Informal Institutions and Comparative Advantage of South-Based MNEs: Theory and Evidence*

Pao-Li Chang† Yuting Chen‡

June 4, 2018

Abstract

It has been suggested by the literature that similarly poor state institutions may be a source of comparative advantage for South-based MNEs when investing in developing countries. Exactly how these comparative advantages arise is, however, less than fully understood because often the relative cost advantages of the North and South MNEs are assumed rather than derived. In this paper, we propose a theoretical model to micro-found the cost structure of firms, given their endogenous response to the state institution of the country where they are based and the country where their production facilities might be. Firms' optimal choice of FDI location, and sourcing and production decisions are fully characterized, allowing for many countries, industries, and heterogeneous firms. We arrive at the main hypothesis that predicts an institutional complementarity pattern across countries in bilateral FDI flows at both the firm and country levels. We conduct an extensive test of the theory using worldwide bilateral FDI data at the firm level and at the country level. The results indicate a statistically significant assortative matching pattern in the institutional qualities of FDI origins and destinations.

Key Words: Informal Institution; Firm Productivity; Firm R&D Intensity; FDI Location
JEL Classification: D02; D21; D22; F21; F23

*The authors thank Andrei Levchenko, Chang-Tai Hsieh, Yi Lu, Kim Sau Chung, Chia-Hui Lu, Wen-Tai Hsu, Jiahua Che, Ping Wang, José de Sousa, Benjamin Faber, Andrés Rodríguez-Clare, and conference and seminar participants for helpful comments and suggestions. This research was supported by the Singapore Ministry of Education (MOE) Academic Research Fund (AcRF) Tier 1 grant (C244/MSS13E002). The *fDi Markets* dataset was kindly shared by Yue Lu at the University of International Business and Economics, Beijing, China.

†School of Economics, Singapore Management University, 90 Stamford Road, Singapore 178903. Email: plchang@smu.edu.sg. Tel: +65-68280830. Fax: +65-68280833.

‡School of Economics, Singapore Management University, 90 Stamford Road, Singapore 178903. Email: yuting.chen.2014@phdecons.smu.edu.sg.

1 Introduction

The accumulated knowledge of the FDI literature (see for example the survey by Helpman, 2006) has provided us a good understanding of the incentives and constraints of multinational enterprises (MNEs) in their choices (of organizational forms and production locations) in response to their own firm characteristics, the nature of the industry, and the country where they operate from. In these existing theoretical frameworks, MNEs are often theorized to be based in the North. This supposition, although understandable given the North MNEs' leading edge in R&D and technology, is increasingly incongruent with the facts. In 2006–2010, 17% of the world FDI outflows originate from the South (Dixit, 2012). At the same time, the share of FDI inflows from the developing country received by their peer South is disproportionately large at 36% in 2000 (Aykut and Ratha, 2004). By 2013, FDI from the developing country (including transition economies) has accounted for 39% of global FDI outflows (UNCTAD, 2014). It is thus important that theoretical framework be developed to formalize the comparative advantage of South-based MNEs. This paper makes one such contribution.[1]

It has been suggested by a lecture of Dixit (2012) that similarly poor governance endowments may be a source of comparative advantage for South-based MNEs when investing in developing countries. Several empirical studies (Darby et al., 2010; Cuervo-Cazurra and Genc, 2008; Bénassy-Quéré et al., 2007; Habib and Zurawicki, 2002) have found patterns consistent with this hypothesis.[2] In these studies, 'experiences', 'skills' and 'abilities' of firms based in the South 'to manage under difficult conditions' and their 'familiarity' with the norms in the host country are often cited as the potential explanations. Exactly how these comparative advantages arise endogenously is, however, less than fully understood, because often the relative cost advantages of the North and the South MNEs have been assumed rather than derived.

In this paper, we propose a theoretical model to micro-found the cost structure of firms, given their endogenous response to the state institutions of the country in which they are based and where their production facilities might be. Firms' optimal choice of FDI location, sourcing decision (FDI or domestic production), and production decision (produce or not) are fully characterized, in a vertical-FDI model with many countries, industries, and heterogeneous firms. The main hypothesis predicts an institutional assortative matching in the state institutional qualities of FDI origins and

[1] In the general framework of Arkolakis et al. (2018), it is possible to have MNEs originating from all countries. However, because the pattern of multinational production (MP) is determined in large part by the efficiency parameters T_{il} characterizing the productivity of firms originating from i conducting MP production in country l, the framework implies a dominance of MNEs based in the North given their technology superiority.

[2] Darby et al. (2010) found that South MNEs are less (or not at all) deterred by bad institutional quality in the host country than North MNE, based on bilateral FDI count data (on the number of MNEs from a country of origin present in a destination country). Cuervo-Cazurra and Genc (2008) measured the proportion of developing-country MNEs among the largest foreign firms in each of 50 LDCs and found that developing-country MNEs are more prevalent in LDCs with poorer regulatory quality and lower control of corruption (although this negative relationship does not apply to all aspects of institutional quality, e.g., rule of law). Bénassy-Quéré et al. (2007), using a gravity model for bilateral FDI from OECD countries to the other countries, found that good institutions in the home country have no or even negative impact on outward FDI, and institutional distance has often a negative impact on bilateral FDI. Last but not least, Habib and Zurawicki (2002) focused on corruption and observed that the distance in the corruption level between the home and host countries reduce bilateral FDI flows.

destinations, all else being equal.

The theory is built on the fundamental assumption that the fixed operating cost of firms increases with poorer state institutions, but decreases with firms' own investment in *informal institutions*, and the investment in informal institutions is more effective in reducing overhead cost in environments of poorer formal institutions. As an endogenous outcome, when and where the formal institutions are weaker, the private sector tends to build more informal institutions to substitute the former. Evidence abounds in the literature that documents the endogenous response of the private sector to the formal institutions the state provides. For the purpose of exposition, we may categorize them as economic, legal, or political informal institutions. First, where the market-supporting institutions such as contract enforcement and bank credit are lacking, firms tend to fill in the void with relational contracting and trade credit. These patterns are documented for example by McMillan and Woodruff (2002) for Russia, China, Poland and Vietnam. McMillan and Woodruff (1999a,b) provide detailed accounts of how these *informal economic institutions* work in Vietnam under reputation incentives and threat of community sanction. A similar argument is suggested by Acemoglu and Johnson (2005) that reputation-based mechanisms can, at least in part, alleviate the problems originating from weak contracting institutions.

Second, where the state legal institution is weak, the private sector tends to turn to *informal legal institutions* such as private patrols, private protection agencies or informal courts to substitute for police protection and judicial systems (Hay and Shleifer, 1998). For example, Frye and Zhuravskaia (2000) find that higher levels of regulation and weak legal institutions are associated with a higher probability of contact with a private protection organization in Russia.

Finally (and perhaps the most controversial of the three given its many faceted implications), where the state's bureaucratic system is inefficient and regulatory quality poor, firms tend to build political connection (Fisman, 2001; Faccio, 2006) with politicians and government officials, or directly participate in politics. Political connection may help firms reduce regulatory burden (e.g., fewer days to obtain business permit, fewer agencies to register or fewer on-site inspections) but also secure property rights (e.g., lower expropriation via tax or fines) and enforce contracts. For example, Li et al. (2006) found that in China, the probability of entrepreneurs entering politics decreases by 8–20% when the institutional index in a region improves by one standard deviation. Chen et al. (2011) similarly show that firms are more likely to establish political connections in regions in which the government has more discretion in allocating economic resources. Bai et al. (2014) provide a vivid account of how in the aluminum and auto industries, Chinese local governments may have a large leverage in providing public goods (such as land and capital) to their cronies and alter the terms of competition in the market. In general, firms may engage in all three types of informal institutional building (economic, legal or political). For example, Cai et al. (2011) infer that the entertainment and travel costs expenditures of Chinese firms consist of grease money to obtain better government services, protection money to lower tax rates, and also business expenditures to build relational capital with suppliers and clients.

The term *informal institution* has been used in the literature to refer to many things ranging

from customs, traditions, norms, religion (Williamson, 2000), social capital, trust (Chan et al., 2015) to culture. Here, we adopt the definition of Helmke and Levitsky (2004) that distinguishes informal institution from informal behavioral regularities, shared values and the broader concept of culture. Specifically, informal institutions are defined as socially shared rules, usually unwritten, that are created, communicated, and enforced outside of officially sanctioned channels.

This paper proceeds to show that in spite of the endogenous choice of heavier investment in informal institutions that combat the fixed operating cost, firms based in the South still have an absolute disadvantage than their peer in the North because the state institution's first-order effect dominates. Nonetheless, they have a comparative advantage in conducting FDI in countries of poorer institutional qualities, because their heavier investment in informal institution plays a more important role in FDI destinations of poorer state institutions. Thus, a MNE from a country of poorer state institutions than another MNE will tend more likely to invest in a destination of poorer state institutions than the other MNE's choice of destination, all else being equal.

The paper also derives the implications on the volume of bilateral FDI flows at the country level, given the firm-level choice of FDI destination, by aggregating the FDI activities across sectors (of different market sizes) and across firms (of heterogeneous productivity levels). The model generates the endogenous presence of zero FDI for some country pairs. Conditional on positive bilateral FDI flows, complementarity in institutions (of FDI origins and destinations) continues to hold at the intensive margin: multinational firms tend to generate more net profits in countries of poorer institutional qualities, the poorer the institutional environment at home. At the extensive margin, subject to qualifying conditions, more multinational firms tend to conduct FDI in countries of poorer institutional qualities, the poorer the institutional environment at home.

The empirical studies cited earlier have presented evidence (at least in part) supporting the above hypothesis. They are however limited in the following ways. First, institutional distance is often used as a control variable in this empirical literature (except Darby et al., 2010). In contrast, the current theory suggests that it is the sorting in institutional qualities that matters, and hence, a more appropriate control is the interaction of the institutional qualities of the FDI origin and destination. Second, the countries included in these studies are often restricted to the least developed countries as the host country (Cuervo-Cazurra and Genc, 2008) or developed countries as the home country (Bénassy-Quéré et al., 2007). Third, when the country coverage is comprehensive, it is often at the cost of using the FDI count data (ie, the number or percentage of firms; Darby et al., 2010) instead of the FDI flows/stocks (that incorporate the intensive margin in addition to the extensive margin). To provide a direct and comprehensive test of the proposed hypothesis, this paper assembles a panel dataset of bilateral FDI stocks (and flows) for 219 economies in years 2001–2010 based on the UNCTAD's Bilateral FDI Statistics. This extends the country coverage to include almost all economies in the world, which allows us to examine the behavior of FDI flows from (to) the whole spectrum of countries in terms of institutional qualities. The state institutional quality is measured by the World Bank's Worldwide Governance Indicators commonly used in the literature. To test the theory's main prediction of a positive assortative matching

pattern in institutions, bilateral FDI activities are regressed on the level and the interaction of the institutional quality indicators of the home and host countries. An extensive set of gravity variables (to proxy for communication and transaction costs of FDI) are also included, in addition to home and host country characteristics (such as GDPs, GDPs per capita, and general production cost levels) and variables suggested by competing hypotheses of FDI. In particular, since income levels and institutional qualities are correlated, the difference in GDPs per capita between the home and host countries is included to control for the Linder effect on FDI as proposed by Fajgelbaum et al. (2015). Overall, the paper finds support for the theory's prediction. The coefficient on the institutional interaction term is positive and significant, and the conclusion is robust to the FDI series used (inward or outward, stocks or flows), the measures of institutional quality, the estimation specifications, and the inclusion of zero FDI observations.

We provide further evidence on the theory's prediction at the firm level using the *fDi Markets* dataset on worldwide firm-level greenfield FDI during 2009–2016, which was merged with the Orbis financial dataset on private companies to obtain parent firms' key performance measures (and to estimate their productivity levels). For the period 2009–2016, there are 35,039 unique firms from 168 origin countries that conduct greenfield FDI in 200 destination countries. Each observation refers to an incident of greenfield foreign capital investment in a sector and year by a firm reported by *fDi Markets*, and the corresponding characteristics of the investing firm, origin and destination countries. We regress capital investment on the interaction of the institutional quality indicators of the home and host countries, on firm productivity and its interaction with destination institutional quality, on firm R&D intensity and its interaction with destination institutional quality, and the same set of gravity variables as the country-level analysis. An extensive set of fixed effects (origin-year, destination-year, destination-sector) are also controlled for.

We continue to find a positive and significant coefficient on the interaction term of the origin and destination institutional qualities. This provides the firm-level evidence for the institutional complementarity effect. In addition, more productive firms tend to invest more in countries of poorer state institutions, which is consistent with the theory's prediction (as these firms with larger market shares have stronger incentives to locate production in countries of lower wages, and they are able to afford the higher fixed cost associated with larger investment in informal institution in such countries). On the other hand, firms of higher R&D intensity (and technology sophisticatedness) makes less FDI, but such negative effects are moderated by better destination institutions. This is consistent with the quality-control theory of Chang and Lu (2012), where the risk of quality-control failure in cross-border production arrangement discourages high-technology firms from locating their production in countries of weaker technology capacity or institutional support.

Singapore often ranks among the top in terms of good governance. For example, in 2012, it clinched the 1st in terms of GE and RQ, the 4th in CC, and the 5th in RL. Thus, when its government undertook to jointly develop the China-Singapore Suzhou Industrial Park (SIP) with the Chinese government in 1994, by transplanting its Singapore-style institutions overseas in the

Chinese land of cheap labor, it was greeted by the investor community with great enthusiasm. Take a few examples from Pereira (2002):

> *We are a Western multinational company. We operate entirely above board. We don't like hidden costs and personal benefits in business. We came on the basis that there would be a Singaporean system here. We can justify every single entry honestly in our account books. (Manager, European company, male, Germany citizen, aged 40-50)*

> *Things here [at the SIP] are very straightforward. All the rules are clear, all the personnel are very professional, and the estate is very modern. So this has allowed our company to focus on doing business rather than worry about all the other aspects. (Manager, US company, male, Singapore citizen, aged 30-40)*

Few expected that the joint venture would soon 'sour' in 2001. There are no typical barriers in terms of language, ethnicity, or cultural origins. As the Singaporean leaders later reflected, the Singapore government misjudged the importance of relationship with local authorities. In particular, it underestimated the extent of latitude that the Chinese local officials had versus Beijing in altering the terms of competition (Pereira, 2002). The quotations cited above and the overall incident bring home the point that institutional endowments of an investor (what it is endowed with in formal institutions and what it develops in informal institutions) play a non-negligible role in the operation and the outcome of FDI.

The rest of the paper is organized as follows. Section 2 develops the theoretical model and predictions. Sections 3 and 4 present the country-level and firm-level evidence, and Section 5 concludes.

2 Model

This model is designed to highlight the mechanism of institution on FDI activities, and to keep the model tractable, we intentionally drop many other mechanisms that the previous literature has shown to be important. Thus, it is not a quantitative FDI model suitable for calibration. Rather, the theoretical prediction in this section will be tested as a 'partial' effect of institution on FDI in the empirical section (after controlling for other relevant determinants of FDI). We discuss possible extensions of the current framework to incorporate these other elements of interest in Section 2.5. For recent developments in quantitative FDI models, see for example Garetto (2013), Ramondo and Rodríguez-Clare (2013), Irarrazabal et al. (2013) and Arkolakis et al. (2018).

Suppose there are a continuum of countries indexed by $r \in R$, where r is an inverse measure of the quality of formal institutions. The larger r is, the poorer the institution of the country. There are a continuum of sectors indexed by j producing differentiated goods, and one sector producing homogeneous good (used as the numeraire). The only factor of production is labor, and the homogeneous good is produced with constant unit labor requirement. We abstract away from any kind of trade frictions (and thus the incentives of horizontal FDI driven by market access).

This implies that there is a single world market for goods. Labor endowment is assumed to be large enough in each country such that the homogeneous good is always produced. As a result, a country's labor productivity in the numeraire good determines its wage rate w. Countries with better formal institutions are assumed to have higher labor productivity in the numeraire good and hence a higher wage: $w = \omega(r)$ and $\omega'(r) \equiv d\omega(r)/dr < 0$.

