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ABSTRACT

This paper examines the role of contracting institutions on the insertion of developing countries in international production networks and particularly on the prospects of LAC to source goods beyond the region's traditional patterns of specialization. We show that LAC's insertion in global production networks is biased towards arm's-length transactions in industries that tend to be labor-intensive and that do not typically require relation-specific investments. We also show that the countries that have been able to diversify their export successfully in international production networks have not focused exclusively on arm's-length transactions but engage in both types of sourcing via arm's-length and intra-firm trade. Results from an econometric model indicate that taking advantage of offshoring opportunities arising from capital- and contract-intensive industries requires fostering the quality of contractual institutions. Increasing the quality of contracting institutions is likely to improve first the chances of supplying contract-intensive activities through FDI, but further increases may potentially induce additional offshoring through local contractors.

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1. Introduction

Production processes have been increasingly fragmented worldwide. That is, for many goods, production has become a multi-country process in which different stages are carried out in specialized plants in different parts of the world, a phenomenon that is called vertical specialization.

From the point of view of developing countries, vertical specialization is providing opportunities to engage in international trade transactions that were not available before. In particular, it allows countries to become part of an ever finer international division of labor whereby they enter into cross-border production networks by participating in one or a few of the activities involved in producing a final good instead of mastering entire production processes from start to finish.

The fact that international production fragmentation may provide developing countries with new opportunities to diversify their trade can be particularly important for certain regions, like Latin America and the Caribbean (LAC), that still exhibit highly concentrated export bases.

In the assessment of how developing countries can join global production networks, a particular important topic is the issue of contracting institutions. Global production networks necessarily entail contracting relationships between agents located in different countries with heterogeneous legal systems and contracting institutions. Different legal jurisdictions could produce demarcations that may segment markets in much the same ways that transport costs or tariffs do (Rodrik, 2000). For example, when an agent in a country reneges on a contract involving residents of foreign countries, local courts may be unwilling to enforce it especially if such enforcement would entail an adverse outcome for the local resident. International laws and bodies could alleviate this problem but they provide at best some partial protection (Antras, 2011).¹ Uncertain and ambiguous practices in contract enforcement can thus undermine international transactions. The negative trade impacts of imperfect contract enforcement can be particularly acute in transaction involving intermediate inputs. This is because the production of intermediate inputs is often accompanied with significant relationship-specific investments. For instance, suppliers may customize their production to the specification of particular buyers and thus the outside option of this production might be close to zero should the buyer decide to renege on the contract. Similarly, when the supplier does not commit to its contractual obligations this could severely affect the buyer's investments as well as its reputation and ultimately the relationship with its clients. A number of recent papers (Feenstra, Hong, Ma and Spencer, 2012; Levchenko, 2007; Nunn 2007; Ranjan and Lee, 2007) provide evidence that institutional quality is important for the ability to trade in differentiated goods that are institutionally

¹ For instance, the United Nations Convention on Contracts for the International Sale of Goods (CISG) is an agreement designed to reduce contractual uncertainties and ambiguities in international transactions, but many countries have not signed it. The International Chamber of Commerce in Paris provides arbitration in international transactions, but is rarely used (Antras, 2011).

dependent due to their greater need for contract enforcement. In this paper we examine the role of contracting institutions and assess their importance for the insertion of LAC in global production networks.

Any empirical analysis that examines the impact of contracting institutions on international production networks confronts two important challenges. The first one is related to measuring a country's quality of contracting institutions. Unlike measuring standard country characteristics like GDP or population, there is not a single variable that could capture the spectrum of factors that are involved in a country's contracting institutions, like the type of laws and regulations governing contractual practices, the degree of discretion in interpreting the law, the type of procedures that apply in the event of a dispute, the degree of enforcement that typically exist in the country or the cost and the time required in the case that the enforcement of a contract is exercised, among other things.

The second challenge is more conceptual and has to do with the notion that different modes of offshoring –FDI or outsourcing– respond differently to the quality of contracting institutions. The prevailing view, for example, is that FDI is an imperfect solution to the problem of incomplete contracts. That is, if contracts in host-countries are hard to enforce, then multinationals have an incentive to internalize activities via FDI to assure that the parties abide to their obligations, but when the contractual environment strengthens, then outsourcing with external suppliers is more likely to occur. This implies that an improvement in the quality of contracting institutions may not bolster the participation of the country in global production networks but rather change the relative participation of the offshoring modes. To capture this nuance when assessing the impact of contracting institution on a country's insertion in international production networks ones requires a framework that addresses this trade-off.

In this paper we use a battery of alternative governance measures that depict a wide spectrum of aspects behind the concept of contracting institutions and employ an empirical strategy that takes into account the firm's optimal mode of offshoring to tackle these two challenges. The aim of the study is to analyze the impact of contracting institutions on the insertion of developing countries in international production networks and in particular, to examine whether contracting institutions play a role in the prospects of LAC to source goods beyond the region's traditional patterns of specialization. We find that LAC's insertion in global production networks is biased towards arm's-length transactions in industries that tend to be labor-intensive and that do not typically require relation-specific investments. We also find that the countries that have been able to diversify their export successfully have not focused exclusively on arm's-length transactions but engage in both types of sourcing via arm's-length and intra-firm trade. The results from an econometric model show that differences in endowments do not explain entirely LAC's bias towards arm's-length trade. Differences in the quality of contracting institutions play an important role too. Improving contracting institutions is likely to improve the changes of diversifying exports towards more contract-intensive activities. The results suggest that the path

might not be linear, however. Increasing the quality of contracting institutions is likely to improve first the chances of supplying contract-intensive activities through FDI, but further increases may potentially induce additional offshoring through local contractors.

The paper is divided as follows: the next section presents a battery of measures that capture the quality of contracting institutions across countries, and compare LAC with other regions. Section 3 presents an empirical characterization of the modes of offshoring and highlights important stylized facts about the extent to which the choice between outsourcing versus FDI varies across industries and countries. Section 4 delves into the relationship between contracting institutions and international production networks by estimating an econometric model that takes into account the firm's decision about the mode of offshoring. Finally, section 5 summarizes what the quality of contracting institutions and the modes of offshoring means for the insertion of LAC in cross-border production sharing.

2. The Quality of Contracting Institutions

In the last few years the literature of trade and institutions has expanded dramatically with theoretical and empirical analyses examining the effects of various types of institutions, like contracting, financial and labor institutions, on trade patterns (Costinot, 2009, Levchenko, 2007, Nunn, 2007, Acemoglu, et al., 2009, Tang, 2010). Characterizing the quality of institutions, and particularly contracting institutions, is a difficult challenge. We present in this section a battery of measures that capture a wide spectrum of factors behind this notion. The ultimate goal is to examine the extent to which LAC has an environment conducive to international transactions that are highly contract-intensive.

We employ the following variables to capture several aspects of contracting institutions: (1) the number of procedures for enforcing a contract, (2) the time (in days) for enforcing a contract, (3) the cost (as a percentage of the claim) of enforcing a contract, (4) an index of legal formalism, measuring the number of formal legal procedures necessary to resolve a simple case of collecting on an unpaid check, (5) an index of legal structure and security of property rights, (6) and index of property rights protection, (7) an index of intellectual property rights protection, and (8) an index of the rule of law.

Measures (1) to (3) come from the Doing Business dataset; measure (4) originates from the work by Djankov et al. (2003) and measures (5) to (8) come from the Fraser Institute, the Heritage Foundation, the Property Rights Alliance and Kaufmann, Kraay and Mastruzzi (2006), respectively.

Measures (1) to (4) correspond to the costs of enforcing straightforward contracts; measures (5) to (7) address the concept of property rights and measure (8) deals with the broader concept of the rule of law. Even though there might be differences between the role of contracting institutions and the role of property rights

institutions, there are also many commonalities as both sets of institutions relate to the protection of citizens from opportunistic behavior (Acemoglu and Johnson, 2003).

One advantage of all these measures is that are available for a large set of countries which makes them suitable for cross-country analyses. All these variables have been used before by other researchers in various contexts. For instance, Djankov et al. (2006), Cooley et al. (2004) and Lerner et al. (2006) employ the Doing Business dataset to measure the relationship between contract enforceability and economic growth, macroeconomic volatility, and financial transactions, respectively. Acemoglu and Johnson (2005) use the index of legal formalism to measure the relationship between contracting institutions and financial intermediation. Johnson, et al. (1998), Claessens et al. (2003) and La Porta et al. (1998) employ the index of the Heritage Foundation to measure the relationship between property rights and the informal economy, the allocation of assets and per capita income, respectively. Stroup (2007) uses the index of the Fraser Institute to measure the correlation between economic freedom and various measures of well-being. Smarzynska (2004) and Claessens et al. (2003) use the index of intellectual property rights from the Property Rights Alliance to examine how intellectual property protection affects FDI composition and economic growth, respectively. Finally, Bernard, Jensen, Redding and Schott (2010) use the Kaufmann, Kraay and Mastruzzi measures of governance to proxy for contracting institutions in their analysis of the determinant of intra-firm trade.²

Table 1 presents the results of comparing LAC with other regions.³ It is clear that LAC shows a poor record in terms of contracting institutions when compared to other regions. For instance, while the average time for enforcing a contract in East Asia is 377 days, the corresponding figure for LAC is 706 days. Similarly, while the average cost (as a percentage of the claim) for enforcing a contract in Europe is 19%, the cost in LAC is 33%. Similar poorer performances arise along the property rights index and the rule of law measure. For instance, LAC exhibits the lowest value in the rule of law index across all the regions. LAC only outperforms one region (Southeast Asia) in only one variable (cost for enforcing a contract). Except from this instance, however, LAC falls behind any region - including the world as a whole - in all of the measures in the table. The question then is: to what extent the gap in contracting institutions has affected the chances of LAC to join cross-border production sharing? We address this question in the rest of the paper.

² The Kaufmann, Kraay and Mastruzzi measures include: Voice and Accountability, Political Stability and No Violence, Government Effectiveness, Regulatory Quality, Control of Corruption and Rule of Law. BJRS employs the principal component of these six measures in their analysis. We prefer to concentrate in the Rule of Law measure because the other indexes might be capturing aspects of governance that are not related to the protection and enforceability of contracts. Nevertheless, in the econometric exercise of this paper we also run regressions with the principal component of the six indexes and the results do not change in any significant way.

³ See Appendix B for the list of countries included in each region.

3. The Modes of Offshoring across Industries and Sourcing Countries

A proper assessment of the role of contracting institutions on LAC's insertion in global production networks must take into consideration the possibility that different modes of offshoring –FDI or outsourcing- may respond differently to the quality of these institutions.

In developing their business strategies, firms that fragment production need to decide where to locate the different stages of the value chain and also the degree of control they want to exercise over these processes. The latter is a classic make-or-buy decision, whereby the firms choose to contract the procurement of these inputs with external suppliers or to keep the production of inputs within firm boundaries engaging in FDI activities and intra-firm trade. Nike's contracts with independent producers in various countries to supply many of its inputs is an example of the first modality while Intel's opening of a subsidiary plant in Costa Rica to offshore part of its microprocessors is an example of the latter.

