 (0.0055)			
Creditor Rights*Log of Parent R&D			-0.0010 (0.0003)			
Private Credit				-0.0632 (0.0195)	-0.0384 (0.0215)	-0.0084 (0.0220)
Private Credit*Log of Parent R&D						-0.0031 (0.0012)
FDI Ownership Restrictions	-0.0406 (0.0146)	-0.0426 (0.0154)	-0.0426 (0.0155)	-0.0323 (0.0171)	-0.0358 (0.0160)	-0.0358 (0.0162)
Workforce Schooling	0.0200 (0.0057)	0.0110 (0.0042)	0.0115 (0.0043)	0.0199 (0.0060)	0.0151 (0.0048)	0.0157 (0.0049)
Log of GDP	-0.0224 (0.0055)	-0.0179 (0.0070)	-0.0180 (0.0071)	-0.0157 (0.0062)	-0.0148 (0.0084)	-0.0148 (0.0085)
Log of GDP per Capita	-0.0327 (0.0112)	-0.0066 (0.0153)	-0.0073 (0.0154)	-0.0285 (0.0136)	0.0026 (0.0167)	0.0030 (0.0169)
Corporate Tax Rate	-0.1288 (0.0776)	-0.2135 (0.0763)	-0.2061 (0.0764)	-0.1135 (0.0743)	-0.1803 (0.0742)	-0.1731 (0.0745)
Patent Protections		-0.0392 (0.0113)	-0.0388 (0.0114)		-0.0434 (0.0119)	-0.0436 (0.0120)
Property Rights		-0.0111 (0.0113)	-0.0110 (0.0115)		0.0097 (0.0103)	0.0113 (0.0106)
Rule of Law		0.0059 (0.0078)	0.0062 (0.0079)		0.0065 (0.0080)	0.0068 (0.0080)
Risk of Expropriation		0.0010 (0.0090)	0.0007 (0.0091)		0.0009 (0.0092)	0.0003 (0.0094)
Constant	1.2571 (0.1083)	1.0379 (0.1511)	1.0388 (0.1527)	1.0444 (0.1479)	0.7810 (0.1701)	0.7652 (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

Parents provide more capital to affiliates located in countries with weak credit markets

Results more pronounced for technology intensive firms

# Test #3: Share of Affiliate Equity Owned by Parent

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Dependent Variable:	Share of Affiliate Equity Owned by Parent					
	(1)	(2)	(3)	(4)	(5)	(6)
Creditor Rights	-0.0091 (0.0028)	-0.0101 (0.0035)	-0.0010 (0.0031)			
Creditor Rights*Log of Parent R&D			-0.0010 (0.0003)			
Private Credit				-0.0506 (0.0135)	-0.0481 (0.0174)	0.0078 (0.0144)
Private Credit*Log of Parent R&D						-0.0057 (0.0009)
FDI Ownership Restrictions	-0.0728 (0.0126)	-0.0637 (0.0133)	-0.0611 (0.0134)	-0.0622 (0.0117)	-0.0560 (0.0122)	-0.0529 (0.0122)
Workforce Schooling	0.0005 (0.0024)	-0.0049 (0.0024)	-0.0044 (0.0025)	0.0007 (0.0026)	-0.0030 (0.0026)	-0.0026 (0.0026)
Log of GDP	-0.0157 (0.0037)	-0.0116 (0.0046)	-0.0116 (0.0045)	-0.0110 (0.0035)	-0.0079 (0.0046)	-0.0079 (0.0046)
Log of GDP per Capita	0.0309 (0.0064)	0.0358 (0.0132)	0.0363 (0.0132)	0.0381 (0.0078)	0.0402 (0.0143)	0.0416 (0.0144)
Corporate Tax Rate	-0.2633 (0.0638)	-0.3456 (0.0712)	-0.3391 (0.0700)	-0.2778 (0.0584)	-0.3249 (0.0582)	-0.3179 (0.0564)
Patent Protections		-0.0142 (0.0073)	-0.0137 (0.0072)		-0.0127 (0.0078)	-0.0122 (0.0077)
Property Rights		-0.0055 (0.0072)	-0.0044 (0.0075)		0.0000 (0.0071)	0.0014 (0.0072)
Rule of Law		0.0005 (0.0061)	0.0012 (0.0061)		0.0009 (0.0061)	0.0017 (0.0060)
Risk of Expropriation		0.0054 (0.0068)	0.0050 (0.0068)		0.0069 (0.0067)	0.0059 (0.0067)
Constant	1.1593 (0.1006)	1.1102 (0.1246)	1.0938 (0.1224)	0.9833 (0.0947)	0.9353 (0.1028)	0.9073 (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