Each variety of the differentiated goods requires a headquarter service component and a manufactured component using a Cobb-Doublas production function (à la Antràs and Helpman, 2004), where each component has a unit labor requirement equal to one. This implies a unit cost of production equal to $c = w_h^{\eta} w_d^{1-\eta}/\phi$, where ϕ indexes the productivity of the firm producing the variety, η denotes the headquarter intensity in the production, and w_h and w_d corresponds to the wage rate of the country where the headquarter and the manufacturing facility of the firm are located, respectively.

The world is populated by a unit measure of consumers with identical preferences: $U = x_0 + \frac{1}{\mu}\int X_j^{\mu} dj$, $0 < \mu < 1$, where x_0 indicates the consumption of the numeraire good, and X_j a CES function over all available varieties $x_j(i)$ in sector j with an elasticity of substitution σ. We drop the sector index j for the time being to simplify the notation until Section 2.4. Given monopolistic competition, the CES preferences imply the standard pricing and profit function. Each firm charges a constant markup over its marginal cost of production $p(c) = \frac{\sigma}{\sigma-1}c$, sells a quantity of $x(p(c)) = X_j^{\sigma(\mu-1)+1} p(c)^{-\sigma}$ and earns a variable profit:

$$\begin{aligned} \pi &= (p(c) - c)x(p(c)) \\ &= Bc^{1-\sigma} \\ &= B\tilde{\phi}\left(w_h^{\eta} w_d^{1-\eta}\right)^{1-\sigma}, \end{aligned} \tag{1}$$

where $B \equiv \frac{1}{\sigma} X_j^{\sigma(\mu-1)+1} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma}$ can be taken as an index of the world market size for the sector (exogenous from the point of view of the individual firm) and $\tilde{\phi} \equiv \phi^{\sigma-1}$ a transformed index of the firm productivity level.

2.1 Choice of Informal Institution

A firm given its productivity level chooses whether to produce or not. If it chooses to produce both components at home, it incurs a fixed overhead cost $f(r_h, I)$, which depends on: i) the quality of the formal institution where the firm is headquartered and, ii) the informal institution I that the firm invests in. If it chooses to produce the manufactured component in a country different from where it is headquartered, it incurs an *additional* overhead cost $f(r_d, I)$, which depends on the quality of the formal institution in the country where the production facility is located, and similarly, its choice of informal institutional investment.

The fixed overhead cost is assumed to depend on the formal and informal institutions as follows. First, it is assumed that $f(r, I)$ strictly increases in r: $f_r \equiv \partial f(r, I)/\partial r > 0$. That is, worse

formal institution increases the fixed overhead cost. Next, $f(r, I)$ strictly decreases in I: $f_I(r, I) \equiv \partial f(r, I)/\partial I < 0$, i.e., firm-specific informal institution helps reduce the fixed overhead cost. Finally, it is assumed that

$$\frac{\partial}{\partial r}\left(\frac{\partial f(r, I)}{\partial I}\right) < 0, \tag{2}$$

that is, informal institution is more effective in reducing the fixed overhead cost in environments of poorer formal institutions.

The investment in informal institution is assumed to be a common good within the boundary of the firm: it can be used at home or in the country where its production facility is located. Investing in informal institution, however, costs the firm $k(I)$, which is assumed to be increasing and convex in I.

A firm chooses I^* that minimizes $F(r_h, I) \equiv f(r_h, I) + k(I)$ if it chooses local production. Alternatively, the firm chooses $I^{FDI,*}$ that minimizes $F^{FDI}(r_h, r_d, I) \equiv f(r_h, I) + f(r_d, I) + k(I)$ if it chooses to undertake FDI. Define $F^*(r_h) \equiv f(r_h, I^*(r_h)) + k(I^*(r_h))$ and $F^{FDI,*}(r_h, r_d) \equiv f(r_h, I^{FDI,*}(r_h, r_d)) + f(r_d, I^{FDI,*}(r_h, r_d)) + k(I^{FDI,*}(r_h, r_d))$; i.e., they are the respective minimal fixed cost of local production and FDI. We could characterize the choice and impacts of informal institutions as follows:

Proposition 1 *(i) The investment in informal institution will be higher for firms engaging in multinational production than for firms engaging only in local production: $I^{FDI,*}(r_h, r_d) > I^*(r_h)$; (ii) The total fixed cost of production will be higher for multinational production than for local production: $F^{FDI,*}(r_h, r_d) > F^*(r_h)$; (iii) The total fixed cost of multinational production will be higher in FDI destination of poorer institutions: $dF^{FDI,*}/dr_d > 0$; (iv) For a given FDI destination, the total fixed cost of multinational production will be higher for MNEs based in countries of poorer institutions: $dF^{FDI,*}/dr_h > 0$.*

Proof. (i) $\frac{\partial F^{FDI}}{\partial I}|_{I=I^*} = \frac{\partial f(r_h, I^*)}{\partial I} + \frac{\partial f(r_d, I^*)}{\partial I} + k'(I^*) = \frac{\partial f(r_d, I^*)}{\partial I} < 0$, where the second equality follows by the FOC condition for I^*: $\frac{\partial f(r_h, I^*)}{\partial I} + k'(I^*) = 0$, and the last inequality follows by the assumption that $f(r, I)$ strictly decreases in I. This implies that $I^{FDI,*} > I^*$. (ii) We can write $F^{FDI,*} - F^* = \left\{F^{FDI,*} - F(r_h, I^{FDI,*})\right\} + \left\{F(r_h, I^{FDI,*}) - F^*\right\} > 0$. The inequality holds since $F^{FDI,*} - F(r_h, I^{FDI,*}) = f(r_d, I^{FDI,*}) > 0$ by the setup, and $F(r_h, I^{FDI,*}) - F^* > 0$ by the definition of F^* and the fact that $I^{FDI,*} \neq I^*$. (iii) By the envelope theorem, we have

$$\frac{dF^{FDI,*}}{dr_d} = \frac{\partial f(r_d, I^{FDI,*})}{\partial r_d} + \frac{\partial F^{FDI}(r_h, r_d, I^{FDI,*})}{\partial I}\frac{\partial I^{FDI,*}}{\partial r_d} > 0, \tag{3}$$

where the sign follows by the assumption that $f(r, I)$ strictly increases in r and by the FOC for $I^{FDI,*}$ such that $\partial F^{FDI}(r_h, r_d, I^{FDI,*})/\partial I = 0$. (iv) The proof is similar to (iii), by replacing r_d with r_h. ■

The predictions in Proposition 1 are derived under the endogenous choice of I by firms and yet they are consistent with many typical assumptions (observations) often made in the FDI literature. First, note that firms will have a stronger incentive to invest in informal institutions when they

engage in multinational production than if they produce only locally, because in the former case, the informal institution can be used to help lower the overhead cost of both the headquarter operation at home and the production abroad. This prediction is in line with the fact that larger firms tend to be more politically connected or politically active (Hellman et al., 2003; Faccio, 2006; Li et al., 2006; Chen et al., 2011), because MNEs also tend to be larger in size than domestic firms. Second, multinational production sets a higher threshold than local production in terms of fixed costs. This helps explain the typical sorting of MNEs and local firms in terms of productivity. Third, poor state institutions discourage inward FDI by raising the total fixed cost of multinational production ($dF^{FDI,*}/dr_d > 0$). This is in spite of the fact that firms endogenously undertake heavier investment in informal institutions should they choose such locations. Thus, the direct effect of weak state institutions still dominates the countervailing effect of self-remedy. Finally, poor state institutions also impose an absolute disadvantage on firms based in the South; they incur a higher total fixed cost of multinational production than firms based in the North given the same choice of FDI destination ($dF^{FDI,*}/dr_h > 0$). This helps explain in part the dominance of MNEs from the North.

Proposition 2 *Multinational firms headquartered in countries of poorer institutions will invest more in informal institution:* $\frac{\partial I^{FDI,*}(r_h,r_d)}{\partial r_h} > 0$. *As a corollary, multinational firms headquartered in countries of poorer institutions will be more effective at reducing its overhead fixed cost at a given FDI destination:* $\frac{df(r_d,I^{FDI,*})}{dr_h} < 0$.

Proof. Let $f_{II}(r,I) \equiv \frac{\partial^2 f(r,I)}{\partial I^2}$. The FOC for $I^{FDI,*}$ requires that at $I^{FDI,*}$,

$$f_I(r_h, I) + f_I(r_d, I) + k'(I) = 0. \tag{4}$$

Take total differentiation of (4) with respect to r_h and $I^{FDI,*}$, we have

$$\frac{\partial I^{FDI,*}}{\partial r_h} = -\frac{\frac{\partial f_I(r_h,I)}{\partial r_h}}{f_{II}(r_h, I) + f_{II}(r_d, I) + k''(I)} > 0$$

at $I^{FDI,*}$ by the SOC for $I^{FDI,*}$ and the assumption in (2).[3] As a corollary,

$$\frac{df(r_d, I^{FDI,*})}{dr_h} = f_I(r_d, I^{FDI,*})\frac{\partial I^{FDI,*}}{\partial r_h} < 0$$

by the assumption $f_I(r,I) < 0$ and the previous result $\frac{\partial I^{FDI,*}}{\partial r_h} > 0$. ■

To interpret this result, note that the marginal benefit to invest in informal institution is higher for firms based in a country of poorer state institution, because the firm-specific informal institution reduces the fixed overhead cost of headquarter operation by more in such environment. The heavier investment in informal institution in turn enables these firms to reduce the overhead cost of production at the FDI destination. Propositions 1 and 2 together imply that for each given

[3]We impose the necessary condition on $f_{II}(r,I)$ to ensure that the SOC, $f_{II}(r_h, I) + f_{II}(r_d, I) + k''(I) > 0$, is satisfied. Given the convexity of $k(I)$, a sufficient condition is $f_{II}(r,I) > 0$.

FDI destination r_d, although South-based MNEs have a higher total fixed cost of multinational operation due to their home institutional disadvantage and the higher cost incurred to build I, they actually incur a lower fixed cost of production at the FDI destination, $f(r_d, I)$. As an implication, the comparative advantage of South-based MNEs will be stronger in destinations of poorer state institutions, as the following analysis formally shows.

2.2 Optimal FDI Destination

If a firm chooses to produce locally, its net profit is

$$\Pi^D \equiv \pi^D - F^*(r_h) = B\tilde{\phi}\,(w_h)^{1-\sigma} - F^*(r_h), \tag{5}$$

which increases in $\tilde{\phi}$ linearly. Note that $F^*(r_h)$ has taken into account the optimal choice I^* given the home institutional environment r_h. If a firm chooses to undertake FDI, its net profit is instead

$$\Pi^{FDI} = \pi^{FDI} - F^{FDI,*}(r_h, r_d) = B\tilde{\phi}\left(w_h^{\eta} w_d^{1-\eta}\right)^{1-\sigma} - F^{FDI,*}(r_h, r_d), \tag{6}$$

where again $F^{FDI,*}(r_h, r_d)$ has taken into account the optimal choice $I^{FDI,*}$ given the destination r_d and the MNE's home institution r_h. Given Proposition 1(ii) that the fixed cost of production of FDI is higher than local production, if firms choose FDI, they necessarily choose a destination with lower wages than at home ($w_d < w_h$, i.e., $r_d > r_h$) such that the higher variable profit of FDI helps offset the higher fixed cost of FDI. This is in line with most vertical-FDI models in the literature, where FDI is driven by differences in the production cost across countries. Of course, in the data, reverse FDI ($r_d < r_h$) can take place for reasons not modeled in the paper (such as market access or technology acquisition motives). Thus, if we do find empirical pattern in support of our hypotheses, it suggests that the mechanism proposed in the paper is strong enough to dominate potential countervailing forces.

Among possible destinations of FDI, firms trade off lower wages with higher fixed costs associated with poorer institutions, and choose r_d that maximizes (6). The FOC for the optimal choice r_d^* requires that at r_d^*:

$$\frac{\partial \pi^{FDI}}{\partial w_d}\omega'(r_d) - \frac{\partial f(r_d, I^{FDI,*})}{\partial r_d} = 0, \tag{7}$$

where $\partial F^{FDI,*}(r_h, r_d)/\partial r_d = \partial f(r_d, I^{FDI,*})/\partial r_d$ by the envelope theorem. Equation (7) defines the optimal choice of the FDI destination r_d^* as an implicit function of the firm, industry and home country characteristics: $r_d^* \equiv H(r_h, \tilde{\phi}, B, \eta)$. In particular, these include the home institution r_h, the firm productivity level $\tilde{\phi}$, the world demand for the sector B, and the headquarter intensity of the industry η.

Proposition 3 *(i)* **(Complementarity of Institutional Qualities at Firm-level FDI)** *All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the poorer the institutional quality at home:* $\frac{\partial r_d^*}{\partial r_h} > 0$*; (ii) All else being equal, a firm will choose*

to undertake FDI in countries of poorer institutional qualities, the more productive the firm is: $\frac{\partial r_d^*}{\partial \tilde{\phi}} > 0$*; (iii) All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the larger the world demand for the sector is:* $\frac{\partial r_d^*}{\partial B} > 0$*; (iv) All else being equal, a firm will choose to undertake FDI in countries of poorer institutional qualities, the less headquarter-intensive the sector is:* $\frac{\partial r_d^*}{\partial \eta} < 0$.

Proof. (i) Totally differentiate (7) with respect to r_d^* and r_h, we obtain

$$\frac{\partial r_d^*}{\partial r_h} = -\frac{\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial w_h}\omega'(r_d)\omega'(r_h) - \frac{\partial^2 f}{\partial I \partial r_d}\frac{\partial I^{FDI,*}(r_h,r_d)}{\partial r_h}}{\frac{\partial^2 \Pi^{FDI}}{\partial r_d^2}} > 0. \tag{8}$$

The inequality holds because $\frac{\partial^2 \Pi^{FDI}}{\partial r_d^2} < 0$ by the SOC for r_d^*,[4] and the numerator is positive by the facts that: (a) $\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial w_h} = \eta(1-\eta)(1-\sigma)^2 \pi^{FDI}/(w_h w_d) > 0$ and $\omega'(r) < 0$, and (b) $\frac{\partial^2 f}{\partial I \partial r_d} < 0$ by the assumption in (2) and $\frac{\partial I^{FDI,*}(r_h,r_d)}{\partial r_h} > 0$ by Proposition 2.

(ii) Similarly, taking total differentiation of (7) with respect to r_d^* and $\tilde{\phi}$, we have

$$\frac{\partial r_d^*}{\partial \tilde{\phi}} = -\frac{\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial \tilde{\phi}}\omega'(r_d)}{\frac{\partial^2 \Pi^{FDI}}{\partial r_d^2}} > 0, \tag{9}$$

because $\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial \tilde{\phi}} = (1-\eta)(1-\sigma)\pi^{FDI}/(w_d \tilde{\phi}) < 0$ and $\omega'(r) < 0$.

(iii) It is straightforward to see that B has an analogous (positive) effect as $\tilde{\phi}$ on r_d^*, because B and $\tilde{\phi}$ enter π^{FDI} multiplicatively.