To avoid confusion, throughout the rest of this paper we follow Antras and Helpman (2008) and use the term “offshoring” to refer to the process of firms obtaining their inputs from other countries regardless of the mode employed. We use the terms “arm's-length trade”, “outsourcing abroad” or simply “outsourcing” to refer to the situation in which the offshoring is done via external contractors. We use the term “FDI” or “vertical integration” to refer to the situation in which offshoring is done via the firm's affiliates.⁴

The choice between offshoring via outsourcing versus FDI does not occur at random. Alfaro and Charlton (2009), for example, argue that multinationals tend to own the suppliers that conduct the stages of production close to the final output but outsource raw materials and inputs in the early stages of the production. It is also commonly argued that multinationals tend to offshore via FDI the inputs that are close to their core competences as well as products sensitive to intellectual property and outsource to external providers the inputs that can be produced more efficiently outside the firm's boundaries or in which the protection of intellectual knowledge is not a relevant issue (e.g. Ethier, 1986, Markusen, 1995).⁵

Recent theoretical contributions (Antras, 2003, Antras and Helpman, 2004, Antras and Helpman, 2008 and Costinot, Oldenski and Rauch, 2011) indeed indicate that the trade-off between outsourcing and FDI depends on a complex interaction of forces, some of which are related to intrinsic characteristics of the industry and others to host-country-specific factors. At the industry-level, for example, the more standardized or codified the knowledge can be, the higher the chances that the offshoring would occur through independent contractors.

⁴ The more specialized literature on Global Value Chains tends to differentiate on the various degrees of contractual forms, and as such, arm's-length trade refers to international transactions in which the relationship between the parties do not have any material impact on the way they conduct their business, while outsourcing involves some contractual obligations between the parties. In this paper, we use the terms outsourcing and arm's-length trade indistinctively to refer to any type of offshoring that is not carried through FDI.

⁵ Another strand of the literature argues that the optimal mode selected by the firm depends on the relative costs and benefits, the associated risks, and the feasibility of each option (Buckley and Casson, 1976, 2001).

On the contrary, in highly-knowledge intensive sectors, and in industries where knowledge tends to be tacit and difficult to transfer, FDI is more likely to arise. At the country level, for example, if credible and capable local partners cannot be found or if local partners do not have access to capital, then the prospects of offshoring through affiliates become the prevalent mode. On the other hand, if there are prohibitive restrictions on FDI as an entry mode in the host country, then outsourcing may be the only feasible option.

In the next section we analyze the drivers of the mode of offshoring and specifically how the quality of contracting institutions influences the choice between outsourcing and FDI. In this section we present a few stylized facts that uncover some patterns behind this trade-off that proves to be useful for the analysis that follows in the next section.

Measuring intra-firm and arm's-length trade

International trade data that identifies transactions by mode of offshoring practically does not exist. A rare exception is the U.S. Related Party Trade database compiled by the U.S. Census Bureau. These data distinguish whether each international trade transaction in the U.S. occurred between affiliated parties or independent firms. In particular, for each transaction, U.S. importers are required to identify whether imports are intra-firm (related party) or between independent companies (non-related party). See Appendix A for details.⁶

Figure 1 presents the share of U.S. imports that is intra-firm by 3-digit NAICS industry. The figure shows that there is a considerable variation in intra-firm imports across industries: some industries are largely traded through FDI while others are mostly trade via arm-length. For instance, while the imports of electrical equipment, transport equipment, or computer and electronic products exhibit intra-firm shares higher than 50%, the equivalent figures for livestock, leather and fish products are all close to 10%. It is worth noting that the results remain very similar regardless of whether we consider imports of all goods or imports of intermediates only.⁷ The largest difference appears on transport equipment which is associated with the very high intra-firm exports of finished vehicles from foreign manufacturing plants to their U.S. wholesale affiliates. In general,

⁶ There are various characteristics of this dataset that make it attractive. First, the data are of high quality since several quality assurance procedures are performed by the U.S. Census Bureau. Second, the dataset covers a wide range of industries and countries offering the possibility to exploit heterogeneity in industry and in exporting country characteristics.

⁷ To eliminate the imports of final goods from the total flows of imports we employ the Bureau of Economic Analysis (BEA) 2002 Import Matrix and Input-Output table which are disaggregated at the 6-digit NAICS level. This information shows the share of imports that is used as intermediate inputs and the share of imports that is used for final consumption for each import at the 6-digit NAICS level. We multiply the share of imports that is used as an intermediate with the flows of related and non-related party trade to eliminate the imports of final goods in each category. Then, we recalculate the ratio of related to total (related + non-related) exports. The use of I-O tables to separate between intermediates and final goods have been popularized in recent years because this avoid the arbitrariness of using classification schemes that divide goods into intermediate and other categories, as stressed by Hummels, Ishii and Yi (2001).

however, there is a similar pattern, regardless of the sample used, showing the existence of a considerable degree of variation in the intensity of intra-firm trade across industries.⁸

The results from Figure 1 suggest that the preponderance of FDI relative to outsourcing tend to differ by type of industry. Nevertheless, the figure shows averages for each industry and as such it masks important differences that take place across the exporting countries. In Figure 2 we present an example for a particular industry: electrical equipment, appliances and components (335). Even though in Figure 1 this industry exhibits, on average, a share of intra-firm imports of around 50%, the results from Figure 2 indicate that the share associated with each exporting country varies greatly from 0% to 100%.⁹ A similar finding is observed in many other industries. This implies that the mode of offshoring is not completely characterized by industry factors. Host-country factors may also play a role. The evidence presented in Figure 1 and 2 indeed goes in line with the predictions of the theory mentioned above that the optimal mode of offshoring depends on forces related to intrinsic characteristics of the industry but also on host-country-specific factors. These forces interact in complex ways as we will see below. In the next section we seek to disentangle the role of these forces with the help of an econometric model while we pay special attention to the role of contracting institutions.

Before moving to the next section, it is worth presenting a few stylized facts about the composition of LAC's trade with the U.S. by mode of offshoring. Figure 3 shows that the participation of LAC in intra-firm trade relative to other regions. It is clear that LAC's exports to the U.S. are not very intensive in intra-firm transactions when compared to the other regions. Figure 4 suggests that this may be the result, at least in part, of a specialization biased towards industries that are typically traded via arm's-length. In particular, Figure 4 shows that relative to East Asia, LAC tends to have a larger proportion of its exports (Panel B) concentrated in industries that exhibit small intra-firm trade intensities (the industries close to the top in Panel A). Conversely, East Asia tends to have a larger proportion of its exports concentrated in industries that exhibit large intra-firm trade intensities (industries close to the bottom in Panel A).¹⁰ This suggests that differences in endowments, a main determinant of specialization patterns, might be behind some of the differences in intra-firm trade observed across regions.

⁸ Throughout the rest of the paper we continue to show results for intermediates goods and also for all goods, including final products. The reason is that eliminating all final goods from the sample is likely to remove some import flows related to international production networks. For instance, there are many companies that fragment production internationally and use an array of suppliers who perform the physical transformation activities from start to finish while they engage in activities like design, coordination of the suppliers, marketing and selling of the product. Therefore, these companies do not necessarily import intermediate inputs but goods physically completed. Still, these trade flows are very much associated with internationally fragmented production and offshoring. Moreover, even though these companies do little or no physical transformation activities at home, they still need to engage in specific-relationships with their suppliers which are subject to all the problems of incomplete contracts highlighted in the introduction. Therefore, excluding the exports of final goods is an extreme measure that eliminates this type of trade flows from the sample. Antras (2011) in fact argues that the question of why some finished goods may be mostly imported through outsourcing or vertical integration is still one of tracing firm boundaries, and thus it is not obvious that one would want to discard these trade flows when testing the predictions of theory.

⁹ Figure 2 shows the share of intra-firm exports when all goods are included. The figure for intermediates goods do not change in any significant way.

¹⁰ The same pattern is observed when we compare LAC with the EU15

It is also important to note that the countries that have been able to diversify their export bases engage in both types of sourcing via arm's-length and intra-firm trade and not in only one form of offshoring. This is shown in Figure 5 which presents the total number of industries (at the 6-digit NAICS level) in which each country is active exporting to the U.S. according to the mode of offshoring. It is clear that there are not many industries in which countries export to the U.S. exclusively through FDI or exclusively through arm-length. The countries that manage to be active in sourcing to the U.S. in many industries tend to engage in both modes of offshoring at the same time.

Note that the findings in Figure 5 could be the result of industry aggregation. For example, within each 6-digit NAICS industry, there could be goods that are traded purely at arm's-length and goods that are traded exclusively through FDI. While some of this could explain the large proportion of industries being sourced through both types of offshoring, results in Figure 6, which repeats the same exercise but at a much higher level of disaggregation (6 digit HS), cast doubts that this is the main explanation behind the results. Bernard, Jensen and Schott (2006) also provide evidence at the 10-digit HS level showing that multinationals tend to conduct both intra-firm and arm's-length trade even in the same country. Therefore, simple aggregation bias cannot be the entire story. An explanation in terms of heterogeneity might be more likely. For instance, in Antras and Helpman (2004), vertical integration is assumed to be more costly than outsourcing, and as a result, firms that fragment production internationally but have different productivity levels might choose different modes of offshoring even in the same industry. Regardless of the reason, however, what the findings in Figures 5 and 6 suggest is that the countries that are active exporting in many industries tend to take advantage of opportunities arising in outsourcing as well as in FDI, and thus may have conditions that are good enough for both types of offshoring to emerge. The implication of this for the insertion of LAC in global production networks is that the diversification of the region's exports beyond their current pattern of specialization which is highly biased towards arm's-length transactions might entail exporting in many industries for which offshoring is more likely to occur, at least initially, through FDI. Having conditions that do not discriminate to this type of offshoring might be important for such a diversification of exports to thrive. It is in this sense that understanding the drivers of the optimal mode of offshoring is important. We turn to this in the next section with an emphasis on the role of contracting institutions.

4. Untangling the Forces behind the Mode of Offshoring

Many factors affect the mode of offshoring that a firm chooses to fragment production internationally. The previous section provided empirical evidence suggesting that some of these factors are related to intrinsic characteristics of the industry and others to host-country-specific factors. One of the country variables that we pay particular attention in this paper is the quality of contracting institutions. The influence of contracting institutions on the mode offshoring is an issue that has evolved in the theoretical literature in recent years. The

traditional view has been that FDI is most frequently used in countries with weak contractual environments because this shields multinationals from problems related to opportunistic behavior. This implies that improvements in the contractibility environment of the host-country would trigger an increase in outsourcing as multinationals can rely more on the legal system to exercise compliance of the contracts. This has been referred in the literature as the *standard effect*. New developments in the theory (Antras and Helpman, 2008), however, argue that there is also an offsetting effect, also called the *surprise effect*, that consists on the notion that with a better contracting environment it is no longer as important to employ outsourcing to incentivize foreign suppliers to comply with contracts.¹¹ As a result, when the contracting environment of a country improves, the balance tilts towards vertical integration. Ultimately, the net effect of an improvement in the contractual environment depends on the relative strength of these two forces.