Parents own a larger share of affiliate equity in countries with weak credit markets

Results more pronounced for technology intensive firms

Robust to conditional logit specifications

# Test #4: Empirical Tests of Scale Effects

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- Given the large number of theories of MNC activity, it is difficult to include controls sufficiently extensive to distinguish between alternative explanations of scale – Indeed, specifications analyzing the level of affiliate activity are not conclusive
- Focus on a more subtle prediction that follows from the theory
  - The response of firms to ownership restriction liberalizations should be larger in foreign countries with weak capital markets
  - Test this hypothesis using annual BEA data



<i>Dependent Variable:</i>	Log of Affiliate Sales		Log of Aggregate Affiliate Sales	
	(1)	(2)	(3)	(4)
Post Liberalization Dummy	0.0016 (0.0684)	-0.0073 (0.0712)	-0.0633 (0.1230)	-0.1049 (0.1262)
Post Liberalization Dummy * Low Creditor Rights Dummy	0.3011 (0.0827)		0.3682 (0.1552)	
Post Liberalization Dummy * Low Private Credit Dummy		0.2947 (0.0899)		0.3812 (0.1769)
Log of GDP	0.3886 (0.3888)	0.3409 (0.3960)	-0.0786 (0.7833)	-0.1351 (0.7040)
Log of GDP per Capita	1.3675 (0.3720)	1.4488 (0.3867)	2.6620 (0.5425)	2.8376 (0.6192)
Constant	-13.5818 (9.2414)	-13.0613 (9.2484)	-4.7847 (22.1876)	-4.9033 (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

Affiliate scale changes more in response to ownership restriction liberalization in countries with weak credit markets

# Conclusion

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- The paper provides an integrated explanation for MNC activity and the way it is financed
- Desire to exploit technology is critical, but frictions associated with obtaining external finance give rise to multinational activity, not risk of expropriation of technology
- US MNCs, especially technology intensive ones, exhibit behavior consistent with predictions of model
  - Propensity to do FDI vs. licensing, the share of affiliate assets financed by the parent and the share of affiliate equity owned by the parent are all higher in countries with weak financial development, but the scale of MNC activity is lower in such settings

# Future Directions

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- Incorporate export vs. FDI decision
- In a previous version of the paper, we sketched a general equilibrium model of the world economy and illustrated how it can qualitatively account for the following patterns observed in the data:
  - Substantial two-way FDI flows between relatively developed countries (because of high  $\alpha$  despite low  $F/\alpha$ )
  - More modest one-way FDI flows from developed countries to developing countries (because of low  $\alpha$  despite high  $F/\alpha$ )
  - Very small one-way FDI flows from developing countries to developing countries (because of high  $\beta$  in those countries)
- Interactions between local firms and FDI in institutionally weak environments

# Model: The Role of $\beta$

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- Also assume that the inventor is able to invest the initial lump-sum payment  $P$  at Home and obtain a gross return  $\beta$ , while expected dividends  $\phi_I p_H R(x)$  are not pledgeable at Home
  - When combined with  $\beta > 1$  assumption, optimal contract gives rise to minimum level of  $\phi_I$
  - $\beta > 1$  can be justified if
    - External finance is costly for inventor (Appendix with financial frictions at Home)
    - Inventor is risk averse