(iv) Finally, by similar derivations, we have

$$\frac{\partial r_d^*}{\partial \eta} = -\frac{\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial \eta}\omega'(r_d)}{\frac{\partial^2 \Pi^{FDI}}{\partial r_d^2}} < 0,$$

where $\frac{\partial^2 \pi^{FDI}}{\partial w_d \partial \eta} = (1-\sigma)\left[(1-\eta)(1-\sigma)\ln\frac{w_h}{w_d} - 1\right]\pi^{FDI}/w_d > 0$, since $w_h > w_d$ ($r_d > r_h$) holds at the optimal choice of FDI destination. ■

To understand Proposition 3(i), note that institutional complementarity at the firm level in bilateral FDI flows arises for two reasons. First, firms based in countries of poorer institutional qualities tend to be more heavily endowed with firm-specific informal institutions, which gives them a comparative advantage in conducting FDI in destinations of poorer institutional qualities (as the adverse effect of weak institutions at the destination on fixed cost is reduced by the firm-specific institutional investment, and more so in destinations of poorer institutions). This is the key mechanism proposed by the paper. In addition, given the supermodularity between the headquarter and the intermediate component implied by the Cobb-Douglas production function, a lower wage at home (a lower-cost headquarter input) also increases the marginal benefit (increments in variable

[4] We make the necessary assumptions on $\omega''(r)$ and $\frac{\partial^2 f(r,I)}{\partial r^2}$ to ensure that the SOC, $\frac{\partial^2 \Pi^{FDI}}{\partial r_d^2} < 0$, for r_d^* is satisfied.

profits) of securing a lower-cost manufactured component. This second mechanism reinforces the main mechanism and strengthens the institutional complementarity effect.

Next, note that a larger $\tilde{\phi}$ (or B) increases the marginal benefit of producing the manufactured component at a location with lower wages w_d, since the market share of the firm at stake (or the size of the aggregate demand for the industry) is larger. This encourages the firm to take on higher fixed costs associated with FDI in countries of poorer institutions so as to access the cheaper labor pool in these destinations. In contrast, when a sector is more headquarter intensive, the cost of the manufactured component becomes less important a concern, which weakens the incentive of firms to locate FDI in countries with weaker institutional support.

The prediction that a more productive firm will choose to engage FDI in countries of poorer institutions may come across as a surprising result. But it is no different from the traditional vertical-FDI models where the more productive firms in the North are more likely than the less productive firms to engage FDI in the South: the more productive firms with larger market shares stand to gain more from the lower variable production cost in the South, and at the same time, they can afford the higher fixed cost of FDI. Naturally, there are factors outside the model that may moderate this stark prediction. We discuss them in Section 2.5.

2.3 Sorting of Firms

Proposition 3(ii) (that the more productive firms choose FDI in countries of poorer institutions) implies that the net profit function of FDI will be an increasing and convex function of firm productivity level $\tilde{\phi}$ for a given sector and home country. To see this, define

$$\Pi^{FDI,**} \equiv \max_{r_d} \left\{ \pi^{FDI}(r_h, r_d, \tilde{\phi}, B, \eta) - F^{FDI,*}(r_h, r_d) \right\}$$

and $\pi^{FDI,**}$ and $F^{FDI,**}$ the corresponding variable profit and fixed cost given the optimal choice of destination r_d^*. Applying the envelope theorem, we have

$$\begin{aligned} \frac{d\Pi^{FDI,**}}{d\tilde{\phi}} &= \frac{\partial \pi^{FDI,**}}{\partial \tilde{\phi}} = B(w_h^{\eta} w_d^{1-\eta})^{1-\sigma} > 0; \\ \frac{d^2\Pi^{FDI,**}}{d\tilde{\phi}^2} &= (1-\eta)(1-\sigma) w_d^{-1} B(w_h^{\eta} w_d^{1-\eta})^{1-\sigma} \omega'(r_d^*) \frac{\partial r_d^*}{\partial \tilde{\phi}} > 0, \end{aligned}$$

where the sign for the second derivative follows by Proposition 3(ii). In addition, by Proposition 1(iii) and Proposition 3(ii) again, we have

$$\frac{dF^{FDI,**}}{d\tilde{\phi}} = \frac{dF^{FDI,**}}{dr_d^*} \frac{dr_d^*}{d\tilde{\phi}} > 0.$$

Thus, as the more productive firms choose FDI in countries of higher r_d, they earn a higher variable profit margin but also incur a higher fixed cost. This is illustrated in Figure 1 by firms of three representative productivity levels $\tilde{\phi}_1 < \tilde{\phi}_2 < \tilde{\phi}_3$. Their respective choice of r_d (with

$r_{d,1} < r_{d,2} < r_{d,3}$) implies increasingly steeper variable profit margins and higher fixed costs. The net profit function $\Pi^{FDI,**}$ corresponds to the upper contour of the net profit functions across the continuum of FDI destinations.

The profit function of producing locally and that of FDI are juxtaposed in Figure 2. Given a convex profit function $\Pi^{FDI,**}$ for FDI but a linear one for local production, and a higher fixed cost for FDI than local production (Proposition 1(ii)), there exists a productivity level $\tilde{\phi}^{FDI}$ at which firms are indifferent between FDI and local production ($\Pi^{FDI,**} = \Pi^{D}$). Let $\tilde{\phi}^{D}$ denote the productivity cutoff level for local firms to break even. Further, assume $\Pi^{FDI,**}(\tilde{\phi}^{D}) < 0$ such that not all firms undertake FDI. It follows that firms with $\tilde{\phi} \in [\tilde{\phi}_{\min}, \tilde{\phi}^{D}]$ will choose not to produce and exit the industry, firms with $\tilde{\phi} \in [\tilde{\phi}^{D}, \tilde{\phi}^{FDI}]$ will produce locally, and firms with $\tilde{\phi} \in [\tilde{\phi}^{FDI}, \tilde{\phi}_{\max}]$ will undertake FDI. The cutoffs are defined implicitly by:

$$B\tilde{\phi}^{D}\omega(r_h)^{1-\sigma} = F^{*}(r_h); \tag{10}$$

$$B\tilde{\phi}^{FDI}\left[\omega(r_h)^{\eta}\omega(r_d(\tilde{\phi}^{FDI}))^{1-\eta}\right]^{1-\sigma} - B\tilde{\phi}^{FDI}\omega(r_h)^{1-\sigma} = F^{FDI,*}(r_h, r_d(\tilde{\phi}^{FDI})) - F^{*}(r_h). \tag{11}$$

The sorting condition $\Pi^{FDI,**}(\tilde{\phi}^{D}) < 0$ can be rewritten as: $\left(\frac{\omega(r_h)}{\omega(r_d(\tilde{\phi}^{D}))}\right)^{(1-\eta)(\sigma-1)} < \frac{F^{FDI,*}(r_h, r_d(\tilde{\phi}^{D}))}{F^{*}(r_h)}$, that is, the extra fixed cost of FDI dominates the wage advantage FDI offers for the least productive surviving firms (given its endogenous choice of r_d if it were to undertake FDI). We assume that this condition holds since sorting of firms by productivity levels into domestic and multinational firms is a well-documented stylized fact.

2.4 Aggregate Bilateral FDI

As suggested by Figure 1, in the limiting scenario with a continuum of destinations r_d, for each destination r_d^o, there is one unique productivity level $\tilde{\phi}^{o}$ of firms in each sector that consider r_d^o as the optimal FDI destination. To arrive at an expression for the aggregate bilateral FDI at the country level, we impose some structures on the sectoral-level parameters. In general, sectors may differ in terms of its global market size B, headquarter intensity η and firm productivity distribution. For simplicity, we suppress the latter two sectoral heterogeneity and work with only the sectoral demand heterogeneity because of its simple multiplicative relationship with firm productivity. We discuss the possibility of generalizing the framework in Section 2.5.

Suppose that the global market size has a uniform distribution across sectors such that $B \sim \mathcal{U}(0,1)$. In addition, assume that firm productivity in each sector follow the same cumulative density function $G(\tilde{\phi})$ with support $\tilde{\phi} \in [1, \infty)$.

For illustrative purposes, focus on a particular destination r_d^o. For a given home country r_h and sector B, this pins down the firm productivity level $\tilde{\phi}^{o}$ that will choose r_d^o as a preferred FDI destination. Specifically, the FOC for r_d^* in (7) requires that $\tilde{\phi}^{o} = C(r_h, r_d^o)/B$, where $C(r_h, r_d) \equiv \left\{w_h^{\eta(1-\sigma)} w_d^{(1-\eta)(1-\sigma)-1}(1-\eta)(1-\sigma)\omega'(r_d)\right\}^{-1} \frac{\partial f(r_d, I^{FDI,*})}{\partial r_d}$ is a constant given r_h and r_d. Thus, a lower sectoral demand B raises the corresponding productivity level of firms that would prefer r_d^o. More formally, we have $d\tilde{\phi}^{o}/dB = -\tilde{\phi}^{o}/B$.

Whether the firm indeed undertakes FDI in r_d^o, however, depends on whether the firm produc-

tivity level $\tilde{\phi}^o$ exceeds the threshold $\tilde{\phi}^{FDI}$. If this is not the case, the FDI profit $\Pi^{FDI,**}$ falls short of domestic profit Π^D and FDI will not realize. Using the cutoff condition (11) for FDI, we can similarly derive the effect of the sectoral demand B on the cutoff productivity $\tilde{\phi}^{FDI}$. In particular, take total differentiation of (11) with respect to B and $\tilde{\phi}^{FDI}$, applying the FOC (7), we have $d\tilde{\phi}^{FDI}/dB = -\tilde{\phi}^{FDI}/B$. Thus, a lower sectoral demand also raises the productivity cutoff for FDI.

Given the response of $\tilde{\phi}^o$ and $\tilde{\phi}^{FDI}$ to the sectoral demand B, we can characterize the bilateral FDI flows across sectors and country pairs. Starting with the highest sectoral demand level $B = 1$, label the corresponding productivity level in this sector that would prefer r_d^o as a potential FDI location as $\tilde{\phi}^o(1)$, and the FDI cutoff level in this sector as $\tilde{\phi}^{FDI}(1)$. It turns out that there are only two possible scenarios.

2.4.1 zero bilateral FDI at the aggregate

In the first scenario, suppose $\tilde{\phi}^o(1) < \tilde{\phi}^{FDI}(1)$ holds. This implies zero FDI in r_d^o from r_h in the sector with the largest demand. As we look across sectors with lower B, since

$$\left|d\tilde{\phi}^o/dB\right| = \left|-\tilde{\phi}^o/B\right| < \left|-\tilde{\phi}^{FDI}/B\right| = \left|d\tilde{\phi}^{FDI}/dB\right|, \tag{12}$$

$\tilde{\phi}^o$ rises by less than $\tilde{\phi}^{FDI}$. As a result, the firm who might prefer r_d^o as a possible FDI destination in a sector always finds domestic production preferable to FDI. Thus, there would be no FDI in r_d^o from r_h for all $B \in [0, 1]$, and hence zero bilateral FDI at the aggregate.

2.4.2 positive bilateral FDI at the aggregate

On the other hand, suppose $\tilde{\phi}^o(1) > \tilde{\phi}^{FDI}(1)$ holds, which implies positive FDI from r_h in r_d^o in the sector with the highest demand. Since in this case,

$$\left|d\tilde{\phi}^o/dB\right| = \left|-\tilde{\phi}^o/B\right| > \left|-\tilde{\phi}^{FDI}/B\right| = \left|d\tilde{\phi}^{FDI}/dB\right|, \tag{13}$$

$\tilde{\phi}^o$ increases faster than $\tilde{\phi}^{FDI}$ as B decreases. Hence, firms who might choose r_d^o as a potential FDI destination also find FDI more profitable relative to domestic production for all $B \in [0, 1]$.

Aggregating across all sectors and firms, we have the bilateral FDI activity from country r_h to

r_d^o (when measured in net profit) as:

$$\begin{aligned} V(r_h, r_d^o) &\equiv \int_0^1 \int_1^\infty \Pi^{FDI}(\tilde{\phi}, B, \eta; r_h, r_d^o)\ \delta\left(\tilde{\phi} - \tilde{\phi}^o(B)\right) g(\tilde{\phi})\, d\tilde{\phi}\, dB \\ &= \int_0^1 \int_1^\infty \left(B\tilde{\phi}\left(w_h^\eta\, \omega (r_d^o)^{1-\eta}\right)^{1-\sigma} - F^{FDI,*}(r_h, r_d^o)\right)\ \delta\left(\tilde{\phi} - \tilde{\phi}^o(B)\right) g(\tilde{\phi})\, d\tilde{\phi}\, dB \\ &= \int_{\tilde{\phi}^o(1)}^\infty \left(C(r_h, r_d^o)\left(w_h^\eta\, \omega (r_d^o)^{1-\eta}\right)^{1-\sigma} - F^{FDI,*}(r_h, r_d^o)\right)\ g(\tilde{\phi}) d\tilde{\phi} \\ &= \left(C(r_h, r_d^o)\left(w_h^\eta\, \omega (r_d^o)^{1-\eta}\right)^{1-\sigma} - F^{FDI,*}(r_h, r_d^o)\right) \int_{\tilde{\phi}^o(1)}^\infty g(\tilde{\phi}) d\tilde{\phi} \\ &= \left(C(r_h, r_d^o)\left(w_h^\eta\, \omega (r_d^o)^{1-\eta}\right)^{1-\sigma} - F^{FDI,*}(r_h, r_d^o)\right)\left(1 - G(\tilde{\phi}^o(1))\right). \end{aligned} \tag{14}$$

where δ is a Dirac delta function and $g \equiv dG/d\tilde{\phi}$ is the density function of firm productivity. Recall that $\tilde{\phi}^o(B) = C(r_h, r_d^o)/B$ by the FOC (7). In the above derivations, the first equality holds because B has a uniform distribution and only firms with productivity $\tilde{\phi}^o(B)$ will choose to engage FDI in destination r_d^o given sectoral demand level B. The second equality substitutes in the expression of the FDI profit, and the third equality follows by integrating over the combinations of (B, $\tilde{\phi}$) that satisfy the FOC (7) such that $B\tilde{\phi}^o = C(r_h, r_d^o)$. The lower bound $\tilde{\phi}^o(1) = C(r_h, r_d^o)$ corresponds to the productivity level of firms that choose r_d^o in the sector with the highest demand ($B = 1$). As B decreases toward zero across sectors, the corresponding productivity level of firms that choose r_d^o increases toward infinity.

We may interpret the first term in (14) as reflecting the 'intensive margin' and the second term the 'extensive margin' of FDI activity. They correspond, respectively, to the average net FDI profit per firm and the mass of firms from country r_h engaging FDI in country r_d^o.[5]

Proposition 4 (Complementarity of Institutional Qualities in Aggregate FDI) *Conditional on positive bilateral FDI: (i) At the intensive margin, bilateral FDI activity at the country aggregate level exhibits complementarity of institutional qualities: multinational firms generate more net profits in countries of poorer institutional qualities, the poorer the institutional environment at home; (ii) At the extensive margin, bilateral FDI activity may exhibit complementarity of institutional qualities (subject to certain qualifying conditions): more multinational firms conduct FDI in countries of poorer institutional qualities, the poorer the institutional environment at home.*

Proof. See the appendix for the proof of Proposition 4(ii). ■

Proposition 4(i) follows from the result $\frac{\partial \Pi^{FDI}}{\partial r_d \partial r_h} > 0$ shown in the proof of (8). In particular, $\frac{\partial \Pi^{FDI}}{\partial r_d \partial r_h}$ corresponds to the numerator of (8) and is shown to be positive for arbitrary combinations of $(r_h, r_d, \tilde{\phi}, B, \eta)$. This implies that the result $\frac{\partial \Pi^{FDI}}{\partial r_d \partial r_h} > 0$ also holds for the profit function Π^{FDI}

[5]The intensive and extensive margins are defined here conditional on positive bilateral FDI flows. This is not exactly the same as how these two margins are sometimes used in the literature. For example, some studies in the trade literature define the extensive margin by the proportion of active trade status among the universe of country-pairs, sectors, or product groups.

in (14) when $r_d = r_d^o$ and $(B, \tilde{\phi})$ satisfies the FOC (7). Thus, the intensive margin of FDI at the aggregate inherits the same institutional complementarity mechanism shown for individual firms in Proposition 3(i), with similar intuitions.

At the extensive margin, poorer institutions, as shown in Proposition 1(iv), raises the total fixed cost of production for MNEs based in these countries, which reduces the outward FDI from the South relative to the North. However, so long as this higher total fixed cost of FDI does not kill the outward FDI from r_h toward a destination r_d^o, home countries with poorer institutions have a larger mass of firms investing in the given destination r_d^o. Intuitively, the higher informal institutional investment made by firms in the South allows less productive firms than their peers from the North to survive in a given FDI destination.