In this section we analyze in general the drivers of the mode of offshoring and in particular the complex interaction between these modes and the quality of contracting institutions. The ultimate goal is to shed light on what all of this mean for the insertion of LAC in international production networks and, in particular, for the prospects of sourcing goods beyond the region's traditional patterns of specialization. Before specifying the details of the empirical estimation, it is worth reviewing some of the key aspects of the theoretical models that motivate this empirical analysis (Antras, 2003; Antras and Helpman, 2004, 2008).

According to the theory, there are at least three forces that affect the choice between intra-firm trade and arm's-length trade. These forces are the production technology of the good, the factor abundance in the supplier's country and the degree of contract incompleteness associated with the production of the good.

With respect to the production technology, Antras (2003) argues that since suppliers may have superior local knowledge in hiring workers or because managing workers properly requires a physical presence, investments related to the labor input are harder to share than investments related to physical capital. This motivates a theoretical framework predicting that vertical integration is more likely to occur in capital-intensive industries than in labor-intensive industries.

The second force is related to factor endowments. Comparative advantage theory estates that capital-abundant countries tend to specialize in capital-intensive industries. This together with the first prediction implies that capital abundant countries are more likely to engage in intra-firm trade than capital-scarce countries.

¹¹ More specifically, outsourcing give incentives to suppliers to comply with production because it strips the lead firms of any control over the supplier's inputs and thus it strengthens the bilateral bargaining position of the supplier on how to split the rents. Therefore, the lead firm would choose outsourcing if it want to offer incentives to the supplier to comply. When the contracting environment improves, however, it is less important for the lead firm to provide incentives to the suppliers to comply and so it may choose vertical integration instead of outsourcing (see Antras and Helpman, 2008)

The third factor is related to the nature of the contract between the parties involved. If the product is “contractible” then firms fragmenting production internationally have more incentives to turn to independent suppliers to source their input via outsourcing. In this framework the “contractibility” of a product is a concept that depends on the characteristics of the good and also on the characteristics of the contracting institutions in the supplier’s country. In other words, that a product is contractible means, on the one hand, that it is easy to write a contract and it is easy to verify the investments made by the parties due to the characteristics of the product. On the other hand, it also means that it is simple to exercise compliance of the contract (if need it) because the institutions in the supplier country are adequate to do so. When the product is not easy contractible, however, FDI tends to emerge.

An important question in this framework then is what happens when there is an improvement in the quality of contracting institutions in the supplier’s country. The model in Antras and Helpman (2008) generates the general prediction that better contract enforcement increases *all* types of offshoring, that is, it increases both outsourcing and FDI. The main reason for this is that while production in the supplier’s country (South) is always cheaper than producing in headquarters (North), there are also fixed costs of fragmenting production internationally and thus only the most productive firms can do so. However, when the quality of institutions in the supplier’s country increases (in the model this means that a larger number of components become contractible) *both* types of offshoring becomes relatively more profitable than producing in headquarters and thus a larger number of firms engage in this practice. Which mode increases more; however, is an ambiguous outcome of this theory due to the presence of the two opposite effects mentioned earlier. The net effect depends on the relative strength of these two opposite effects.

In order to take the general theory to the empirical front we use a framework that follows Bernard, Jensen, Redding and Schott (2010, BJRS hereafter) and also Nunn and Trefler (2008). These papers are part of a recent emergence of empirical analyses that examine the factors that affect the decision behind the optimal mode of offshoring (see also Corcos et al., 2009, Carluccio and Fally, 2010, and Tomiura, 2007).¹²

The insights of the theoretical framework summarized above indicate that the empirical model should include proxies for the production technology of the good, for the factor abundance of the supplier’s country and for the degree of contract incompleteness associated with the good and the country of the supplier. Regarding proxies for the production technology and for factor abundance, the empirical specification in this paper includes a measure of the industry’s capital intensity and a measure of the country’s capital abundance. In addition, following BJRS, we also include industry skill intensity and country skill abundance to allow for the possibility that other factor intensities matter as well. With respect to the issue of contractibility, we include

¹² Corcos et al. (2009) and Carluccio and Fally (2010) employ firm level data from France while Tomiura (2007) employs firm level data from Japan.

variables that capture the degree of contractibility at the good level and at the supplier’s country level. The precise empirical specification takes the following form:

$$X_{ci} = \beta_0 + \beta_1 r_i + \beta_2 G_c + \beta_3 r_i G_c + \beta_4 k_i + \beta_5 Z_c + \beta_6 k_i Z_c + \beta_7 s_i + \beta_8 H_c + \beta_9 s_i H_c + \beta_{10} P_c + \varepsilon_{fpc} \quad (1)$$

where X_{ci} is a measure of intra-firm exports in industry i from country c to the United States; r_i , k_i and s_i are measures of contractibility, capital intensity and skill intensity of industry i , respectively; G_c , Z_c , H_c , and P_c are measures of the legal contractual framework, physical capital abundance, human capital abundance and total population¹³ in exporting country c and ε is the error term.

Following BJRS, we examine both the extensive and the intensive margins of trade. For the extensive margin, the dependent variable takes the form of a dummy that is equal to 1 if there are positive intra-firm exports of country c in industry i and zero otherwise. In this case, equation (1) is estimated using a probit model. In the case of the intensive margin, the dependent variable is the share of intra-firm exports of country c in industry i . This regression is estimated using OLS.

Data

Similar to section 3, we employ the U.S. Related Party Trade Database. We choose the year 2005 to match as close as possible the time period available for most of the covariates in the model. Additionally, we work at the 6-digit NAICS level of disaggregation because this matches exactly the level of disaggregation of all the covariates that capture industry characteristics.

Regarding the variable that measures the level of contractibility of the product, we follow Nunn and Treffer (2008) and use Nunn’s measure of industry contract intensity. Nunn defines contract intensity when the production of a good requires the use of highly specialized and customized inputs. The more specialized and customized the input is, the more specific the relationship is and the more contract-intensive the production of the good becomes.¹⁴ To facilitate the interpretation of the results we follow Nunn and Treffer (2008) and use 1 minus the fraction of inputs that are relationship-specific as the variable of interest in the regression. Therefore, the higher the value of this variable the less contract-intensive the industry is. This is our measure of industry contractibility, or r_i in equation (1).¹⁵ Capital intensity in industry i (k_i) is measured by the capital-labor ratio of

¹³ Total population or labor force is also a variable that is typically included in this type of regressions to examine the role of size on vertical integration.

¹⁴ In particular, Nunn uses Rauch’s (1999) commodity classification to define whether an input is relationship-specific and combines this with information from the 1997 US I-O table to construct for each good the fraction of its inputs that are relationship-specific.

¹⁵ An alternative measure of the level of contractibility of a product is the degree of “routineness” inherent to its production. Costinot, Oldenski and Rauch (2011), for example, develop a ranking of sectors in terms of their “routineness” by using U.S. rating of occupations by their intensities in solving problems. There is actually a negative correlation of 0.11 between Nunn’s measure of contract intensity and Costinot et al.’s measure of routineness implying that more routine activities are less contract-intensive and thus are more easily contractible. Costinot et al., show that non-routine activities are more likely to be offshored via FDI.

the industry, while skill intensity (s_i) is measured by the ratio of non-producer workers to total workers. These data are taken from the NBER-CES Manufacturing Industry Database, which are available at the 6-digit NAICS level for the year 2005. Physical capital abundance in country c (Z_{ct}) is an updated version of the Hall and Jones (1999) measure of physical capital per worker. The update is constructed using the Penn World Tables dataset for the years 2005 (see Appendix A). Total population is also taken from the Penn World Tables. Following a standard practice in the development literature we use as a proxy of human capital abundance in country c (H_{ct}) the average years of schooling attained in the population older than 25. The data are available for the year 2005 from Barro-Lee Data set (2011). Regarding the quality of the contractual environment we employ the various alternative proxies that were presented in section 2.

We also include two additional covariates in the model to measure the role of trade costs. Even though the theory is silent with respect to these costs, they might have an important impact on the location and on the mode of offshoring. We specifically include a dummy variable equal to 1 if the exporting country has a preferential trade agreement with the U.S. and zero otherwise. This measure intends to capture the role of market access on intra-firm trade. The second variable is a measure of transport costs consisting on the ad-valorem freight rate associated to the exports from country c to the U.S. in industry i . The freight rates are calculated using the U.S. imports of Merchandise dataset from the U.S. Census Bureau, which includes the customs import value of all import transactions in the U.S. as well as their associated freight charges at the 10-digit Harmonized System (HS). The dataset is converted to 6-digit NAICS using a concordance table taken from the World Integrated Trade Solution of the World Bank.

In Table 2 we show descriptive statistics for all the variables in the model except for the proxies of contractual environment, which were already presented in section 2. Table 2 shows averages for the entire sample and for each of the sub-regions. For instance, among all the countries, the average share of positive intra-firm exports is 37.8% while the average number of (NAICS-6) industries with positive intra-firm trade is 113 (out of 388 industries). Supporting the findings in section 3, LAC falls behind relative to all the sub-regions in both dependent variables: the share of intra-firm exports and the number of industries with positive intra-firm exports. Regarding the explanatory variables, it is worth mentioning some interesting findings, for instance: (i) the average basket of exports from LAC to the U.S. is less contract-intensive than the average basket of exports from most of the other regions; (ii) the average basket of exports from LAC to the U.S. is less capital-intensive than the average baskets of exports from most of the other regions; (iii) the stocks of physical and human capital are typically smaller in LAC than in the other regions and (iv) the average transport cost are normally higher in LAC than in the other regions.

Figure 7 to 10 present some simple correlations between the share of intra-firm trade and some of these key explanatory variables. Figure 7 shows a positive correlation between Nunn's measure of contractibility and

the share of intra-firm trade. The correlation is broadly in line with what one would expect from the theory that more contract-intensive industries tend to exhibit larger shares of intra-firm trade. Note, however, that there is a lot of dispersion in this relationship. This suggests that contract-intensity is not the only factor affecting the share of intra-firm trade of the industry as mention above. Figure 8, for example, presents another industry characteristic that influences the share of intra-firm trade: the degree of capital-intensity. As suggested by the theory, vertical integration is more likely to occur in capital-intensive industries.

Figure 9 presents the relationship between intra-firm exports and the factor endowments of the exporting country, in particular, physical capital. As mentioned earlier, capital abundant countries are more likely to engage in intra-firm trade, a positive relationship that is clearly visible in the figure.

Finally, figure 10 shows the relationship between intra-firm exports and the various measures of contracting institutions presented in section 2. We combine the three variables of contract enforcement from the Doing Business by calculating the principal component of these measures after being mean-centered. Also, we multiply this measure, as well as the index of legal formalism, by minus one so that an increase in these variables corresponds to a better governance outcome like the rest of the institutional variables employed. Figure 10 shows a positive relationship between the share of intra-firm exports and all the measures of contracting institutions examined, suggesting that countries with better contractual environments export more to the U.S. via intra-firm transactions. This, in principle, goes against the standard view that FDI is an imperfect solution to the problem of incomplete contracts and tends to support the existence of the so-call surprise effect. However, as we will see from the econometric results, the relationship between the quality of contracting institutions and the mode of offshoring is not as linear as it is suggested by these graphs.

Table 3 shows the results of estimating equation 1 for both the extensive and the intensive margins of trade. In these estimations we employ the Kaufmann, Kraay and Mastruzzi (2006) measures of governance, particularly the index of the Rule of Law to proxy contracting institutions. We use the alternative proxies in the robustness tests.

Given that our econometric analysis follows very closely the data and the estimation strategy in BJRS, it is not surprising that the results are very similar. Nevertheless, it is worth commenting the main findings and also pointing out some of the differences. The first row of column (1) confirms the prediction of the theory that the easier the contractibility of a product, the lower the share of intra-firm trade. In other words, when products are contractible, firms tend to favor outsourcing. The next two rows show that the quality of the legal contractual system promotes the establishment of intra-firm trade (supporting the existence of the surprise effect as mentioned earlier) especially if the product is non-contractible. Regarding the relationship between contractibility and the intensive margin, the results in column (2) indicate that even though good governance triggers the establishment of intra-firm trade (the extensive margin), it does not induce its intensity once established. The

positive interaction between product contractibility and country governance in this regression means that an increase in the contractibility of the good tends to reduce the share of intra-firm trade but less so in countries with good governance.¹⁶

Corroborating results in BJRS we also find that intra-firm trade is higher in capital-intensive and skill-intensive industries, as predicted by the theory. In particular, capital-intensive industries are associated with higher intra-firm trade at the intensive margin while skill-intensive industries are associated with higher intra-firm trade at both the intensive and the extensive margins. Capital abundance countries tend to be more engaged in intra-firm trade and they promote more vertical integration. This is also a result expected from the theory.

The coefficients for the country-human capital abundance are not significant for any of the margins suggesting that there is not a direct relationship between human capital and intra-firm trade. However, there are indirect impacts via the interaction of human capital and the skill-intensity of the industry. Specifically, the interaction terms of human capital and skill intensity in columns (1) and (2) are positive and negative respectively. This implies that among the skill-intensive industries it is more likely that intra-firm trade will be established if the country is abundant in human capital (the extensive margin); however, once the relationship is established, human capital accumulation tends to give rise to outsourcing (the intensive margin). Also consistent with BJRS we find that the correlation between country size and intra-firm trade is positive for the extensive margin while negative for the intensive margin. Finally, we find that lower trade costs promote vertical integration. In particular, trade agreements seem to promote intra-firm trade in the extensive margin while lower freight costs induce intra-firm trade in both the extensive and the intensive margins.

In columns (3) and (4) we repeat the regressions in (1) and (2) but without clustering the standard errors by the exporting country. We do this to compare our results more closely to those of BJRS who do not cluster their standard errors by country group. The main difference is in the intensive margin (column 4). Specifically, the rule of law index and the endowment of human capital become significant as in BJRS. The coefficient for the PTA also becomes significant in this regression. The positive coefficient of the rule of law in column (3) and the negative coefficient in column (4) implies, as argued by BJRS, that there is a non-linearity in the effect of contracting institutions. Specifically, it means that good governance promotes the establishment of intra-firm trade, but once relationships exist further advances in contracting institutions give rise to outsourcing. This non-linearity of the effects of governance on economic outcomes is not new. For instance, the literature specialized on the effects of intellectual property rights has long described that firms selling patented or copyrighted products to other countries tend to place them via exports if intellectual property protection is weak. But as protection strengthens, firms reduce the level of exports and serve the markets via FDI and finally through licensing (Maskus, 2000) generating an inverted-U relationship between FDI and intellectual property rights.

¹⁶ This again goes in the direction of the surprise effect.

While the regressions in columns (3) and (4) make our results more in line with those in BJRS, we continue to use country-clustered standard errors in the rest of the estimations. The final two regressions in table 3 present the results when we exclude from the sample the exports of final goods. While the coefficients tend to change slightly, none of the qualitative results found so far change in any way.

In tables 4 and 5 we repeat the estimations of equation (1) but with the alternative variables that capture the quality of the country's contracting institutions. To facilitate the comparison, column (1) in tables 4 and 5 repeat the results shown in table 3 for the probit and OLS models, respectively. The results indicate that regardless of the measure of governance used, the outcomes remain qualitatively similar to the original estimations for both margins of trade. Therefore, the results are robust to changes in the measure of contracting institutions.

The econometric results have potential important implications for LAC. We have seen that LAC's insertion in global production networks is biased towards arm's-length transactions in industries that tend to be labor-intensive and that do not typically require relation-specific investments. We have also seen that the countries that have been able to diversify their export successfully have not focused exclusively on arm's-length transactions but engage in both types of sourcing via arm's-length and intra-firm trade. Therefore, if countries in the region aim to take advantage of offshoring opportunities arising from capital- and contract-intensive industries, which in general have higher chances to occur through FDI (at least initially), the econometric results indicate that fostering the quality of contractual institutions is a relevant factor.

We can actually use the results of the probit model to examine specifically the extent to which an improvement in the quality of contracting institutions of the host-country triggers offshoring opportunities. Using the estimation results from Table 3 (column 1) we first evaluate the model when all the covariates take the mean values of LAC and then calculate the change in the dependent variable after modifying the value of the governance variable to take the mean value of East Asia while keeping the rest of the covariates constant. For comparison purpose we repeat the exercise where the covariate that we modify is the level of physical capital. The results are shown in Table 6. An increase in the quality of contracting institutions in LAC to the average levels observed in East Asia increases the probability of establishing intra-firm trade with the U.S. by 16% to 44%, depending on the measure of institutions used. With respect to endowments, an increase in the level of physical capital increases the probability of establishing intra-firm trade by 21% to 34% depending on the model. The results show that differences in endowments, while important, do not explain entirely LAC's bias towards arm's-length type of transactions. Improving contracting institutions is also likely to reduce this bias and raise the chances of diversifying exports towards more contract-intensive activities.

5. Policy Implications

Analyzing the determinants of intra-firm trade and outsourcing is important for countries seeking to participate in international production networks because even though outsourcing and FDI are alternative modes of offshoring, they are not perfect substitutes. The results presented in section 4 indeed show that industries that are capital-intensive, skill-intensive and not easily contractible –which typically involving nonroutine activities– tend to be offshored via FDI while labor and unskilled-intensive industries as well as industries that are easily contractible tend to be outsourced. While it is certainly possible for capital-intensive, skill-intensive and contract-intensive activities to be offshored through arm’s-length trade, what the econometric results imply is that they have a higher likelihood of being sourced, everything else equal, through vertical integration.

The results also show that the decision to establish a foreign affiliate in a country differs from the choice of how much to source from the affiliate once it is established. Specifically, affiliates are more likely to be located in countries with large physical capital endowments, large size, adequate market access and low transport costs. Once the affiliates are established, however, large physical capital endowments and low transport costs encourage offshoring from affiliates while country size (and potentially human capital and market access) encourage more outsourcing. The effect of contracting institutions is also not linear. Having good contract-enforcement institutions tends to trigger vertical integration and thus intra-firm trade, particularly in industries that are highly contract-intensive. However, once relationships exist, improvements in governance potentially may lead to relatively more arm’s-length trade.

The econometric results provide key insights behind LAC’s current trade patterns. We have seen that LAC’s insertion in global production networks is biased towards arm’s-length transactions in industries that tend to be labor-intensive and that do not typically require relation-specific investments. We have also seen that the countries that have been able to diversify their export successfully have not focused exclusively on arm’s-length transactions but engage in both types of sourcing via arm’s-length and intra-firm trade. Therefore, if countries in the region aim to take advantage of offshoring opportunities arising from capital- and contract-intensive industries, which in general have higher changes to occur through FDI (at least initially), the econometric results indicate that fostering the quality of contractual institutions is a relevant factor.

Counterfactual analyses show that differences in endowments contribute to LAC’s bias towards arm’s-length transactions, but not entirely. Differences in contracting institutions also lead to this pattern. Improving contracting institutions is likely to reduce this bias and raise the changes of diversifying exports towards more contract-intensive activities. The results suggest that the path is not linear, however. Increasing the quality of contracting institutions is likely to improve first the chances of supplying contract-intensive activities through FDI, but further increases may potentially induce additional offshoring through local contractors.

The findings in this paper support the general notion that has emerged in recent years that the quality of contracting institutions can shape the geographical location of fragmented production and thus it constitutes, beyond relative endowments, an additional source of comparative advantage.

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Table 1: Governance variables, simple average of countries in the sample

Variable	Range	All	LAC	EU15	East Asia	Southeast Asia	Oceania
(1) No. of procedures for enforcing a contract	--	37.09	37.43	31.33	36.75	33.00	29.50
(2) Time for enforcing a contract, in days	--	616.13	706.30	520.33	376.50	484.33	305.50
(3) Cost for enforcing a contract, as % of claim	--	31.22	32.67	19.21	15.45	39.35	21.35
(4) Legal formalism index ^a	1 to 6	3.66	4.56	3.38	3.03	3.35	1.69
(5) Index of legal structure and security of property rights ^b	0 to 10	5.88	4.94	7.84	6.98	6.03	8.72
(6) Index of property rights ^b	0 to 100	48.83	43.64	80.67	60.00	43.33	90.00
(7) Index of protection of intellectual property rights ^b	0 to 10	5.48	4.51	7.61	6.40	5.45	8.25
(8) Rule of law index ^b	-2.5 to 2.5	0.06	-0.41	1.45	0.61	0.13	1.75

Notes: The table shows the simple average of the countries in the sample. The variables are: (1) the number of procedures for enforcing a contract, (2) the time (in days) for enforcing a contract, and (3) the cost (as a percentage of the claim) of enforcing a contract from the Doing Business dataset. (4) Index of legal formalism, measuring the number of formal legal procedures necessary to resolve a simple case of collecting on an unpaid check from Djankov et al. (2003). (5) Index of legal structure and security of property rights from the Fraser Institute (6) Index of property rights from the Heritage Foundation. (7) Index of protection of intellectual property rights from the Property Rights Alliance. (8) Index of rule of law from Kaufmann, Kraay and Mastruzzi (2006).

a: Higher value corresponds to worse governance outcome

b: Higher value corresponds to better governance outcome

Table 2: Descriptive statistics, simple average of countries in the sample

Variable	All	LAC	EU15	East Asia	Southeast Asia	Oceania
(1) Share of intra-firm exports, in percent	37.75	34.20	58.78	48.16	39.20	41.72
(2) Number of industries with positive intra-firm trade	112.74	105.21	278.00	335.00	202.43	261.00
(3) Contract intensity of the average industry, in percent	46.18	45.48	52.46	70.55	71.11	47.48
(4) Capital intensity of the average industry, in US\$	121.70	125.55	129.85	131.31	123.52	128.67
(5) Skill intensity of the average industry, in percent	33.15	30.36	35.48	36.54	40.04	28.37
(6) Capital abundance, in logs	10.23	10.22	12.02	11.18	10.38	12.14
(7) Human capital abundance, in logs	1.98	1.96	2.30	2.27	1.88	2.49
(8) Population, in logs	9.19	8.90	9.49	11.66	10.60	9.10
(9) Ad valorem freights, in percent	5.51	5.28	4.44	4.61	5.56	5.52

Notes: The table presents simple averages of the respective variable for the countries in the corresponding sample. The variable are: (1) the share of intra-firm exports in total exports (only shares with positive values are included). (2) Number of industries in 6-digit NAICS level with positive shares of intra-firm exports. (3) Contract-intensity is the fraction of inputs that are relationship-specific. (4) Capital intensity is the average capital labor ratio, measured in thousands of US\$. (5) Skill intensity is the ratio of non-production workers to total workers. (6) Capital abundance is the log of physical capital per worker. (7) Human capital abundance is the log of average years of schooling attained. (8) Population is the log of total population. (9) Ad valorem freights is the ad-valorem freight rate of the exports in the industry.