Whether this advantage of the South at the extensive margin is stronger in destinations with poorer institutions depends on two components. First, it depends on whether a higher r_h lowers the productivity cutoff $\tilde{\phi}^o(1)$ by a larger margin in destinations of higher r_d^o. The answer is positive on second-order approximations. Next, it also depends on $g'(\tilde{\phi}^o(1))$, the curvature of the productivity distribution at the cutoff. Intuitively, as r_d^o increases and the corresponding productivity threshold $\tilde{\phi}^o(1)$ increases, the advantage of the South is stronger if $g'(\tilde{\phi}^o(1)) > 0$, as we move up to a productivity level where the density of firms is higher; the reverse is true if $g'(\tilde{\phi}^o(1)) < 0$. Overall, the institutional complementarity effect will hold at the aggregate FDI level if the intensive margin dominates this potential countervailing force at the extensive margin.

2.5 Discussions of the Model

We discuss several possible extensions of the model. First, in the model, we have implicitly assumed that labor productivity is the same across countries in the production of intermediate (headquarter or manufactured) components for differentiated goods. We can relax this assumption without affecting the result, if the wage rate adjusted for labor productivity remains lower in countries of poorer institutional qualities.

Second, for modeling simplicity, we have also assumed that informal institutional endowment is a common good within the firm boundary and fully transnational (i.e., equally effective in combatting weak formal institutions in foreign countries as at home). Admittedly, the informal institution built likely cannot be fully transferred across countries. In alternative setups, we may allow firms to build local informal institutions at home and in the host country separately. The main result will continue to hold, so long as the level of informal institution that a firm can build in the host country is constrained by its home institutional environment.

Third, in the literature, several studies have suggested that larger firms tend to be more politically connected or politically active (Hellman et al., 2003; Faccio, 2006; Li et al., 2006; Chen et al., 2011). In the current setup, domestic firms do not differ in their choices of I. However, as shown by Proposition 3(ii), conditional on firms making the cutoff for FDI, the more productive firms will choose FDI destinations of higher r_d. Since the more productive firms are also larger and the informal institution a firm develops increases with r_d in the current model, this establishes a

positive correlation between firm size and firm-specific investment in informal institutions.

Fourth, the prediction of Proposition 3(ii) is derived from pure vertical-FDI incentives. We can think of some potential factors outside the model that may moderate this stark prediction. For example, in alternative setups with trade frictions, firms may conduct FDI in several destinations (of good or bad institutions) for market-access motives. Nonetheless, it is still likely that the lower bound of institutional qualities of the destinations where a firm engages FDI will be lower, the higher the firm productivity level (all else being equal); intuitively, the higher fixed cost at a destination of poorer institutional qualities raises the bar on firm entry. Yet another possible moderating factor is quality-control risk. If higher firm productivity is partly due to more sophisticated production technologies a firm uses, higher risk of quality-control failure may create disincentives for more productive firms to locate production in countries with lower wages but poorer institutions (Chang and Lu, 2012). As a result, there may arise a non-monotonic relationship between the firm productivity level and the institutional quality of a firm's chosen FDI destination. In firm-level empirical analysis below, we will control for both firm productivity and firm technology intensity to distinguish their different interactions with the destination institutional quality.

Fifth, in deriving the aggregate bilateral FDI, we have assumed the firm productivity support to be unbounded. We may instead impose some upper bound on the productivity support (à la Helpman et al., 2008). This will not affect the zero FDI conclusion in the first scenario (Section 2.4.1) but will introduce additional incidence of zero FDI in the second scenario (Section 2.4.2). Zero FDI in this case will occur not only at the bilateral country level but also at the sectoral level. In particular, let $\bar{\tilde{\phi}}$ be the upper bound of the firm productivity support. Define $b \equiv C(r_h, r_d^o)/\bar{\tilde{\phi}}$; i.e., b is the cutoff on the sectoral demand where the most productive firm would undertake FDI in r_d^o from r_h. For $B < b$, the required productivity level for a firm to choose r_d^o exceeds the upper bound of the productivity support. Thus, FDI will occur only in sectors of sufficiently large demand with $B \in [b, 1]$ for given r_h and r_d^o. We have zero FDI from r_h in r_d^o in all sectors if $b > 1$.

Sixth, in deriving Proposition 4, we focus on the second-order (interaction) effects of home with respect to host institutions on bilateral FDI flows. In doing so, we have assumed that firm productivity distributions do not vary systematically across countries. If developed economies have "better" productivity distributions, it is likely that more firms would be able to pay the fixed cost of FDI and set affiliates in countries with lower wages and poorer institutions. In empirical exercises, we will include home and host-country specific variables to control for such level effects.

Seventh, in deriving the aggregate FDI flows, we have also suppressed possible heterogeneity in headquarter intensity across sectors. In principle, it is possible to introduce another layer of subsectors characterized by $\eta \in [0, 1]$ within each sector $B \in [0, 1]$. For given (B, η), we can identify the unique productivity level $\tilde{\phi}^o(B, \eta)$ of firms that would prefer r_d^o as a FDI destination. Assume $\eta \sim U(0, 1)$, the aggregate bilateral FDI can in principle be derived in a similar way as in (14). The difficulty is to identify the boundary between zero and positive bilateral FDI in terms of both parameters (B, η) and as a result, a closed-form solution for the aggregate bilateral FDI.

Without doubts, the current model has missed some relevant features of multinational produc-

tion, such as outsourcing and horizontal FDI. It is possible to introduce the sorting structure of outsourcing and FDI à la Antràs and Helpman (2004) such that the fixed cost of FDI is greater than outsourcing in the South taking into account the endogenous choice of firm-specific informal institution, and at the same time, the FDI variable profit margin is steeper than outsourcing in a given destination. Similar to how the FDI profit function is derived in Figure 1, the outsourcing profit function taking into account firm's optimal choice of destination will likely be an increasing convex function and cut the domestic and FDI profit functions in the middle spectrum of firm productivity, creating a lower cutoff for outsourcing and an upper cutoff for FDI. Institutional complementarity effect at the firm level is likely to follow for outsourcing as for FDI by a similar mechanism.

In models of horizontal FDI, firms may engage FDI in multiple destinations for market-access motives. However, the same institutional complementarity effect identified in this paper at the firm level is likely to apply to this alternative setting. Assume away differences in wage costs (and thus vertical-FDI incentives). MNEs based in poorer institutions still have a comparative advantage at reducing the overhead cost of FDI at a destination given their heavier informal institutional investment at home, and thus will be more likely to choose FDI over exporting to serve the market with poorer institutions, all else being equal.

3 Empirical Evidence: FDI activities at the country level

Proposition 3(i) hypothesizes that all else equal, a MNE from a country with poorer institutional quality (than another MNE) tend more likely to invest in a destination with poorer institutional quality (than the other MNE's choice of destination). Subject to further qualifying conditions, Proposition 4 further suggests that this institutional complementarity pattern may also hold at the aggregate country level. We now provide empirical evidence consistent with these theoretical predictions.

We start with country-level analysis, and estimate the following equation for FDI:

$$\begin{aligned}\ln(FDI_{hdt}) &= \beta_0 + \boldsymbol{\beta_1(G_{h,t-1} * G_{d,t-1})} + \boldsymbol{\beta_2 G_{h,t-1}} + \boldsymbol{\beta_3 G_{d,t-1}} \\ &\quad + \beta_4 \ln(gdp_{h,t-1}) + \beta_5 \ln(gdp_{d,t-1}) + \beta_6 \ln(gdppc_{h,t-1}) + \beta_7 \ln(gdppc_{d,t-1}) \\ &\quad + \beta_8 \ln(p_{h,t-1}) + \beta_9 \ln(p_{d,t-1}) + \beta_{10} |\ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1})| \\ &\quad + \gamma' X_{hd,t-1} + \varepsilon_{hdt}, \end{aligned} \tag{15}$$

where $FDI_{hd,t}$ measures FDI from country h in country d in year t. Foremost, the institutional qualities of both the home ($G_{h,t-1}$) and destination ($G_{d,t-1}$) countries and their interaction term ($G_{h,t-1} * G_{d,t-1}$) are included as part of the FDI determinants. Proposition 4 implies a relational matching pattern in FDI in terms of institutions. Thus, a positive sign of β_1 will provide support for this hypothesis. On the other hand, an insignificant β_1 would invalidate it, as in this case, the home or destination institution has a uniform impact on FDI regardless of the partner country's

institutional conditions.

In developing the theoretical model, we have abstracted away from many potentially important determinants of FDI suggested by the literature. We control for them empirically in (15). This includes the economic size of the home and host countries (measured by their gross domestic products, $gdp_{h,t-1}$ and $gdp_{d,t-1}$), the income level of the two countries (measured by their GDPs per capita, $gdppc_{h,t-1}$ and $gdppc_{d,t-1}$), and the business operating costs of the two countries (measured by their general price levels, $p_{h,t-1}$ and $p_{d,t-1}$). See Globerman and Shapiro (2002) for a literature survey of how these variables may (or may not) affect FDI. We also include a long list of proxies $X_{hd,t-1}$ to control for transaction and information barriers of FDI. This includes: distance, contiguity, common language, colonial relationship, regional trade agreement (RTA), and currency union (CU). To this list we add bilateral investment treaty (BIT), since in the context of FDI, the presence of BIT may affect the fixed cost of FDI and its pattern as a result.

Fajgelbaum et al. (2015) propose a Linder hypothesis of FDI, whereby MNEs will tend to invest in countries of similar income per capita due to non-homothetic preferences and proximity-versus-concentration trade-off in serving foreign markets. This mechanism is controlled for by including the absolute value of the difference in log income per capita between the home and host countries $|\ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1})|$, as in their study. Thus, the institutional complementarity effect presented below is independent of potential Linder effects due to income similarity.

3.1 Data and Measurement

The FDI data were obtained from the UNCTAD's Bilateral FDI Statistics, which consists of 206 economies reporting their FDI inward stock, outward stock, inward flows, and outward flows (in current US dollars) from and to each of the partner countries during year 2001–2010. The set of partner countries ever recorded during this period consist of 193 economies, 13 of them not in the set of reporters. To the best of our knowledge, this dataset is the most comprehensive in terms of country coverage on bilateral FDI flows: including poor and institutionally weak countries as FDI source or destination countries.[6] This is an advantage for this study, as it allows us to incorporate the less investigated spectrum of South-South FDI.

In this dataset, the inward FDI series reported by the recipient country d (from h) is not necessarily equal to the outward FDI series reported by the origin country h (to d). Given this, we do not attempt to correct the measurement errors, but instead choose to measure FDI_{hdt} based on each of these four series alternately and look for a robust pattern across the series.

We measure a country's institutional quality based on the Worldwide Governance Indicators (WGI), in six dimensions: voice and accountability (VA), political stability and absence of violence (PV), government effectiveness (GE), regulatory quality (RQ), rule of law (RL), and control of corruption (CC).[7] Kaufmann et al. (2010) provide details on the construction of these indicators. Since these indicators are highly correlated with one another, we include them one at a time in the

[6] http://unctad.org/en/Pages/DIAE/FDI%20Statistics/FDI-Statistics-Bilateral.aspx.

[7] http://data.worldbank.org/data-catalog/worldwide-governance-indicators.

estimation of (15). For each governance indicator, a country receives both a point estimate ranging from approximately -2.5 (weak) to 2.5 (strong), and a percentile ranking among all countries. The higher the index, the better the institutional quality. We report the results based on the point estimate, although findings are qualitatively similar based on the percentile ranking.

The data on GDP and GDP per capita (in current US dollars) are based on the World Development Indicators.[8] We construct the general price level of a country relative to the United States by the ratio of its GDP (per capita) in current US dollars to its GDP (per capita) in current PPP dollars. This variable aims to capture the overall cost of production (including, e.g., rent, wages, intermediate materials and infrastructure) facing the firms operating in the country.

The transaction and information cost proxies $X_{hd,t-1}$ were compiled from several sources. The CEPII website provides the data on bilateral distance, and whether two countries are contiguous (*contig*), share a common language (*comlang*), have ever had a colonial link (*colony*), have had a common colonizer after 1945 (*comcol*), are currently in a colonial relationship (*curcol*) or were/are the same country (*smctry*).[9] The data on whether two countries are currently in a regional trade agreement (*rta*), and whether they use a common currency (*comcur*) were retrieved from de Sousa's website.[10] Last but not least, the data on bilateral investment treaties were obtained from UNCTAD. We construct a dummy variable that equals one if a BIT is currently in force between a country pair and zero otherwise, according to the date a BIT enters into force (and the date it is terminated if ever).[11]

All regressors (if time variant) are lagged one period relative to the FDI variable, to reduce the concern of reverse causality. We also experiment using longer lags of the right-hand-side variables in unreported exercises; the results are similar.

In sum, the study covers bilateral FDI stocks (flows) for 219 economies in 2001–2010, with attrition in the sample size due to missing entries or gaps in the data. The effective sample size varies, depending on the FDI series used and the estimation specification studied.[12]

Figure 3 illustrates FDI inflows from countries of poorer institutional quality received by the world, by host countries of poorer institutional quality, and by host countries of better institutional quality, as a fraction of their total FDI inflows, respectively. To classify the source/destination of FDI by institutional quality, we merge the bilateral FDI data with the WGI data (with one-year lag). The cutoff for the institutional quality indicator is set at the 65 percentile to match approximately the proportion of developing countries in the world (139 developing countries and 75 developed countries in 2015 by the World Bank classification).

[8] http://data.worldbank.org/data-catalog/world-development-indicators.

[9] http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=6. See Mayer and Zignago (2011) for further details.

[10] http://jdesousa.univ.free.fr/data.htm. See also de Sousa (2012).

[11] http://investmentpolicyhub.unctad.org/IIA. We set the cutoff date to be July 1st of the current year in defining the year-varying dummy *bit*.

[12] The whole set of 219 economies consists of 206 reporting countries and 13 partner countries that did not appear as reporting countries. Gaps in the data, for example, occur in the governance indicators, which are not available for year 2001. Missing data arise mainly due to the dependent variable, although different country coverage across data sources leads to missing data on the independent variables as well.

Note that the fraction of FDI inflows from countries of poorer institutional quality shown in Figure 3 is likely systematically under-reported than their counterpart reported by UNCTAD (cited in the introduction) for a few reasons. First, the FDI data used to generate the plot are aggregated from bilateral FDI entries, and bilateral FDI entries may show up as missing for minor sources (which tend to be less developed countries) when they are not separately reported. Second, even when the FDI data are not missing, the WGI data may be missing and more likely to be missing for less developed countries. Third, the 65% cutoff also excludes the mass of transition economies that fall into high-income (developed) countries. For these reasons, we will not focus on the absolute magnitude of the numbers in Figure 3 but their relative magnitudes across groups of reporting countries.

Figure 3 indicates that the share of FDI flows from institutionally poor countries received by their counterparts are higher than the world average (which also corresponds to the share of these countries in worldwide FDI outflows). At the same time, the share of FDI flows received by institutionally strong countries from the poor ones are less than the world average. The asymmetry is especially pronounced when countries are classified by institutional quality in VA, GE and RQ, slightly less so in terms of RL and CC, and with no clear pattern in terms of PV.[13] This provides an illustrative evidence of institutional complementarity in bilateral FDI flows. As we will see in the following analysis, this complementarity effect still holds true after controlling for an extensive list of FDI determinants.

3.2 Results

Table 1 presents the OLS estimation result of (15) for FDI inward stock reported by the recipient country. As shown by the table, the coefficient on $(G_d * G_h)$ is positive and significant, regardless of the indicators used to measure institutional quality, supporting the paper's main prediction.

Most of the other coefficients are precisely estimated and consistent with ex ante theoretical predictions. A larger home or host market size, a lower production cost at the destination and a higher production cost at home, physical proximity, common language, colonial relationship, and currency union all help raise bilateral FDI stock. Regional trade agreements and bilateral investment treaties do not have robust positive effects on bilateral FDI. In fact, BIT is shown to have a negative (and statistically significant) effect on inward FDI stock. This result, however, is not robust to variations in estimation specifications as will be discussed later. The Linder hypothesis of Fajgelbaum et al. (2015) is also supported overall by the data.