Table 3: Determinants of Intra-firm Exports to the United States

Regressor	Probit (1)	OLS (2)	Probit (3)	OLS (4)	Probit (5)	OLS (6)
Non-contract-intensity_i	-0.1529*** (0.0225)	-0.0542** (0.0212)	-0.1529*** (0.0204)	-0.0542*** (0.0172)	-0.1951*** (0.0236)	0.0384* (0.0219)
Governance (kkm)_c	0.1074*** (0.0202)	-0.0114 (0.0158)	0.1074*** (0.0058)	-0.0114** (0.0052)	0.1090*** (0.0199)	-0.0098 (0.0159)
x Non-contract-intensity_i	-0.0697*** (0.0259)	0.0643*** (0.0215)	-0.0697*** (0.0186)	0.0643*** (0.0159)	-0.0735*** (0.0266)	0.0649*** (0.0217)
Capital intensity_i	-0.0176 (0.0238)	0.1739*** (0.0189)	-0.0176 (0.0192)	0.1739*** (0.0157)	-0.0028 (0.0238)	0.1636*** (0.0191)
Capital abundance_c	0.0719*** (0.0180)	0.0364** (0.0169)	0.0719*** (0.0052)	0.0364*** (0.0051)	0.0726*** (0.0177)	0.0368** (0.0171)
x Capital intensity_i	0.0346 (0.023)	-0.0058 (0.0114)	0.0346** (0.0159)	-0.0058 (0.0121)	0.0345 (0.0224)	-0.0067 (0.0115)
Skill intensity_i	0.1131** (0.0497)	0.1205*** (0.0359)	0.1131** (0.0364)	0.1205*** (0.0285)	0.0879* (0.0509)	0.1207*** (0.0381)
Human capital abundance_c	0.0261 (0.0642)	-0.0808 (0.0667)	0.0261 (0.0204)	-0.0808*** (0.0183)	0.0249 (0.0621)	-0.0881 (0.0664)
x Skill intensity_i	0.2958** (0.1431)	-0.2431** (0.1115)	0.2958** (0.1086)	-0.2431** (0.0925)	0.3441** (0.1497)	-0.2515** (0.1189)
Population_c	0.1082*** (0.0079)	-0.0230*** (0.0086)	0.1082*** (0.0025)	-0.0230*** (0.0019)	0.1093*** (0.0079)	-0.0239*** (0.0086)
PTA_c	0.1704*** (0.0428)	-0.0267 (0.0602)	0.1704*** (0.0109)	-0.0267** (0.0107)	0.1699*** (0.0438)	-0.0257 (0.0599)
Freights_{ic}	-0.0386*** (0.0051)	-0.0653*** (0.0056)	-0.0386*** (0.0039)	-0.0653*** (0.0038)	-0.0382*** (0.0051)	-0.0639*** (0.0059)
Observations	19103	12995	19103	12995	18144	12415
R2		0.09		0.09		0.09
Pseudo R2	0.18		0.18		0.18	
Cluster-exporting country	Yes	Yes	No	No	Yes	Yes
Intermediate goods	Yes	Yes	Yes	Yes	Yes	Yes
Final goods	Yes	Yes	Yes	Yes	No	No

Notes: (1), (3) and (5): Probit regression results. Numbers are marginal effects. Dependent variable indicates whether the exports of country c in industry i to the United States are intra-firm. (2), (3) and (6): OLS regression results. Dependent variable is the share of exports of country c in industry i to the United States that is intra-firm and only positive values are included. Non-contract-intensity is 1 minus Nunn's measure of contract intensity in industry i. Governance (kkm) is the index of rule of law from Kaufman, Kraay and Mastruzzi. Capital intensity is the capital labor ratio in industry i. Capital abundance is the log of physical capital per worker in country c. Skill intensity is the ratio of non-production workers to total workers in industry i. Human capital abundance is the log of average years of schooling attained in country c. Population is the log of total population in country c. PTA is a dummy equal to 1 if country c has a preferential trade agreement with the United States. Freights is the ad-valorem freight rate of the exports in industry i from country c to the United States. All regression include year fixed effects. Robust standard errors adjusted for clustering at the country level in parentheses.

*** ; ** ; * significant at the 1%, 5% and 10% level respectively

Table 4: Determinants of Intra-firm Exports to the United States. Probit Estimations
Alternative governance indicators

Regressor	Probit	Probit	Probit	Probit	Probit	Probit
	<i>Governance: kkm</i>	<i>Governance: efw</i>	<i>Governance: ief</i>	<i>Governance: dw</i>	<i>Governance: dlls</i>	<i>Governance: ipr</i>
	(1)	(2)	(3)	(4)	(5)	(6)
Non-contract-intensity_i	-0.1529*** (0.0225)	-0.1537*** (0.0223)	-0.1524*** (0.0224)	-0.1484*** (0.0221)	-0.1490*** (0.0214)	-0.1493*** (0.0223)
Governance_c	0.1074*** (0.0202)	0.0524*** (0.0103)	0.0042*** (0.0010)	-0.0907*** (0.0285)	-0.0358** (0.0141)	0.0661*** (0.0109)
x Non-contract-intensity_i	-0.0697*** (0.0259)	-0.0392** (0.0162)	-0.0013 (0.0011)	0.0017 (0.0384)	0.0419* (0.0244)	-0.0438*** (0.0150)
Capital intensity_i	-0.0176 (0.0238)	-0.0203 (0.0239)	-0.0171 (0.0238)	-0.0094 (0.0251)	-0.0357 (0.0228)	-0.0226 (0.0234)
Capital abundance_c	0.0719*** (0.0180)	0.0798*** (0.0169)	0.0675*** (0.0207)	0.0912*** (0.0198)	0.1229*** (0.0173)	0.0655*** (0.0184)
x Capital intensity_i	0.0346 (0.0223)	0.0339 (0.0228)	0.0214 (0.0221)	0.0196 (0.0223)	0.0301 (0.0230)	0.0377 (0.0230)
Skill intensity_i	0.1131** (0.0497)	0.1142** (0.0496)	0.1115** (0.0497)	0.1097** (0.0499)	0.1067** (0.0489)	0.1248** (0.0488)
Human capital abundance_c	0.0261 (0.0642)	0.0645 (0.0692)	0.0899 (0.0681)	0.0872 (0.0782)	0.0252 (0.0715)	0.0469 (0.0680)
x Skill intensity_i	0.2958** (0.1431)	0.3209** (0.1646)	0.3418** (0.1572)	0.4144*** (0.1476)	0.4253*** (0.1490)	0.3677** (0.1456)
Population_c	0.1082*** (0.0079)	0.1072*** (0.0078)	0.1129*** (0.0084)	0.1070*** (0.0083)	0.1008*** (0.0088)	0.1027*** (0.0082)
PTA_c	0.1704*** (0.0428)	0.1697*** (0.0409)	0.1564*** (0.0379)	0.1919*** (0.0399)	0.1731*** (0.0381)	0.1612*** (0.0419)
Freights_{ic}	-0.0386*** (0.0051)	-0.0363*** (0.0050)	-0.0385*** (0.0049)	-0.0393*** (0.0051)	-0.0352*** (0.0048)	-0.0373*** (0.0052)
Observations	18667	18667	18917	18249	18138	18591
Pseudo R2	0.18	0.18	0.18	0.16	0.16	0.17

Notes: Probit regression results. Numbers are marginal effects. Dependent variable indicates whether the exports of country c in industry i to the United States are intra-firm. Non-contract-intensity is 1 minus Nunn's measure of contract intensity in industry i. Governance indicators are as follows: kkm is the index of rule of law from Kaufman, Kraay and Mastruzzi; efw is the sub-index of legal structure and security of property rights from the Economic Freedom of the World index; ief is the sub-index of property rights from the index of economic freedom of the Heritage Foundation; dw is the principal component of the number of procedures for enforcing a contract, the time (in days) for enforcing a contract and the cost of enforcing a contract (as a percentage of the claim) from the Doing Business; dlls is an index of legal formalism measuring the number of formal legal procedures necessary to resolve a simple case of collecting on an unpaid check from Djankov et al. (2003); ipr is the sub-index of intellectual property rights from the international property rights index. Capital intensity is the capital labor ratio in industry i. Capital abundance is the log of physical capital per worker in country c. Skill intensity is the ratio of non-production workers to total workers in industry i. Human capital abundance is the log of average years of schooling attained in country c. Population is the log of total population in country c. PTA is a dummy equal to 1 if country c has a preferential trade agreement with the United States. Freights is the ad-valorem freight rate of the exports in industry i from country c to the United States. All regression include year fixed effects. Robust standard errors adjusted for clustering at the country level in parentheses.

***, **, * significant at the 1%, 5% and 10% level respectively

Table 5: Determinants of Intra-firm Exports to the United States. OLS Estimations
Alternative governance indicators

Regressor	OLS	OLS	OLS	OLS	OLS	OLS
	<i>Governance: kkm</i>	<i>Governance: efw</i>	<i>Governance: ief</i>	<i>Governance: db</i>	<i>Governance: dlls</i>	<i>Governance: ipr</i>
	(1)	(2)	(3)	(4)	(5)	(6)
Non-contract-intensity_i	-0.0542** (0.0212)	-0.0597*** (0.0217)	-0.0585*** (0.0215)	-0.0430** (0.0200)	-0.0463** (0.0219)	-0.0578*** (0.0211)
Governance_c	-0.0114 (0.0158)	0.0001 (0.0088)	-0.0004 (0.0001)	-0.0299 (0.0287)	-0.0175 (0.0111)	-0.0027 (0.0104)
x Non-contract-intensity_i	0.0643*** (0.0215)	0.0372*** (0.0128)	0.0029*** (0.0009)	-0.0558* (0.0299)	-0.0481** (0.0202)	0.0419*** (0.0125)
Capital intensity_i	0.1739*** (0.0189)	0.1742*** (0.0193)	0.1740*** (0.0189)	0.1690*** (0.0194)	0.1651*** (0.0198)	0.1734*** (0.0193)
Capital abundance_c	0.0364** (0.0169)	0.0339* (0.0173)	0.0394** (0.0176)	0.02667* (0.0159)	0.0342** (0.0149)	0.0335* (0.0179)
x Capital intensity_i	-0.0058 (0.0114)	-0.0061 (0.0114)	-0.0068 (0.0112)	0.0038 (0.0122)	0.0136 (0.0108)	-0.0044 (0.0117)
Skill intensity_i	0.1205*** (0.0359)	0.1198*** (0.0369)	0.1179*** (0.0364)	0.1098*** (0.0378)	0.1211*** (0.0371)	0.1140*** (0.0362)
Human capital abundance_c	-0.0808 (0.0667)	-0.1073 (0.0757)	-0.1059 (0.0718)	-0.1093 (0.0705)	-0.0721 (0.0671)	-0.0859 (0.0691)
x Skill intensity_i	-0.2431** (0.1115)	-0.2457** (0.1207)	-0.2286* (0.1179)	-0.2829** (0.1214)	-0.2881** (0.1129)	-0.2340** (0.1146)
Population_c	-0.0230*** (0.0086)	-0.0229** (0.0090)	-0.0242*** (0.0087)	-0.0205** (0.0096)	-0.0210** (0.0092)	-0.0221** (0.0091)
PTA_c	-0.0267 (0.0602)	-0.0218 (0.0634)	-0.0212 (0.0613)	-0.0177 (0.0609)	-0.0237 (0.0549)	-0.0260 (0.0624)
Freights_{ic}	-0.0653*** (0.0056)	-0.0643*** (0.0058)	-0.0653*** (0.0056)	-0.0657*** (0.0057)	-0.0634*** (0.0056)	-0.0657*** (0.0058)
Observations	12995	12821	12908	12367	12729	12884
R2	0.09	0.09	0.09	0.09	0.09	0.09

Notes: Probit regression results. Numbers are marginal effects. Dependent variable indicates whether the exports of country *c* in industry *i* to the United States are intra-firm. Non-contract-intensity is 1 minus Nunn's measure of contract intensity in industry *i*. Governance indicators are as follows: *kkm* is the index of rule of law from Kaufman, Kraay and Mastruzzi; *efw* is the sub-index of legal structure and security of property rights from the Economic Freedom of the World index; *ief* is the sub-index of property rights from the index of economic freedom of the Heritage Foundation; *db* is the principal component of the number of procedures for enforcing a contract, the time (in days) for enforcing a contract and the cost of enforcing a contract (as a percentage of the claim) from the Doing Business; *dlls* is an index of legal formalism measuring the number of formal legal procedures necessary to resolve a simple case of collecting on an unpaid check from Djankov et al. (2003), *ipr* is the sub-index of intellectual property rights from the international property rights index. Capital intensity is the capital labor ratio in industry *i*. Capital abundance is the log of physical capital per worker in country *c*. Skill intensity is the ratio of non-production workers to total workers in industry *i*. Human capital abundance is the log of average years of schooling attained in country *c*. Population is the log of total population in country *c*. PTA is a dummy equal to 1 if country *c* has a preferential trade agreement with the United States. Freights is the ad-valorem freight rate of the exports in industry *i* from country *c* to the United States. All regression include year fixed effects. Robust standard errors adjusted for clustering at the country level in parentheses.

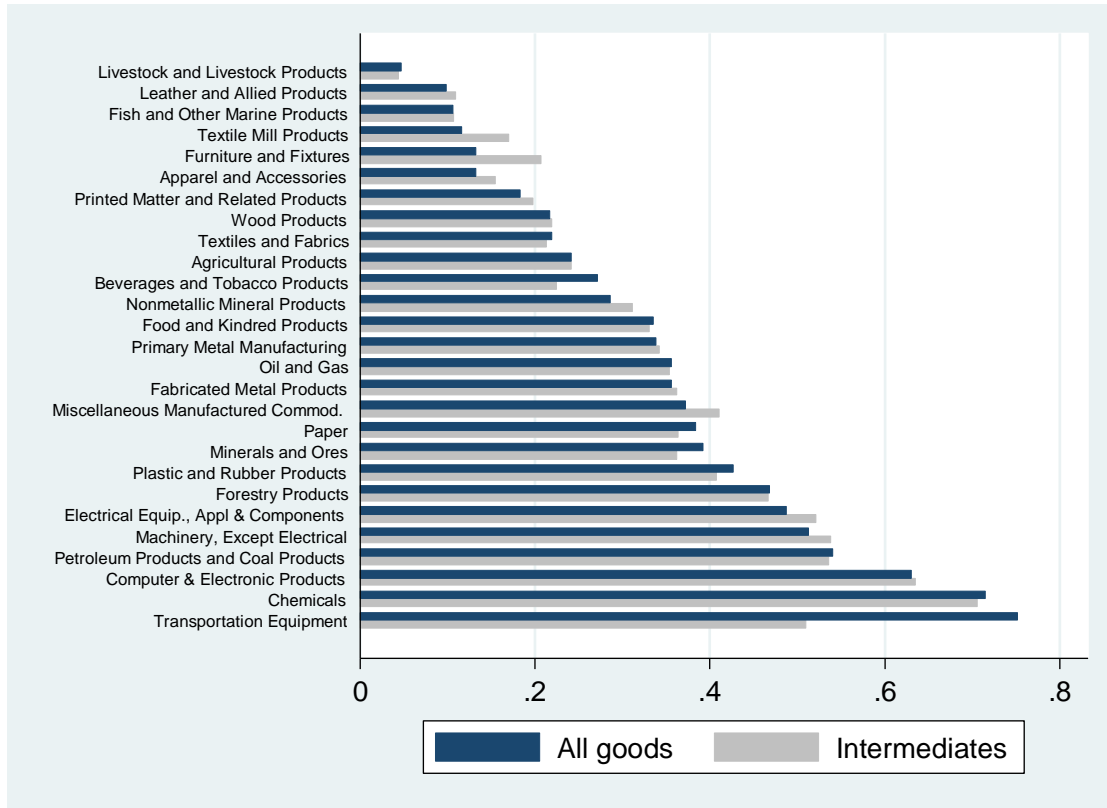
***, **, * significant at the 1%, 5% and 10% level respectively

Table 6: Counterfactual Simulations: Change in LAC's Probability of Engaging in Intra-firm Trade if Covariate Takes Mean Values of East Asia (%)

	<i>Gov: kkm</i>	<i>Gov: efw</i>	<i>Gov: ief</i>	<i>Gov: db</i>	<i>Gov: dlls</i>	<i>Gov: ipr</i>
Policy Variables	(1)	(2)	(3)	(4)	(5)	(6)
Governance	33.57	38.61	23.22	20.92	15.63	43.70
Capital abundance	20.77	28.44	24.84	31.60	34.16	21.73

Notes: the simulations consist on evaluating the estimated model when all the covariates take the mean values of LAC and then calculating the change in the dependent variable after modifying the characteristics of a covariate to take the mean value of the comparator group while keeping the values of all the other covariates the same. The impact includes the indirect effect of the covariate through interactions with other covariates, when they exist. The governance measures are the following: kkm is the index of rule of law from Kaufman, Kraay and Mastruzzi; efw is the sub-index of legal structure and security of property rights from the Economic Freedom of the World index; ief is the sub-index of property rights from the index of economic freedom of the Heritage Foundation; dw is the principal component of the number of procedures for enforcing a contract, the time (in days) for enforcing a contract and the cost of enforcing a contract (as a percentage of the claim) from the Doing Business; dlls is an index of legal formalism measuring the number of formal legal procedures necessary to resolve a simple case of collecting on an unpaid check from Djankov et al.; ipr is the sub-index of intellectual property rights from the international property rights index.

**Figure 1: Share of U.S. Imports that is Intra-Firm
by industry(3-digit NAICS), 2010**



**Figure 2: Share of U.S. Imports of Electrical Equipment, Appliance & Components
that is Intra-Firm by Country of Export, 2010**