Table 2 summarizes the results when the FDI activity is measured by outward stock of the reporting country, or flows instead of stocks. The sign of the coefficient on $(G_h * G_d)$ is significantly positive and robust across all FDI series, and across all institutional indicators (except PV). The results above are hardly affected if we also control for year fixed-effects in the baseline specification (15).

[13]The WGI data are missing for year 2001, which would be used to classify countries' FDI flows in 2002. This explains the missing entries in the figure for year 2002.

3.3 Robustness Checks

3.3.1 With multilateral fixed-effects (FE)

In this section, we include destination-country-year and home-country-year FE as a robustness check, following the work of Head and Ries (2008) and de Sousa and Lochard (2011).

Table 3 summarizes the results. The findings are quite similar regardless of the FDI series used (in stocks or flows, reported by the recipient or the country of origin). The institutional complementarity effect is robust to the inclusion of time-variant multilateral FE controls, and is statistically significant overall. Most of the other variables (unreported) have qualitatively similar effects on FDI as in the benchmark. In contrast, the BIT effect has in general become insignificant (rather than being negative) and the RTA effect has turned statistically positive.

3.3.2 With zero FDI observations

In the second robustness check, we take into account the presence of zero observations on FDI. The raw data differentiate between missing data (data that are not available or are not separately reported) and zero data (where the item is equal to zero or negligible). The pattern of zero and missing FDI data suggests some degrees of measurement errors (e.g., the recipient country reports zero FDI while the origin country reports missing or positive FDI). Having no convincing ways of correcting the data, we use only the positive and zero FDI entries, and treat the missing FDI entries as literally missing and drop them from the analysis.[14]

In unreported exercises, we conduct Probit estimations and find that the same set of regressors in specification (15) have good explanatory powers of the likelihood of having an active bilateral FDI relation (in terms of either stocks or flows). In particular, the interaction term of institutions have the same positive effect on the likelihood of an active bilateral FDI status as on the volume of FDI reported above. Given this, we estimate the joint effects on both intensive and extensive margins using the Tobit estimation method à la Eaton and Kortum (2001). This is implemented by the STATA *intreg* command, where the lower censoring point is allowed to vary across observations and set at the minimum positive value reported by each reporting country. For example, the lower censoring point is \$1 million US dollars for FDI inward stock reported by the United States, and \$2000 US dollars for FDI outward flow reported by El Salvador.

As shown in Table 4, the coefficient on $(G_h * G_d)$ now roughly doubles compared to the benchmark, and is significantly positive across all institutional quality indicators and FDI series. The coefficient estimates for most other variables (unreported) increase in magnitude relative to the benchmark, as may be expected given that OLS estimates of bottom truncated data tend to be downward biased toward zero. In particular, the sign of BIT turns around and becomes significantly positive. This indicates the importance of BIT at driving the extensive margin of FDI. This is also supported by the unreported Probit estimations where BIT is found invariably to raise the

[14] We also drop the negative FDI entries from the analysis, as they cannot be accounted for by the current theoretical or empirical framework.

likelihood of positive FDI.

3.3.3 More robustness checks

We conduct several other robustness checks in terms of the measures of institutional quality, the samples, the estimators, and the estimation specifications. First, the results are qualitatively similar if we measure the institutional quality of a country by its percentile ranking instead of point estimate from WGI. Second, by dropping territories that are considered tax havens, the institutional complementarity effect estimates turn out to be stronger in general across all FDI measures and institutional indicators.[15] Third, we repeat the estimations using different subsets of countries in income levels (setting income ceiling for the FDI recipient countries at the 25%, 50%, or 75% of all countries in the current year). The institutional complementarity effect still holds in general, across estimation specifications or with zero FDI observations.

In dealing with zero FDI observations, we have taken the Tobit approach à la Eaton and Kortum (2001). This approach supposes that there is a minimum level of FDI, such that if the latent value FDI^*_{hdt} falls below this threshold, we observe $FDI_{hdt} = 0$, but otherwise we observe $FDI_{hdt} = FDI^*_{hdt}$. For example, FDI values that fall short of a certain threshold may fail to be recognized by government agencies. This approach is also consistent with a structural interpretation of zero FDI, where FDI activity is observed only if the profits of FDI exceed that of domestic production. Thus, the intensive and extensive margins (at the bilateral country level) are inherently related: a FDI relation is more likely to be dormant where potential FDI profit is small. Another approach proposed by Silva and Tenreyro (2006) in the trade literature, in contrast, treats zeros as random realizations modelled by the Poisson process, and estimates the dependent variable in levels with the Poisson Pseudo Maximum Likelihood (PPML) estimator. When we apply the PPML estimator to the FDI data, the results are not as regular as the Tobit estimates. The coefficient on the income difference has the wrong (positive) sign and rejects the Linder hypothesis of Fajgelbaum et al. (2015). The coefficient on the institutional interaction term is not as uniformly precisely estimated as in the Tobit estimation, although the signs are correct in most cases and statistically significant in several cases.[16]

To exclude the possibility that South-South FDI may be driven by their similarity in industrial structures, we repeat the estimations by including an index of industrial structure similarity between two countries.[17] The industrial structure similarity index does not have a robust sign or significant

[15] We consider two alternative lists of tax havens. The first list was published by the EU on 18 June 2015. This includes (30 of them): Andorra, Anguilla, Antigua and Barbuda, Bahamas, Barbados, Belize, Bermuda, British Virgin Islands, Brunei, Cayman Islands, Cook Islands, Grenada, Guernsey, Hong Kong, Liberia, Liechtenstein, Maldives, Nauru, Niue, Marshall Islands, Mauritius, Monaco, Montserrat, Panama, St Kitts and Nevis, St Vincent and the Grenadines, Seychelles, Turks and Caicos, US Virgin Islands, and Vanuatu (http://www.eubusiness.com/news-eu/economy-politics.120n). The second, shorter, list by Investopedia consists of: Andorra, Bahamas, Belize, Bermuda, British Virgin Islands, Cayman Islands, Channel Islands, Cook Islands, Hong Kong, Isle of Man, Liechtenstein, Mauritius, Monaco, Panama, Switzerland and St. Kitts and Nevis (http://www.investopedia.com/terms/t/taxhaven.asp).

[16] See Head and Mayer (2015, p. 178–180) for further discussions of these two approaches (Tobit and PPML), in particular, with regard to their difference in interpretations based on structural versus random zeros.

[17] The measure is constructed as $indsim_{hdt} = 1 - \sqrt{\sum_{j=1}^{J}(va_{ht,j} - va_{dt,j})^2}/J$, where $va_{ht,j}$ is the value added of

effect on FDI flows. The coefficient on the institutional interaction term remains positive and significant overall across all estimations (benchmark, with multilateral effects, or with zero FDI observations).

There may be concerns that the coefficient estimate on the institutional interaction term is picking up higher-order effects of institutions on FDI. However, any such nonlinear effects of institutions (such as $G^2_{h,t-1}$ and $G^2_{d,t-1}$) would have been absorbed by the multilateral home-country-year and host-country-year fixed effects, and as shown in Table 3, the positive institutional complementarity effect is robust to the inclusion of such fixed effects.

Culture (socially shared values) and institutions (socially shared rules) are two concepts that are sometimes difficult to disentangle, and likely to be highly correlated with each other. In the list of regressors in (15), we have controlled for dimensions of culture in terms of language and the current and past colonial relationships between countries. The above results show that institution has its own independent effects on FDI flows. We also repeat the estimations by including an index of religion similarity between countries as an extra control for cultural similarity.[18] Similarity in religion compositions between two countries helps raise bilateral FDI flows. Nonetheless, the institutional complementarity effect remains positive and significant overall across estimations (with the same caveat regarding PV).

Finally, given that institutional quality does not change much over time, we may also consider restricting the analysis to a cross-sectional analysis by taking the average during 2001–2010 of the FDI measures, the institutional quality, and the other time-variant variables. We run cross-sectional estimations in parallel to the baseline specification (15), the specification with multilateral FE, and the Tobit estimation with zero FDI. The institutional complementarity effect is in general stronger and similar in patterns as documented above for the panel-data analysis.

sector j in year t, as a percentage of GDP of country h, and similarly defined for $va_{dt,j}$. Data were obtained from World Development Indicators, and are available on four distinct sectors: agriculture (ISIC divisions 1-5), manufacturing industry (ISIC divisions 15-37), non-manufacturing industry (ISIC divisions 10-14 and 38-45; including mining, construction, electricity, water, and gas), and services (ISIC divisions 50-99).

[18] The religion index is constructed based on the religion dataset of Maoz and Henderson (2013). The index follows Maoz and Henderson (2013) and measures the similarity of religious compositions between two countries as $relsim_{hdt} = 1 - \sqrt{\sum_{r=1}^{R}(ra_{ht,r} - ra_{dt,r})^2}/R$, where $ra_{ht,r}$ is the proportion of population in country h in year t that are adherents of religion r and similarly defined for $ra_{dt,r}$. We used the top four religion categories: Christianity, Judaism, Islam and Buddhism. The results are similar if we used instead all 14 listed religion categories. The data are available for the period 1945–2010 in every five-year interval. We use the 2000 data for years 2000–2004, the 2005 data for years 2005–2009, and the 2010 data for years 2010–2015.

4 Empirical Evidence: FDI activities at the firm level

We now provide further analysis based on firm-level data to test the predictions of Proposition 3, and estimate the following specification:

$$\begin{aligned}\ln(FDI_{fshdt}) \;=\; & \boldsymbol{\beta_1(G_{h,t-1} * G_{d,t-1})} \\ & +\beta_2 \ln(prod_{f,t-1}) + \boldsymbol{\beta_3\,(\ln(prod_{f,t-1}) * G_{d,t-1})} \\ & +\beta_4 RD_{f,t-1} + \boldsymbol{\beta_5(RD_{f,t-1} * G_{d,t-1})} \\ & +\beta_6 |\ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1})| + \gamma' X_{hd,t-1} \\ & +\chi_{ht} + \zeta_{dt} + \kappa_{ds} + \varepsilon_{hdsft}, \end{aligned} \tag{16}$$

where FDI_{hdsft} measures FDI activity in sector s by firm f of origin h in destination d in year t, $G_{c,t-1}$ country c's institutional quality in year $t-1$, $prod_{f,t-1}$ firm f's productivity in year $t-1$, and $RD_{f,t-1}$ firm f's R&D intensity in year $t-1$.

By Proposition 3(i), we expect to find $\beta_1 > 0$ such that firms from countries of better institutions tend to engage more FDI in destinations of better institutions (relative to another firm of similar characteristics except countries of origin) and vice versa. The next two terms test the prediction of Proposition 3(ii), which suggests $\beta_3 < 0$ because more productive firms with larger market shares have stronger incentives to locate production in cheaper locations (poorer institutions in the current framework). To distinguish this effect of productivity on FDI from that of quality control risk as suggested by Chang and Lu (2012), we also include R&D intensity to proxy for a parent firm's technology sophisticatedness. The theory of Chang and Lu (2012) suggests that firms with more complicated production technology have weaker incentives to engage in vertical FDI for risk of quality-control failure ($\beta_4 < 0$), but such disincentive is less severe in destinations of better institutions ($\beta_5 > 0$).

The three sets of indicator variables, $\{\chi_{ht}, \zeta_{dt}, \kappa_{ds}\}$, control for origin-year, destination-year, and destination-sector fixed effects. For example, the effects of sectoral demand and headquarter intensity on the choice of FDI location, as suggested by Proposition 3(iii)–(iv), will be absorbed by the destination-sector FEs. The remaining terms — difference in log GDPs per capita and country relational characteristics — are again included to control for the Linder effect and other determinants of FDI.

4.1 Data and Measurement

We construct a panel of firm-level FDI data for the period 2009–2016, combining the *fDi Markets* database (that tracks the greenfield FDI activities) and the Orbis dataset (that provides the firm-level financial information). The period of study is dictated by the availability of the Orbis firm-level data.

4.1.1 Firm-level FDI Data

The *fDi Markets* database is a service offered by the Financial Times that tracks cross-border greenfield investment in all sectors and countries. It provides real-time monitoring of investment projects, capital investment and job creation. For every project initiated overseas, this dataset records the date when a project is carried out, the parent firm initiating it, the location of the parent firm (country-state-city), the industry sector of FDI, the host country (and city), the capital investment of the project (in million USD), and the number of jobs created. The advantage of *fDi Markets* is that each project is cross-referenced against multiple sources so that the information is relatively accurate.

This dataset is used as the primary source of greenfield FDI information by various organizations such as UNCTAD and World Bank. It is also increasingly used in FDI studies. For example, Desbordes and Wei (2017) use this dataset to examine the effect of financial constraints on FDI activities. Chan and Zheng (2017) study the effect of networks on outward FDI; Castellani and Lavoratori (2017) exploit the information on the type of project to study the co-location and agglomeration of FDI.

We collapse the firm-level capital investment (originally reported by date and at the city level) into year and destination country basis. Thus, the measure of FDI is at the level of firm, sector, origin country, destination country, and year. For the period 2009–2016, there are 35,039 unique firms from 168 origin countries that conduct greenfield FDI in 200 destination countries.

4.1.2 Firm-level Characteristics

Firm-level financial data (lagged one year) were retrieved from Orbis (compiled by Bureau van Dijk). This dataset provides comprehensive information on private companies worldwide. In particular, we use the information on operating revenues, number of employees, total assets, material costs, and research and development (R&D) expenses. Data were downloaded in US dollars. The Orbis dataset includes over 280 million companies across the globe, so it is infeasible to download all observations. We download the subset of firms that satisfy the following criteria during 2008–2016: (i) firms with observations in at least one year on operating revenues, number of employees, and total assets, and (ii) also with observations in at least one year on material costs (or alternatively, costs of goods sold and costs of employees), since these variables are required in the estimation of firm productivity.[19]

We then merge firms from the FDI dataset with the Orbis observations to obtain the parent firm's annual financial data for the period 2008–2016. The merge process relies on match of two key identifiers — firm name and home country — from both datasets, based on fuzzy matching programs and manual inspection.[20] In the end, we have about 25% of firms in the *fDi Markets*

[19]When the information on material costs is missing, it is proxied by the difference between the costs of goods sold and the costs of employees.

[20]Stata provides a fuzzy matching program, *reclink2*. It is an algorithm for probabilistic record linkage. In particular, it compares strings to determine whether records are 'similar' and provides scores of similarity. The package also provides an algorithm, *stnd_compname*, to pre-process (standardize) company names. We standardize

dataset that are successfully matched to firms from Orbis.

Given the set of parent firms with financial data, we then estimate their productivity using the Levinsohn and Petrin (2003) (LP) method.[21] In the estimation process, we allow the production functions to differ across sectors, where the sector is defined according to the industry sector of FDI reported for the firm by the *fDi Markets* dataset (39 sectors in total). This process provides a panel of productivity estimates for each firm across years according to its sector of FDI. The R&D intensity is constructed as the ratio of R&D expenses to operating revenues. The remaining country-level variables are measured in the same way as documented in Section 3.

In sum, the sample of observations used in the analysis refer to an incident of greenfield foreign capital investment in a sector and year by a firm reported by *fDi Markets* and the corresponding characteristics of the investing firm, origin and destination countries (lagged by one year). Thus, effectively, the observations use variations in FDI during 2009–2016 and those of firm/country characteristics during 2008–2015.

Table 5 provides the summary statistics of the firm-level variables. For the period 2009–2016, the minimum positive FDI value is 8 thousand USD, while the maximum is 18.5 billion USD, with mean at approximately 35.9 million USD. This indicates a large extent of heterogeneities in FDI capital investment across years and across firms.