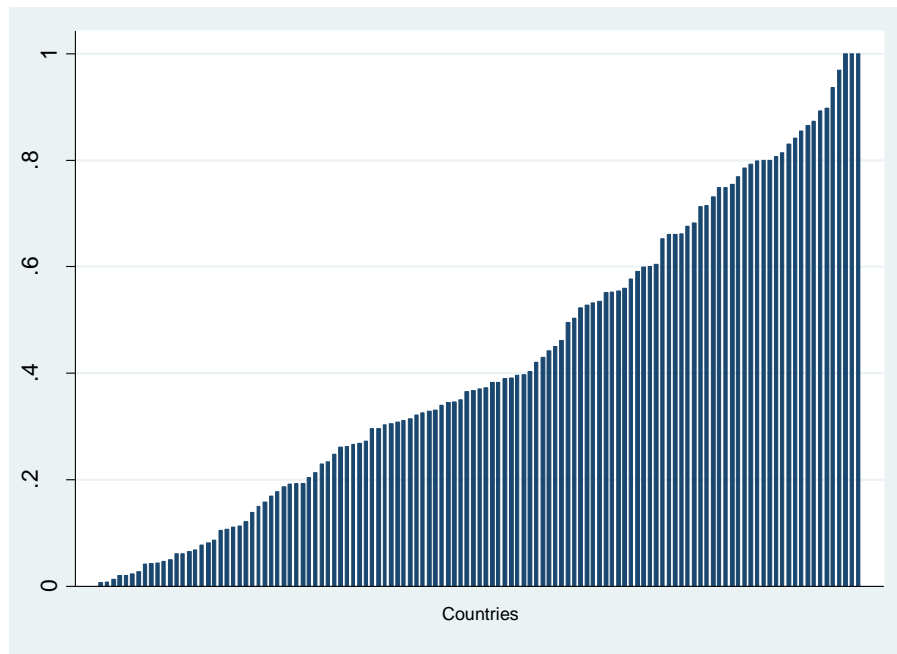


Figure 3: Share of U.S. Imports that is Intra-Firm by Region of Export, 2010

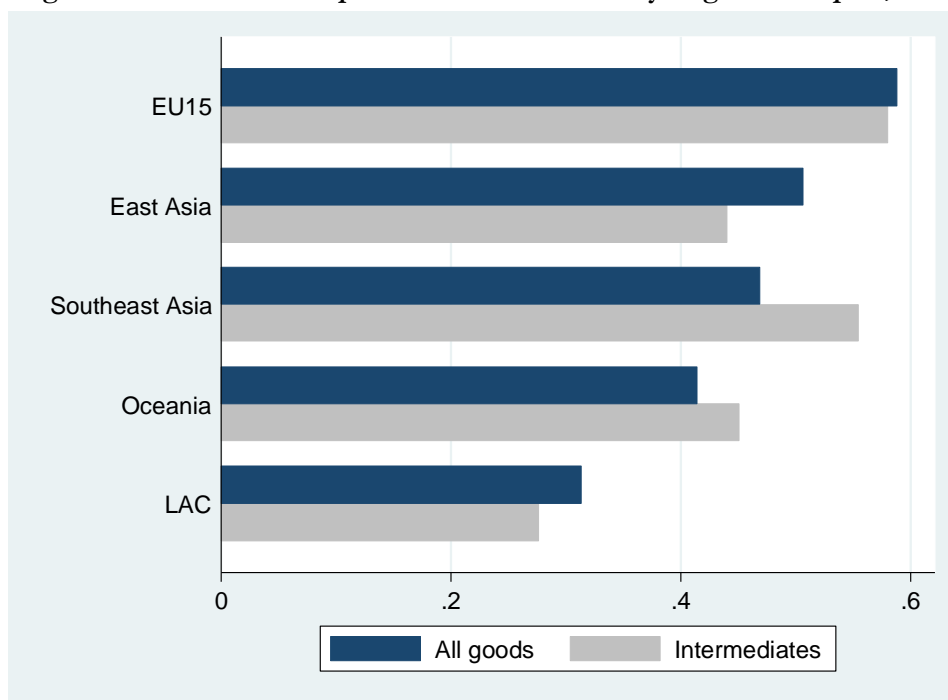


Figure 4: Intra-Firm Trade Intensity and Trade Specialization, 2010

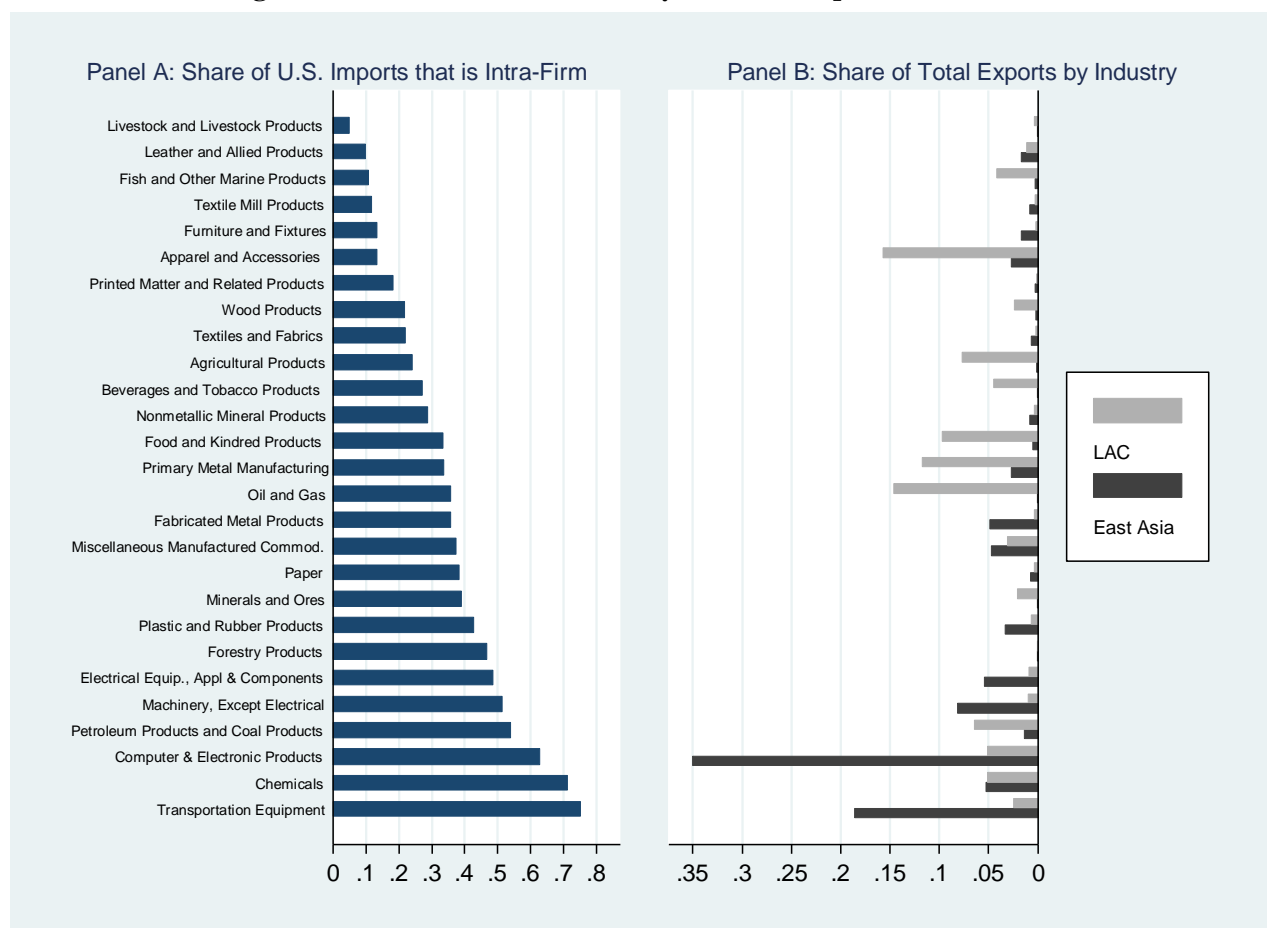


Figure 5: Number of Industries (6-digit NAICS) in which the Country is Active Exporting to the U.S. by Mode of Offshoring

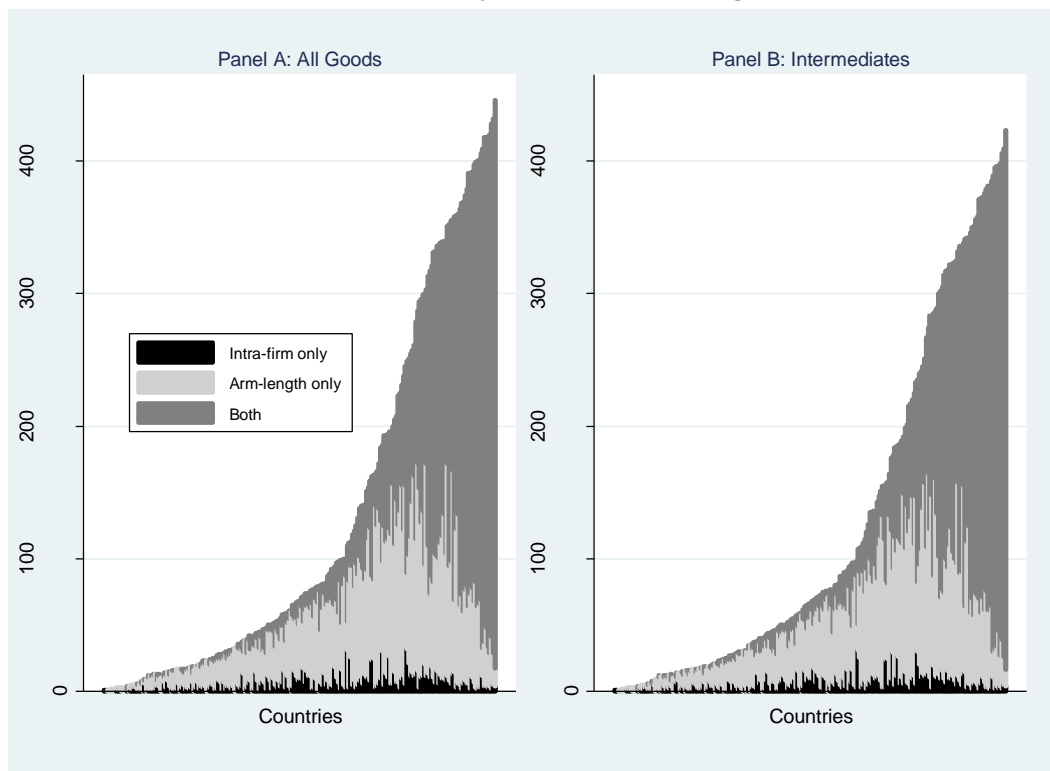


Figure 6: Number of Lines (6-digit HS) in which the Country is Active Exporting to the U.S. by Mode of Offshoring