Next, we present in Table 6 the institutional quality of home and destination countries of FDI in terms of the six WGI indicators. First, it is evident that FDI origins on average have better institutional qualities. This is to some extent consistent with the theory's setting, where FDI tends to flow South ($w_h > w_d$, i.e., $r_h < r_d$) such that the higher variable profit of FDI helps offset the higher fixed cost of FDI. Second, the table also indicates that FDI recipient countries are more dispersed than origins in terms of institutional qualities (standard deviations are larger, while means are lower, for FDI recipient countries).

Unlike the country-level analysis, it is infeasible to conduct analysis incorporating the extensive margin using Probit or Tobit estimations, because the universe of FDI relations (nil or active) across all firm-sector-origin-destination-year combinations is too large for typical computing capacity to handle. Thus, the subsequent analysis focus on firms that were recorded to have undertaken FDI during 2009–2016. We will use the PPML estimator, because zero FDI values exist where the firm does not reveal the amount of capital investment.

each firm's name in both datasets before applying the matching program. Because *reclink2* is a fuzzy matching algorithm, manual check is required to ensure the accuracy. We inspect each record of matched pairs and verify whether they are indeed the same company. Matched pairs where the (core) standardized names are different are dropped.

[21] A possible alternative is the methodology proposed by Olley and Pakes (1996) (OP). We choose the LP approach because it uses intermediate inputs as a proxy for unobserved productivity; it is common that firms report positive use of materials, so that we may preserve as many observations as possible. In contrast, the OP method relies on *investment* as the proxy, whose level depends on the depreciation rate assumed and may be non-positive. See Van Beveren (2012) for a review of alternative methodologies to estimate firm productivity.

4.2 Results

Table 7 reports the PPML estimation results of equation (16). As shown by the table, the coefficient on (G_h*G_d) is positive and significant across all the six governance indicators. This provides support for the paper's main theoretical prediction of an institutional complementarity effect on firm-level FDI activities. In addition, the negative sign of the coefficient on ($prod_f * G_d$) is also consistent with Proposition 3(ii). That is, more productive firms in fact have stronger incentives to engage more FDI in destinations of lower wages, given their larger market shares. At the same time, their heavier investment in informal institutions allow them to operate in such destinations of poorer institutions. Interestingly, the theory of Chang and Lu (2012) also finds support in this exercise, where the coefficient for RD_f is significantly negative but that for ($RD_f * G_d$) is positive. Thus, quality-control risk does present itself as a critical concern in firms' FDI decision.

Coefficients on the country-level variables, when precisely estimated, are in general consistent with prior expectations. One notable exception is the positive sign of the coefficient on the difference in GDPs per capita, contrary to the Linder hypothesis of Fajgelbaum et al. (2015). This result could be due to the pooling of both vertical and horizontal FDI. As vertical FDI is motivated by cost-saving considerations, larger differences in incomes between origins and destinations can promote FDI flows. Unfortunately, there is no satisfactory way to disentangle the two modes of FDI in this exercise (following methods such as in Alfaro and Charlton, 2009), because the *fDi Markets* dataset reports the type of FDI activity in only very broad categories.

4.3 Robustness Checks

We carry out similar robustness checks as for the country-level FDI. The qualitative results are very similar if we use the WGI percentile ranking (of institutions across countries) instead of point estimates. We continue to find a complementarity pattern in institutional qualities, a negative effect of destination institutional quality on the FDI of more productive firms, and a positive effect of destination institutional quality on the FDI of firms of higher R&D intensity.

We then consider dropping countries deemed to be tax havens (using two alternative lists of such countries *cf.* Footnote 15). The patterns documented above for the benchmark sample continue to hold in this scenario.

We then add, as extra controls, the similarity of industrial structures of the home and destination countries, or the similarity of their religion compositions (*cf.* Footnotes 17 and 18). Similarity in industrial structures increases FDI by firms. Nonetheless, our key theoretical predictions continue to hold in the data. In fact, the estimate of the institutional complementarity effect increases in magnitude across the board. Likewise, similarity in religion compositions has positive effects on firm-level FDI, but including the extra control does not alter the conclusion for all key variables of interest discussed above in the benchmark scenario.

Finally, instead of the revenue production function, we also estimate firm productivity levels based on the value-added production function using the LP method. The institutional complementarity effect continues to be positive and highly statistically significant. The coefficient on R&D

intensity remains to be negative and that on its interaction with destination institutional quality positive. Nevertheless, the coefficient on the interaction term of productivity and destination institutional quality, despite being negative across five of six governance indicators, is in general statistically insignificant unlike the benchmark case.

In sum, we find robust empirical support for the theory's main prediction of an institutional complementarity effect at the firm-level FDI (*cf.* Proposition 3(i)).

5 Conclusion

In this paper, we have proposed a theoretical framework to micro-found the hypothesis that South-based MNEs have a comparative advantage to deal with the inefficiency associated with weak formal institutions and to maneuver in relationship-based investment environment, relative to their peers from the North. The theory predicts a complementarity in institutional qualities of the home and host countries in bilateral FDI flows. This helps explain the greater presence of South-based MNEs in countries of relatively poorer institutions.

We have conducted an extensive test of the theory using bilateral FDI for 219 economies during the period 2001–2010. The results indicate a statistically significant complementarity effect in institutional qualities. The finding is robust to the FDI series studied, the institutional indicators used, the inclusion of multilateral country fixed-effects, and the consideration of zero FDI. In addition to predictions on bilateral FDI activity at the country level, the paper's theoretical framework also suggests interesting testable predictions at the firm and sectoral levels. In particular, a firm will choose to undertake FDI in countries of poorer institutional qualities, the poorer the institutional quality at home and the more productive the firm is, all else being equal. Using a worldwide firm-level FDI dataset during the period 2009–2016 (with 35,039 unique firms from 168 origin countries that conduct greenfield FDI in 200 destination countries), we find evidence supporting these firm-level predictions.

References

Acemoglu, D., Johnson, S., 2005. Unbundling institutions. Journal of Political Economy 113, 949–995.

Alfaro, L., Charlton, A., 2009. Intra-industry foreign direct investment. American Economic Review 99, 2096–2119.

Antràs, P., Helpman, E., 2004. Global sourcing. Journal of Political Economy 112, 552–580.

Arkolakis, C., et al., 2018. Innovation and production in the global economy. American Economic Review (Forthcoming).

Aykut, D., Ratha, D., 2004. South-South FDI flows: How big are they? Transnational Corporations 13, 149–176.

Bai, C.-E., Hsieh, C.-T., Song, Z. M., 2014. Crony capitalism with Chinese characteristics. Tsinghua University and University of Chicago.

Bénassy-Quéré, A., Coupet, M., Mayer, T., 2007. Institutional determinants of foreign direct investment. World Economy 30, 764–782.

Cai, H., Fang, H., Xu, L. C., 2011. Eat, drink, firms, government: An investigation of corruption from the entertainment and travel costs of Chinese firms. Journal of Law and Economics 54, 55–78.

Castellani, D., Lavoratori, K., 2017. Location of R&D abroad: An analysis on global cities. John H Dunning Centre for International Business Discussion Papers jhd-dp2017-03. Henley Business School, Reading University.

Chan, J. M., Zheng, H., 2017. Migrant networks, greenfield FDI, and cross-border mergers and acquisitions. manuscript.

Chan, K. S., Xu, X., Gao, Y., 2015. The China growth miracle: The role of the formal and the informal institutions. World Economy 38, 63–90.

Chang, P.-L., Lu, C.-H., 2012. Risk and the technology content of FDI: A dynamic model. Journal of International Economics 86, 306–317.

Chen, C. J., et al., 2011. Rent-seeking incentives, corporate political connections, and the control structure of private firms: Chinese evidence. Journal of Corporate Finance 17, 229–243.

Cuervo-Cazurra, A., Genc, M., 2008. Transforming disadvantages into advantages: Developing-country MNEs in the least developed countries. Journal of International Business Studies 39, 957–979.

Darby, J., Desbordes, R., Wooton, I., 2010. Does public governance always matter? How experience of poor institutional quality influences FDI to the South. Cesifo Working Paper No. 3290.

de Sousa, J., 2012. The currency union effect on trade is decreasing over time. Economics Letters 117, 917–920.

de Sousa, J., Lochard, J., 2011. Does the single currency affect foreign direct investment? Scandinavian Journal of Economics 113, 553–578.

Desbordes, R., Wei, S.-J., 2017. The effects of financial development on foreign direct investment. Journal of Development Economics 127, 153–168.

Dixit, A., 2012. Governance, development, and foreign direct investment. Max Weber Lecture Series 2012/01.

Eaton, J., Kortum, S., 2001. Trade in capital goods. European Economic Review 45, 1195–1235.

Faccio, M., 2006. Politically connected firms. American Economic Review 96, 369–386.

Fajgelbaum, P., Grossman, G. M., Helpman, E., 2015. A Linder hypothesis for foreign direct investment. Review of Economic Studies 82, 83–121.

Fisman, R., 2001. Estimating the value of political connections. American Economic Review 91, 1095–1102.

Frye, T., Zhuravskaia, E., 2000. Rackets, regulations and the rule of law. Journal of Law, Economics and Organization 16, 478–502.

Garetto, S., 2013. Input sourcing and multinational production. American Economic Journal: Macroeconomics 5, 118–51.

Globerman, S., Shapiro, D., 2002. Global foreign direct investment flows: The role of governance infrastructure. World Development 30, 1899–1919.

Habib, M., Zurawicki, L., 2002. Corruption and foreign direct investment. Journal of International Business Studies 33, 291–307.

Hay, J. R., Shleifer, A., 1998. Private enforcement of public laws: A theory of legal reform. American Economic Review 88, 398–403.

Head, K., Mayer, T., 2015. Gravity equations: Workhorse, toolkit, and cookbook. In: Helpman, E., Rogoff, K., Gopinath, G. (Eds.), Handbook of International Economics, North-Holland, vol. 4, chap. 3, pp. 131–196.

Head, K., Ries, J., 2008. FDI as an outcome of the market for corporate control: Theory and evidence. Journal of International Economics 74, 2–20.

Hellman, J. S., Jones, G., Kaufmann, D., 2003. Seize the state, seize the day: state capture and influence in transition economies. Journal of Comparative Economics 31, 751–773.

Helmke, G., Levitsky, S., 2004. Informal institutions and comparative politics: A research agenda. Perspectives on Politics 2, 725–740.

Helpman, E., 2006. Trade, FDI, and the organization of firms. Journal of Economic Literature 44, 589–630.

Helpman, E., Melitz, M., Rubinstein, Y., 2008. Estimating trade flows: Trading partners and trading volumes. Quarterly Journal of Economics 123, 441–487.

Irarrazabal, A., Moxnes, A., Opromolla, L. D., 2013. The margins of multinational production and the role of intrafirm trade. Journal of Political Economy 121, 74–126.

Kaufmann, D., Kraay, A., Mastruzzi, M., 2010. The worldwide governance indicators: Methodology and analytical issues. The World Bank Policy Research Working Paper 5430.

Levinsohn, J., Petrin, A., 2003. Estimating production functions using inputs to control for unobservables. Review of Economic Studies 70, 317–341.

Li, H., Meng, L., Zhang, J., 2006. Why do entrepreneurs enter politics? Evidence from China. Economic Inquiry 44, 559–578.

Maoz, Z., Henderson, E. A., 2013. The world religion dataset, 1945–2010: Logic, estimates, and trends. International Interactions 39, 265–291.

Mayer, T., Zignago, S., 2011. Notes on CEPII's distances measures : The GeoDist database. CEPII Working Paper 2011-25.

McMillan, J., Woodruff, C., 1999a. Disputes prevention without courts in Vietnam. Journal of Law, Economics and Organization 15, 637–58.

—, 1999b. Interfirm relationships and informal credit in Vietnam. Quarterly Journal of Economics 114, 1285–1320.

—, 2002. The central role of entrepreneurs in transition economies. Journal of Economic Perspectives 16, 153–70.

Olley, G. S., Pakes, A., 1996. The dynamics of productivity in the telecommunications equipment industry. Econometrica 64, 1263–1297.

Pereira, A. A., 2002. The Suzhou industrial park project (1994–2001): The failure of a development strategy. Asian Journal of Political Science 10, 122–142.

Ramondo, N., Rodríguez-Clare, A., 2013. Trade, multinational production, and the gains from openness. Journal of Political Economy 121, 273–322.

Silva, J. M. C. S., Tenreyro, S., 2006. The log of gravity. Review of Economics and Statistics 88, 641–658.

UNCTAD, 2014. World Investment Report 2014: Investing in the SDGs: An Action Plan. United Nations, New York and Geneva.

Van Beveren, I., 2012. Total factor productivity estimation: A practical review. Journal of Economic Surveys 26, 98–128.

Williamson, O. E., 2000. The new institutional economics: Taking stock, looking ahead. Journal of Economic Literature 38, 595–613.

Math Appendix

Proof of Proposition 4(ii). To derive the effect of institutions on the extensive margin of FDI, we proceed in three steps. First, note that $\frac{\partial \tilde{\phi}^o(1)}{\partial r_h} < 0$. To see this, use Proposition 3(i) and 3(ii). Since both r_h and $\tilde{\phi}$ raise the optimal choice of r_d, the two must move in opposite directions holding the destination r_d^o constant. More formally, taking total differentiation of (7) with respect to r_h and $\tilde{\phi}$, setting $dr_d = 0$, we have

$$\frac{\partial \tilde{\phi}^o(1)}{\partial r_h} = -\frac{\frac{\partial \Pi^{FDI}}{\partial r_d^o \partial r_h}}{(1-\eta)(1-\sigma) w_h^{\eta(1-\sigma)} w_d^{(1-\eta)(1-\sigma)-1} \omega'(r_d^o)} < 0, \tag{17}$$

where both the numerator and the denominator are positive as shown in the proof of (8) and (9).

Given the above result, it follows that

$$\frac{\partial \left(1 - G(\tilde{\phi}^o(1))\right)}{\partial r_h} = -g(\tilde{\phi}^o(1)) \frac{\partial \tilde{\phi}^o(1)}{\partial r_h} > 0. \tag{18}$$

Next, we analyze whether this advantage of the South at the extensive margin is stronger in destinations with poorer institutions:

$$\frac{\partial^2 \left(1 - G(\tilde{\phi}^o(1))\right)}{\partial r_d^o \partial r_h} = -g(\tilde{\phi}^o(1)) \underbrace{\frac{\partial^2 \tilde{\phi}^o(1)}{\partial r_d^o \partial r_h}}_{(-)} - g'(\tilde{\phi}^o(1)) \underbrace{\frac{\partial \tilde{\phi}^o(1)}{\partial r_h}}_{(-)} \underbrace{\frac{\partial \tilde{\phi}^o(1)}{\partial r_d^o}}_{(+)}. \tag{19}$$

The first component in (19) verifies whether a higher r_h lowers $\tilde{\phi}^o(1)$ by a larger margin in destinations of higher r_d^o. The answer is a qualified yes. To show this, use the result in (9) setting $B = 1$, we have

$$\frac{\partial \tilde{\phi}^o(1)}{\partial r_d^o} = -\frac{\frac{\partial^2 \Pi^{FDI}}{\partial (r_d^o)^2}}{(1-\eta)(1-\sigma) w_h^{\eta(1-\sigma)} w_d^{(1-\eta)(1-\sigma)-1} \omega'(r_d^o)} > 0, \tag{20}$$

where the numerator is negative by the SOC for r_d^* $(= r_d^o)$ and the denominator is positive. The result in (20) is consistent with Proposition 3(ii), which suggests that the more productive firms will choose destinations with higher r_d. Thus, a destination of higher r_d will attract on average the more productive firms. Note that the denominator in (20) increases in r_h (as it decreases in w_h). On the other hand, the derivative of the numerator with respect to r_h involves third-order derivatives of Π^{FDI} (with respect to r_d^2 and r_h), which cannot be signed. Suppose we can safely ignore the higher-order changes in the numerator as r_h changes; the effect of r_h on the denominator in (20) implies that $\frac{\partial^2 \tilde{\phi}^o(1)}{\partial r_d^o \partial r_h} < 0$. Thus, on second-order approximations, the first component in (19) is positive, implying an institutional complementarity effect at the extensive margin.

Turn to the second component of (19). Its sign depends on $g'(\tilde{\phi}^o(1))$, the curvature of the productivity distribution at $\tilde{\phi}^o(1)$. If $g'(\tilde{\phi}^o(1))$ is positive, we have an unambiguous positive complementarity effect, reinforcing the first component in (19). Intuitively, as r_d^o increases and the

corresponding $\tilde{\phi}^o(1)$ increases, we are evaluating (18) at a productivity level where the density of firms is higher if $g'(\tilde{\phi}^o(1)) > 0$, creating a positive complementarity effect. The reverse is true if $g'(\tilde{\phi}^o(1)) < 0$ holds.

Overall, the complementarity effect in institutions will hold at the extensive margin if $g'(\cdot)$ is not too negative such that the first positive component in (19) dominates. ■

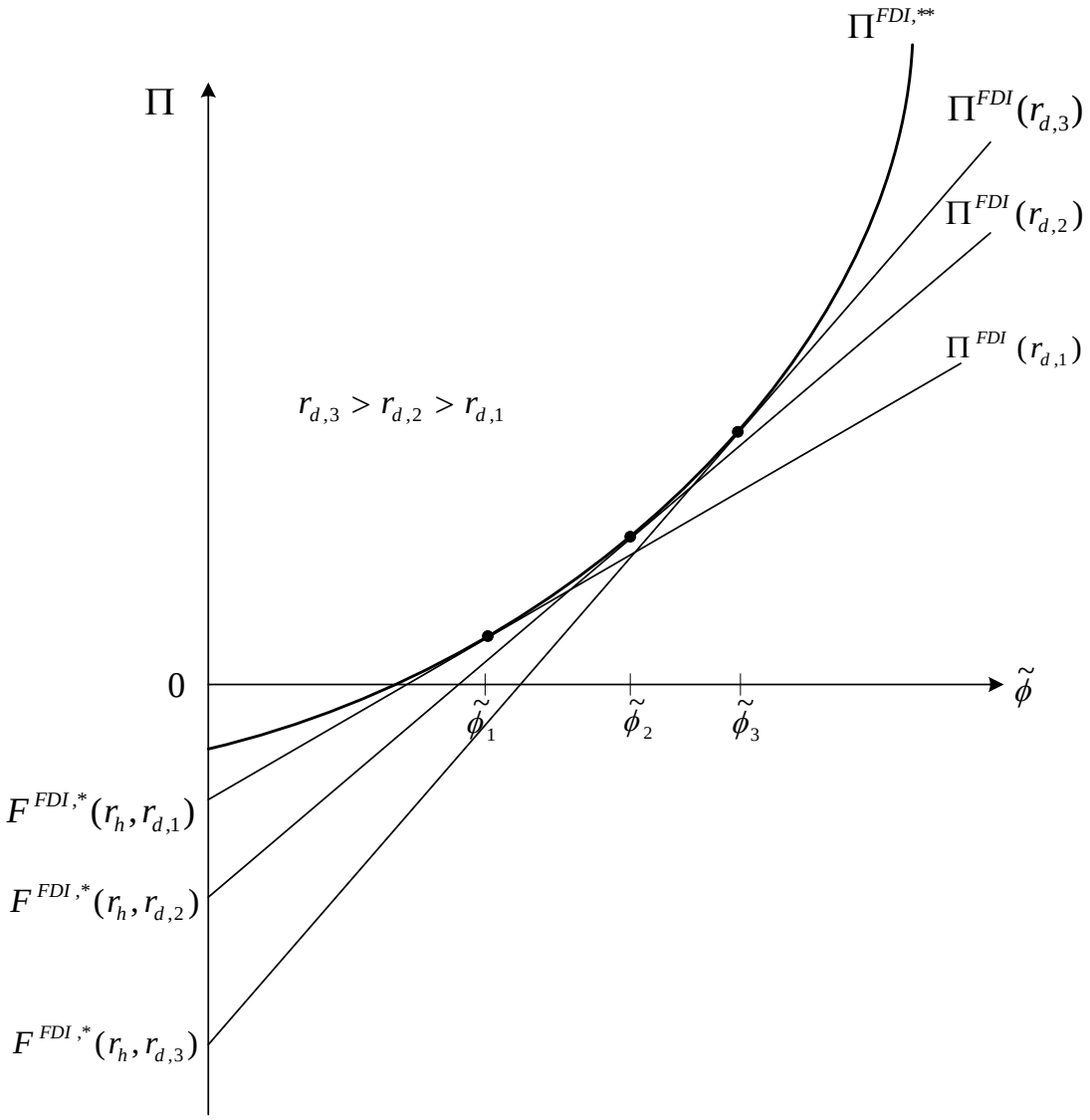

Figure 1: Profit Functions of FDI

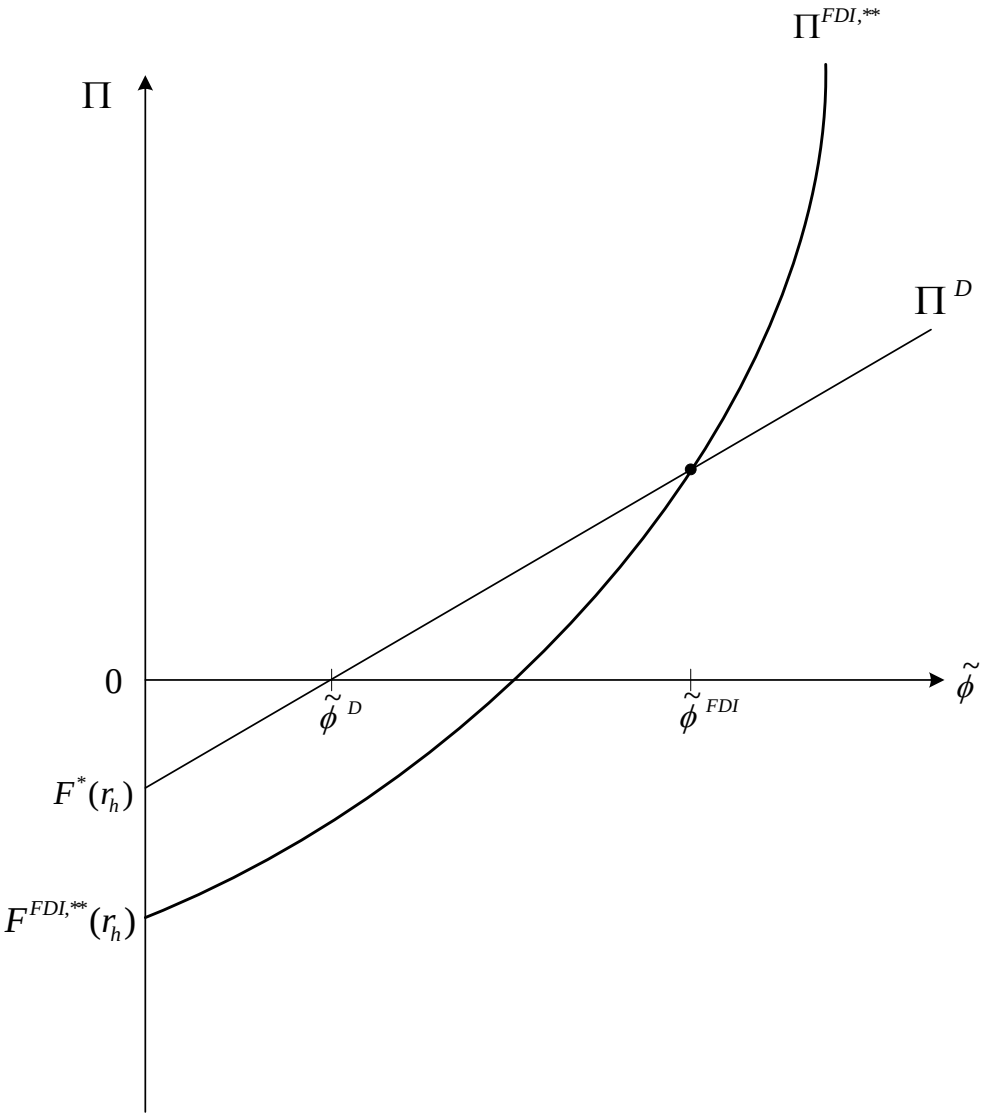

Figure 2: Sorting of Firms

Figure 3: Fraction of FDI flows received from countries of poor institutional quality (based on FDI inflows reported by receiving countries)

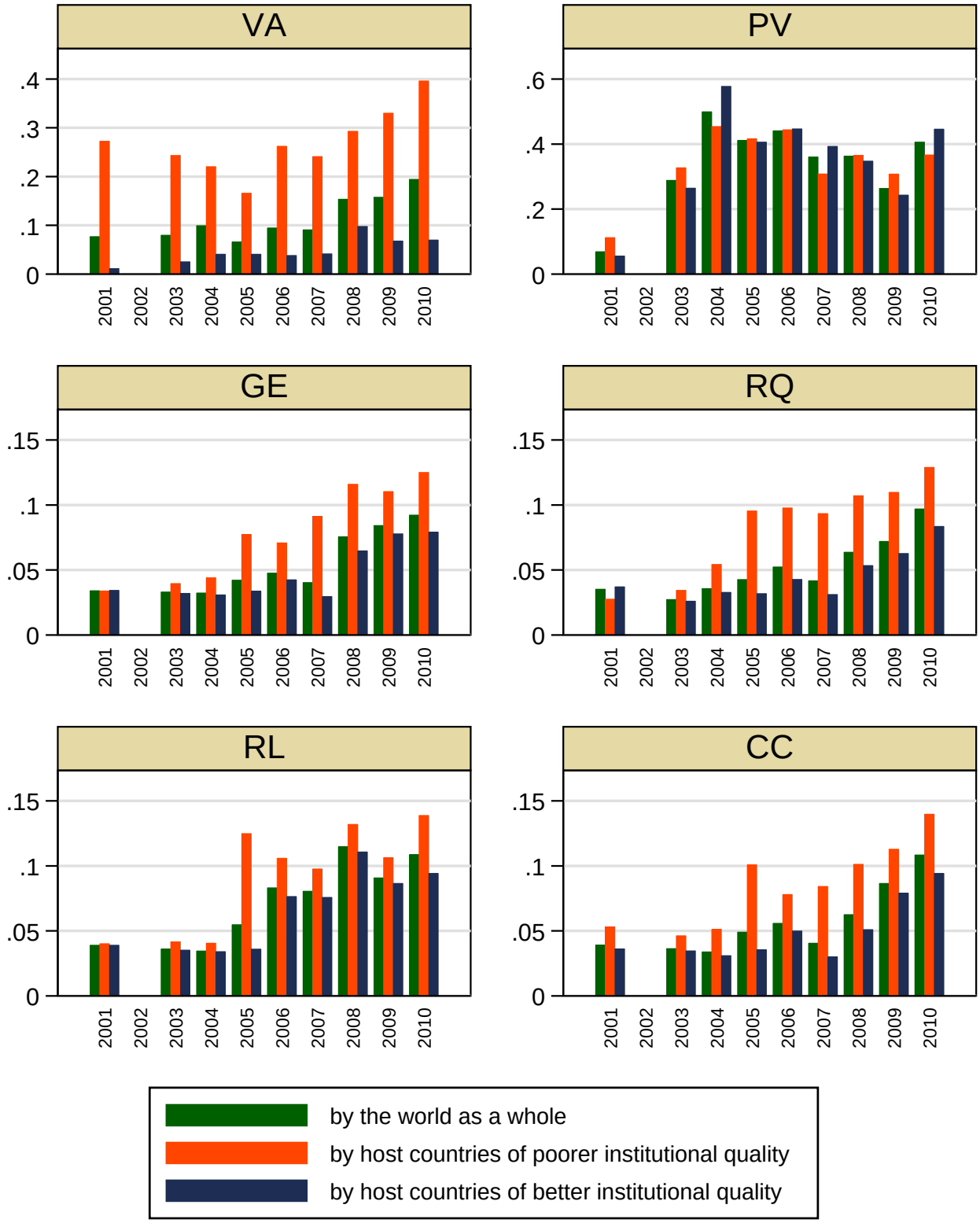

Table 1: Positive bilateral FDI—inward stock reported by the recipient country

FDI inward stock	**VA**		**PV**		**GE**		**RQ**		**RL**		**CC**	
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.267**	***	**0.082**	*	**0.298**	***	**0.400**	***	**0.283**	***	**0.210**	***
	(0.035)		**(0.042)**		**(0.045)**		**(0.055)**		**(0.045)**		**(0.034)**	
$G_{h,t-1}$	0.097	*	0.175	***	0.257	***	0.017		0.290	***	0.310	***
	(0.051)		(0.047)		(0.059)		(0.069)		(0.060)		(0.050)	
$G_{d,t-1}$	-0.124	**	0.167	***	0.150	**	0.164	**	0.168	**	0.224	***
	(0.054)		(0.049)		(0.072)		(0.080)		(0.066)		(0.059)	
$\ln(gdp_{h,t-1})$	0.449	***	0.477	***	0.437	***	0.449	***	0.451	***	0.454	***
	(0.018)		(0.019)		(0.018)		(0.018)		(0.018)		(0.018)	
$\ln(gdp_{d,t-1})$	0.586	***	0.617	***	0.565	***	0.581	***	0.584	***	0.584	***
	(0.020)		(0.022)		(0.020)		(0.020)		(0.020)		(0.020)	
$\ln(gdppc_{h,t-1})$	0.262	***	0.165	***	0.091		0.172	***	0.099	*	0.082	
	(0.054)		(0.058)		(0.057)		(0.057)		(0.058)		(0.056)	
$\ln(gdppc_{d,t-1})$	-0.029		-0.143	**	-0.146	***	-0.148	***	-0.138	**	-0.159	***
	(0.052)		(0.056)		(0.054)		(0.055)		(0.055)		(0.053)	
$\ln(p_{h,t-1})$	0.840	***	1.080	***	0.932	***	1.020	***	0.879	***	0.856	***
	(0.154)		(0.132)		(0.136)		(0.136)		(0.133)		(0.132)	
$\ln(p_{d,t-1})$	-0.088		-0.088		-0.271	**	-0.303	**	-0.301	**	-0.342	***
	(0.136)		(0.120)		(0.125)		(0.125)		(0.124)		(0.124)	
$\lvert \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \rvert$	-0.125	***	-0.179	***	-0.066	*	-0.035		-0.073	*	-0.098	***
	(0.034)		(0.033)		(0.038)		(0.039)		(0.039)		(0.037)	
$\ln(distance_{hd})$	-0.486	***	-0.491	***	-0.525	***	-0.517	***	-0.509	***	-0.522	***
	(0.042)		(0.042)		(0.041)		(0.041)		(0.041)		(0.041)	
$contig_{hd}$	0.535	***	0.513	***	0.552	***	0.567	***	0.560	***	0.531	***
	(0.130)		(0.130)		(0.128)		(0.129)		(0.129)		(0.128)	
$comlang_{hd}$	1.164	***	1.204	***	1.100	***	1.145	***	1.106	***	1.049	***
	(0.090)		(0.089)		(0.088)		(0.088)		(0.089)		(0.088)	
$colony_{hd}$	0.876	***	0.887	***	0.898	***	0.894	***	0.892	***	0.870	***
	(0.136)		(0.135)		(0.134)		(0.133)		(0.136)		(0.133)	
$comcol_{hd}$	0.417	***	0.468	***	0.313	**	0.362	***	0.337	***	0.346	***
	(0.127)		(0.127)		(0.123)		(0.123)		(0.123)		(0.123)	
$curcol_{hd}$	0.484		0.587	*	0.736	**	0.648	**	0.735	**	0.988	***
	(0.330)		(0.328)		(0.349)		(0.313)		(0.345)		(0.370)	
$smctry_{hd}$	0.165		0.089		0.126		0.145		0.187		0.202	
	(0.229)		(0.228)		(0.225)		(0.227)		(0.227)		(0.225)	
$rta_{hd,t-1}$	0.030		0.154	**	0.007		-0.017		0.037		0.064	
	(0.080)		(0.078)		(0.076)		(0.078)		(0.077)		(0.076)	
$comcur_{hd,t-1}$	0.713	***	0.739	***	0.756	***	0.745	***	0.710	***	0.746	***
	(0.144)		(0.146)		(0.145)		(0.142)		(0.146)		(0.144)	
$bit_{hd,t-1}$	-0.176	***	-0.229	***	-0.163	***	-0.212	***	-0.157	**	-0.110	*
	(0.064)		(0.064)		(0.062)		(0.062)		(0.063)		(0.062)	
# Observations	24974		24959		24970		24970		24974		24970	
R^2	0.528		0.525		0.539		0.535		0.537		0.541	

Note: Robust standard errors clustered by country-pairs are reported in the parenthesis. The entry ***, ** and * indicates statistical significance at the 1%, 5% and 10% level, respectively. All regressors (if time variant) are lagged one period relative to the FDI variable.

Table 2: Positive bilateral FDI—all stocks and flows

	VA		PV		GE		RQ		RL		CC	
FDI inward stock:												
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.267**	***	**0.082**	*	**0.298**	***	**0.400**	***	**0.283**	***	**0.210**	***
	(0.035)		**(0.042)**		**(0.045)**		**(0.055)**		**(0.045)**		**(0.034)**	
$G_{h,t-1}$	0.097	*	0.175	***	0.257	***	0.017		0.290	***	0.310	***
	(0.051)		(0.047)		(0.059)		(0.069)		(0.060)		(0.050)	
$G_{d,t-1}$	-0.124	**	0.167	***	0.150	**	0.164	**	0.168	**	0.224	***
	(0.054)		(0.049)		(0.072)		(0.080)		(0.066)		(0.059)	
# Observations	24974		24959		24970		24970		24974		24970	
R^2	0.528		0.525		0.539		0.535		0.537		0.541	
FDI outward stock:												
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.270**	***	**0.018**		**0.273**	***	**0.348**	***	**0.215**	***	**0.184**	***
	(0.037)		**(0.046)**		**(0.047)**		**(0.058)**		**(0.046)**		**(0.034)**	
$G_{h,t-1}$	0.053		0.281	***	0.323	***	0.029		0.428	***	0.533	***
	(0.056)		(0.055)		(0.067)		(0.079)		(0.066)		(0.055)	
$G_{d,t-1}$	0.165	***	0.121	**	0.121		0.235	***	0.100		0.130	**
	(0.058)		(0.054)		(0.076)		(0.083)		(0.069)		(0.062)	
# Observations	22793		22782		22793		22793		22793		22793	
R^2	0.522		0.516		0.528		0.525		0.525		0.535	
FDI inward flow:												
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.248**	***	**0.133**	***	**0.395**	***	**0.444**	***	**0.289**	***	**0.263**	***
	(0.033)		**(0.038)**		**(0.044)**		**(0.055)**		**(0.044)**		**(0.033)**	
$G_{h,t-1}$	0.097	**	0.076	*	0.092	*	0.007		0.207	***	0.130	***
	(0.047)		(0.045)		(0.053)		(0.062)		(0.054)		(0.044)	
$G_{d,t-1}$	-0.103	**	0.214	***	-0.162	**	-0.066		-0.092		0.024	
	(0.051)		(0.046)		(0.069)		(0.076)		(0.064)		(0.057)	
# Observations	19414		19403		19407		19407		19414		19407	
R^2	0.422		0.421		0.432		0.430		0.427		0.431	
FDI outward flow:												
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.250**	***	**0.047**		**0.328**	***	**0.359**	***	**0.216**	***	**0.213**	***
	(0.032)		**(0.041)**		**(0.041)**		**(0.052)**		**(0.042)**		**(0.032)**	
$G_{h,t-1}$	-0.034		0.119	**	0.174	***	-0.022		0.254	***	0.246	***
	(0.050)		(0.050)		(0.056)		(0.068)		(0.058)		(0.047)	
$G_{d,t-1}$	0.066		0.161	***	-0.107		0.041		0.010		0.019	
	(0.053)		(0.048)		(0.068)		(0.075)		(0.061)		(0.057)	
# Observations	16305		16299		16304		16304		16305		16304	
R^2	0.442		0.436		0.449		0.445		0.444		0.449	

Note: Refer to the note of Table 1. The same list of controls as in Table 1 are included.

Table 3: Positive bilateral FDI—all stocks and flows; with multilateral FE controls

	VA		PV		GE		RQ		RL		CC	
FDI inward stock:												
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.174**	***	**-0.056**		**0.163**	***	**0.109**	**	**0.092**	**	**0.113**	***
	(0.032)		**(0.038)**		**(0.043)**		**(0.049)**		**(0.042)**		**(0.031)**	
# Observations	25692		25677		25688		25688		25692		25688	
R^2	0.716		0.714		0.715		0.714		0.715		0.715	
FDI outward stock:												
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.184**	***	**-0.126**	***	**0.151**	***	**0.138**	***	**0.027**		**0.103**	***
	(0.034)		**(0.040)**		**(0.046)**		**(0.053)**		**(0.044)**		**(0.032)**	
# Observations	23323		23312		23323		23323		23323		23323	
R^2	0.721		0.720		0.720		0.720		0.719		0.720	
FDI inward flow:												
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.195**	***	**0.024**		**0.222**	***	**0.202**	***	**0.087**	**	**0.118**	***
	(0.029)		**(0.033)**		**(0.038)**		**(0.045)**		**(0.037)**		**(0.028)**	
# Observations	19905		19894		19898		19898		19905		19898	
R^2	0.643		0.640		0.642		0.642		0.641		0.641	
FDI outward flow:												
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.173**	***	**-0.048**		**0.158**	***	**0.135**	***	**0.036**		**0.071**	**
	(0.033)		**(0.037)**		**(0.041)**		**(0.049)**		**(0.039)**		**(0.030)**	
# Observations	16681		16675		16680		16680		16681		16680	
R^2	0.661		0.659		0.659		0.659		0.659		0.659	
origin-year FE	Y		Y		Y		Y		Y		Y	
destination-year FE	Y		Y		Y		Y		Y		Y	

Note: Refer to the note of Table 1. The same list of controls as in Table 1 (except the country-year varying variables) are included.

Table 4: Zero augmented bilateral FDI—all stocks and flows

	VA		PV		GE		RQ		RL		CC	
FDI inward stock:												
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.554**	***	**0.178**	***	**0.521**	***	**0.641**	***	**0.511**	***	**0.366**	***
	(0.047)		**(0.058)**		**(0.059)**		**(0.071)**		**(0.059)**		**(0.044)**	
$G_{h,t-1}$	-0.268	***	-0.009		0.068		-0.244	***	0.160	**	0.225	***
	(0.066)		(0.066)		(0.081)		(0.091)		(0.080)		(0.068)	
$G_{d,t-1}$	-0.095		0.355	***	0.161	*	0.287	***	0.059		0.156	**
	(0.073)		(0.069)		(0.092)		(0.105)		(0.087)		(0.077)	
# Observations	36587		36483		36567		36567		36587		36567	
# Zeroes	11613		11524		11597		11597		11613		11597	
FDI outward stock:												
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.514**	***	**0.121**	**	**0.442**	***	**0.502**	***	**0.393**	***	**0.354**	***
	(0.049)		**(0.061)**		**(0.062)**		**(0.077)**		**(0.062)**		**(0.046)**	
$G_{h,t-1}$	-0.258	***	0.293	***	0.626	***	-0.007		0.654	***	0.690	***
	(0.073)		(0.071)		(0.092)		(0.107)		(0.090)		(0.075)	
$G_{d,t-1}$	-0.039		-0.029		-0.159		0.159		-0.190	**	-0.156	*
	(0.075)		(0.074)		(0.099)		(0.113)		(0.092)		(0.080)	
# Observations	35225		35134		35225		35225		35225		35225	
# Zeros	12432		12352		12432		12432		12432		12432	
FDI inward flow:												
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.472**	***	**0.204**	***	**0.530**	***	**0.610**	***	**0.366**	***	**0.324**	***
	(0.044)		**(0.052)**		**(0.055)**		**(0.067)**		**(0.055)**		**(0.042)**	
$G_{h,t-1}$	0.031		0.108	*	0.242	***	0.020		0.390	***	0.310	***
	(0.062)		(0.060)		(0.073)		(0.084)		(0.073)		(0.060)	
$G_{d,t-1}$	-0.204	***	0.396	***	-0.286	***	0.000		-0.198	**	-0.055	
	(0.069)		(0.062)		(0.086)		(0.097)		(0.081)		(0.072)	
# Observations	36340		36236		36315		36315		36340		36315	
# Zeros	16926		16833		16908		16908		16926		16908	
FDI outward flow:												
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.547**	***	**0.144**	**	**0.555**	***	**0.546**	***	**0.394**	***	**0.383**	***
	(0.046)		**(0.058)**		**(0.056)**		**(0.071)**		**(0.058)**		**(0.044)**	
$G_{h,t-1}$	-0.206	***	0.253	***	0.327	***	-0.028		0.481	***	0.430	***
	(0.069)		(0.067)		(0.080)		(0.093)		(0.082)		(0.066)	
$G_{d,t-1}$	-0.061		0.096		-0.374	***	-0.022		-0.200	**	-0.197	**
	(0.072)		(0.068)		(0.091)		(0.106)		(0.083)		(0.076)	
# Observations	32913		32832		32900		32900		32913		32900	
# Zeros	16608		16533		16596		16596		16608		16596	

Note: Refer to the note of Table 1. The same list of controls as in Table 1 are included.

Table 5: Summary statistics of firms undertaking FDI in 2009–2016

	Obs	Mean	Std. Dev.	Min	Max
2009–2016:					
FDI capital investment (in million USD)	32,403	35.90	302.19	0	18,500
Lagged:					
Productivity (in log)	19,322	3.35	4.81	-17.62	17.26
R&D Intensity (= R&D expenses / Operating revenues)	13,621	0.10	3.40	0	259.34
Operating revenues (in log, thousand USD), real	26,765	12.75	3.47	-4.50	20.50
No of employees (in log)	24,247	7.27	3.24	0	13.78
Total assets (in log, thousand USD), real	27,458	12.71	3.69	-6.76	19.97
Material costs (in log, thousand USD), real	21,476	11.67	3.93	-6.87	20.28

Note: The GDP deflator is used to normalize the current values of operating revenues, total assets, and material costs, before they are used in the productivity estimations.

Table 6: Institutional quality of home and destination countries (Firm-level FDI data 2009–2016)

	Obs	Mean	Std. Dev.	Min	Max
Home country					
VA (Voice and Accountability)	37,062	1.14	0.50	-1.83	1.77
PV (Political Stability and Absence of Violence)	37,073	0.60	0.54	-2.81	1.57
GE (Government Effectiveness)	37,073	1.40	0.53	-1.50	2.43
RQ (Regulatory Quality)	37,073	1.32	0.53	-2.14	2.26
RL (Rule of Law)	37,073	1.40	0.57	-1.99	2.12
CC (Control of Corruption)	37,073	1.38	0.73	-1.42	2.53
Destination country					
VA (Voice and Accountability)	37,064	0.35	1.02	-2.24	1.77
PV (Political Stability and Absence of Violence)	37,065	0.15	0.80	-3.06	1.57
GE (Government Effectiveness)	37,053	0.78	0.86	-2.22	2.43
RQ (Regulatory Quality)	37,053	0.72	0.87	-2.45	2.26
RL (Rule of Law)	37,063	0.65	0.97	-2.45	2.12
CC (Control of Corruption)	37,054	0.58	1.04	-1.84	2.53

Note: Statistics refer to institutional quality lagged by one year before the year of FDI.

Table 7: Firm-level FDI's dependence on institutional quality

	VA	**PV**	**GE**	**RQ**	**RL**	**CC**
FDI capital investment						
$\boldsymbol{G_{h,t-1} * G_{d,t-1}}$	**0.592*** **	**1.022*** **	**0.753*** **	**0.766*** **	**0.801*** **	**0.501*** **
	(0.0757)	**(0.126)**	**(0.132)**	**(0.145)**	**(0.120)**	**(0.0855)**
$\ln(prod_{f,t-1})$	-0.0414	-0.0567	0.0288	0.0248	-0.0218	-0.0221
	(0.0352)	(0.0365)	(0.0544)	(0.0417)	(0.0503)	(0.0396)
$\boldsymbol{\ln(prod_{f,t-1}) * G_{d,t-1}}$	**-0.0983*** **	**-0.0389**	**-0.114** **	**-0.148*** **	**-0.0463**	**-0.100*** **
	(0.0259)	**(0.0483)**	**(0.0476)**	**(0.0415)**	**(0.0443)**	**(0.0354)**
$RD_{f,t-1}$	-0.482**	-0.0505***	-3.105***	-1.550***	-2.568***	-0.656***
	(0.209)	(0.00971)	(0.300)	(0.104)	(0.319)	(0.0908)
$\boldsymbol{RD_{f,t-1} * G_{d,t-1}}$	**0.328** **	**0.0390*** **	**1.953*** **	**0.946*** **	**1.512*** **	**0.360*** **
	(0.153)	**(0.0151)**	**(0.192)**	**(0.0652)**	**(0.190)**	**(0.0526)**
$\lvert \ln(gdppc_{h,t-1}) - \ln(gdppc_{d,t-1}) \rvert$	0.822***	0.979***	1.068***	1.116***	1.303***	1.107***
	(0.166)	(0.153)	(0.173)	(0.175)	(0.184)	(0.184)
$\ln(distance_{hd})$	-0.189	-0.272**	-0.219*	-0.198*	-0.133	-0.200*
	(0.118)	(0.108)	(0.113)	(0.113)	(0.111)	(0.112)
$contig_{hd}$	0.638***	0.592***	0.808***	0.747***	0.812***	0.809***
	(0.208)	(0.219)	(0.222)	(0.219)	(0.212)	(0.218)
$comlang_{hd}$	0.381**	0.481***	0.666***	0.701***	0.611***	0.621***
	(0.188)	(0.165)	(0.174)	(0.172)	(0.169)	(0.171)
$colony_{hd}$	-0.208	-0.117	-0.467**	-0.502**	-0.450**	-0.399**
	(0.209)	(0.192)	(0.199)	(0.204)	(0.199)	(0.193)
$comcol_{hd}$	0.0373	0.275	0.240	0.122	0.141	0.0926
	(0.528)	(0.426)	(0.411)	(0.425)	(0.459)	(0.423)
$smctry_{hd}$	-1.356***	-1.538***	-1.015***	-0.913**	-1.073***	-1.244***
	(0.355)	(0.356)	(0.381)	(0.378)	(0.380)	(0.369)
$rta_{hd,t-1}$	-0.140	0.184	-0.0399	-0.0620	0.0955	0.0963
	(0.213)	(0.194)	(0.217)	(0.218)	(0.203)	(0.207)
$comcur_{hd,t-1}$	0.528**	0.379	0.405*	0.490**	0.464**	0.431*
	(0.246)	(0.232)	(0.233)	(0.236)	(0.232)	(0.235)
bit_{t-1}	-0.220	-0.358**	-0.285*	-0.250	-0.179	-0.225
	(0.186)	(0.170)	(0.172)	(0.173)	(0.174)	(0.175)
$constant$	-8.024***	-24.83***	-37.55***	-21.39***	-18.85***	-25.22***
	(1.607)	(1.893)	(2.440)	(1.790)	(1.794)	(1.940)
# Observations	7522	7522	7522	7522	7522	7522
R^2	0.806	0.806	0.804	0.807	0.803	0.806
origin-year FE	Y	Y	Y	Y	Y	Y
destination-year FE	Y	Y	Y	Y	Y	Y
destination-sector FE	Y	Y	Y	Y	Y	Y

Note: PPML estimation of equation (16). Robust standard errors clustered by country-pairs are reported in the parenthesis. Productivity estimates based on the LP method and operating revenues. The entry ***, ** and * indicates statistical significance at the 1%, 5% and 10% level, respectively.