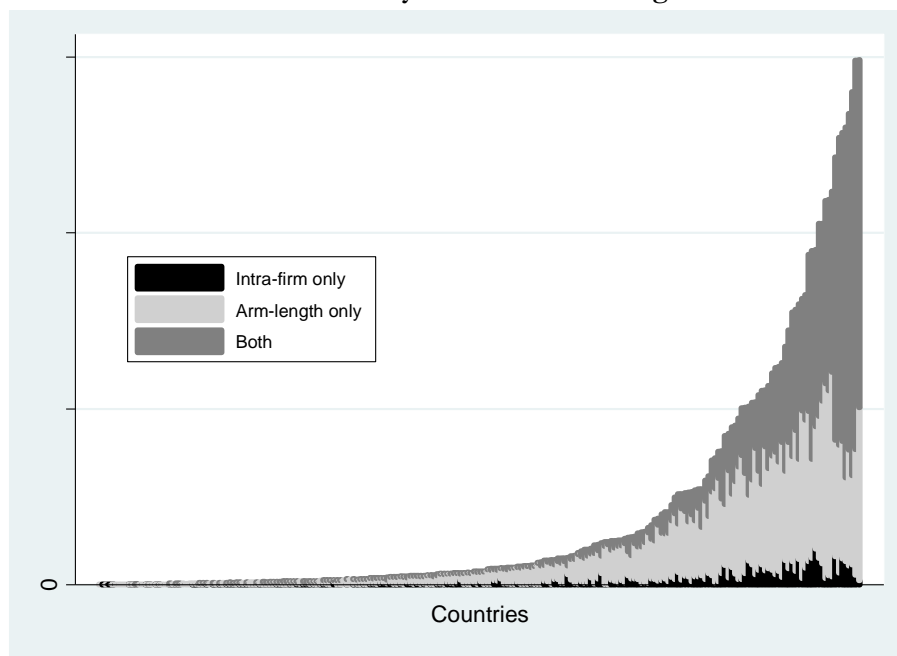


Figure 7: Intra-firm Trade and Industry Contract-intensity

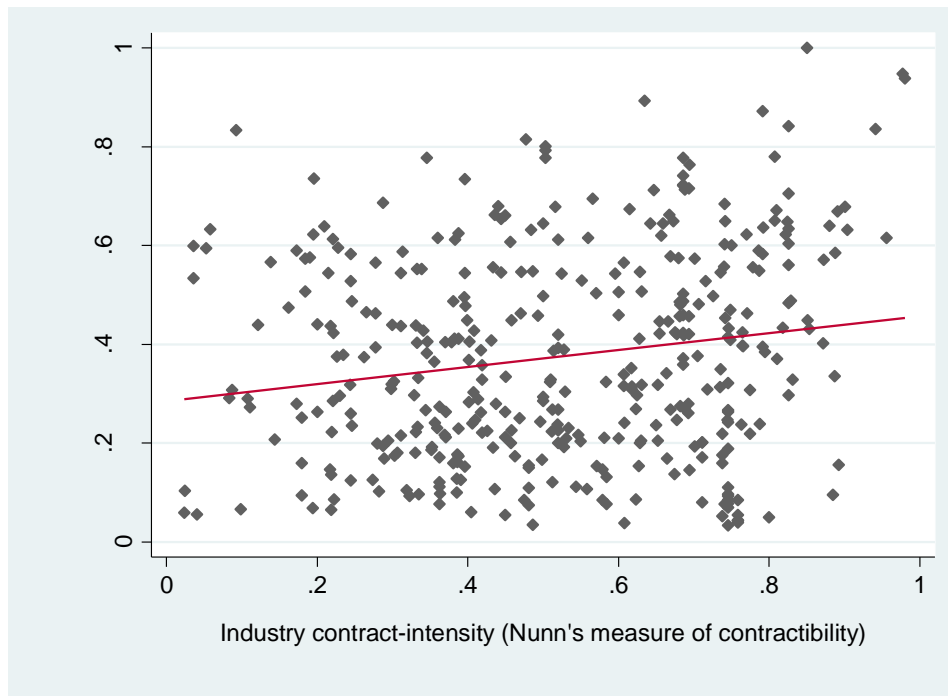


Figure 8: Intra-firm Trade and Industry Capital-intensity

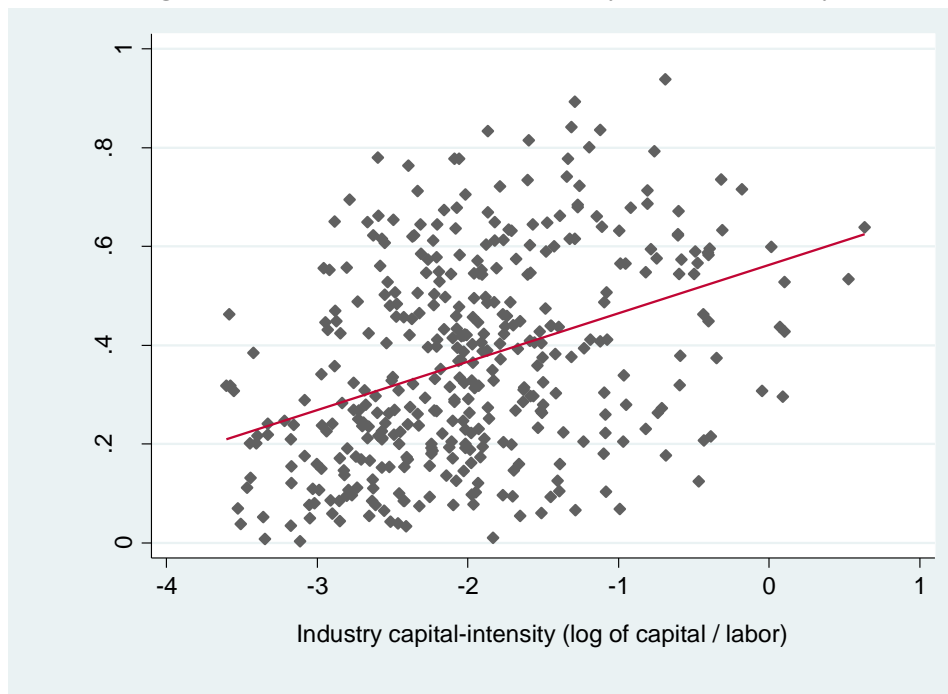


Figure 9: Intra-firm Trade and Physical Capital

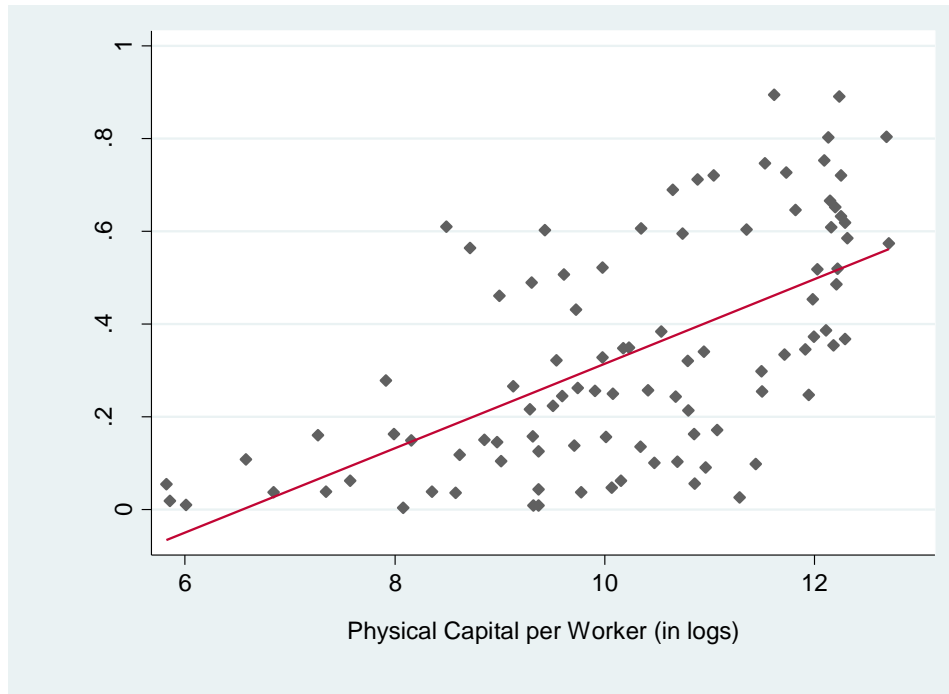
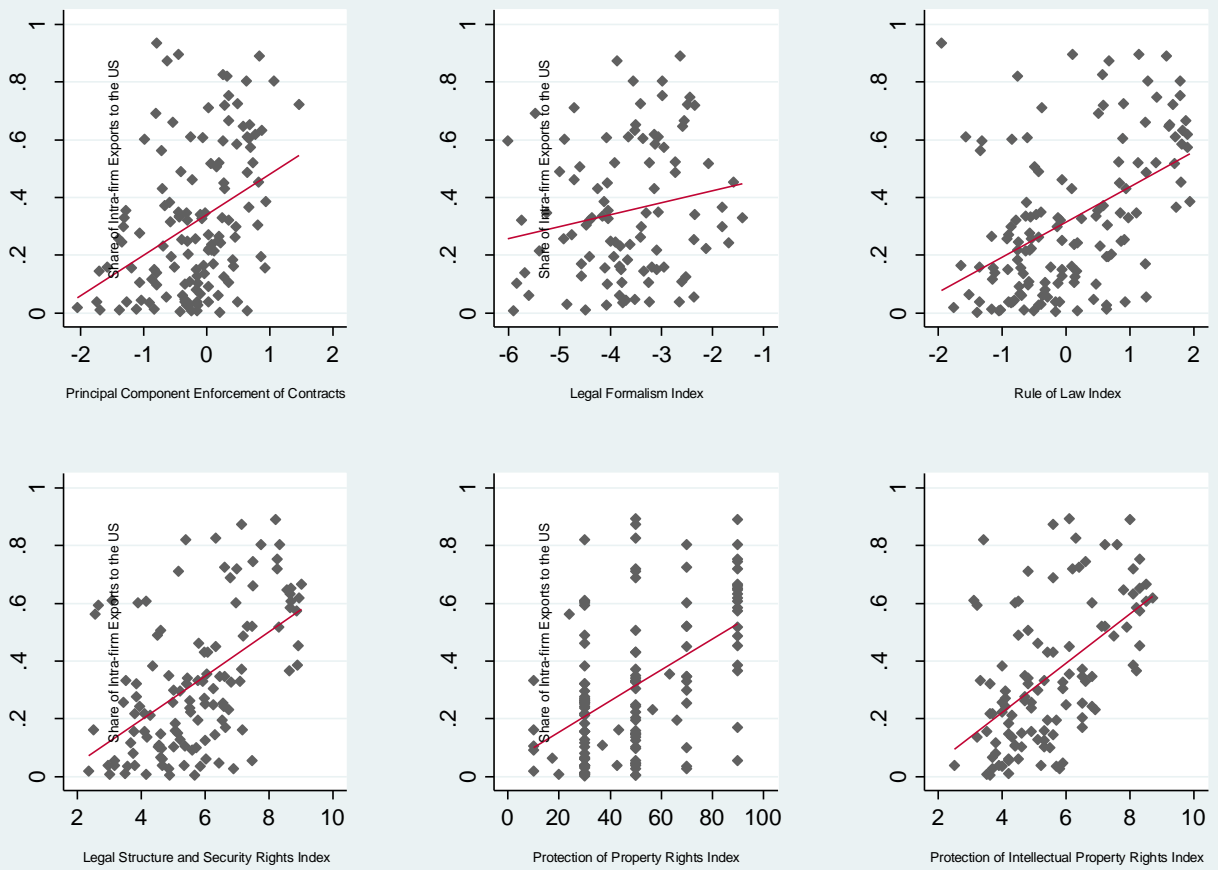


Figure 10: Intra-firm Trade and Quality of Contracting Institutions



Appendix A

Variable	Description	Source	Year
Intra-firm trade	Ratio of related-party exports over total exports from country c to the U.S. Related-party trade is the trade with an entity located outside the United States in which the importer holds at least a 6% equity interest.	U.S. Related Party Trade Data Set, U.S. Census Bureau. 2005	2005
Industry contract-intensity	Fraction of inputs in the industry (6-digit NAICS) that are relationship-specific	Nathan Nunn: "Relationship-Specificity, Incomplete contracts, and the Pattern of Trade," 2007. The Quarterly Journal of Economics, 122	1997
Industry capital-intensity	Ratio of capital to total workers in the industry (6-digit NAICS)	NBER-CES Manufacturing Industry Database	2005
Industry skill-intensity	Ratio of non-production workers to total workers in the industry (6-digit NAICS)	NBER-CES Manufacturing Industry Database	2005
Country human capital	Average years of schooling attained in the population older than 25	Barro-Lee Data Set (2011)	2005
Country physical capital per worker	This is an updated version of the Hall and Jones (1999) measure of physical capital per worker. We employ the capital-output ratio of each country also calculated by Hall and Jones (Note that capital-output ratios tend to remain relatively constant over long periods of time). With the capital-output ratio and the real level of output in 2005 from the Penn World Tables, we back out the implied level of total physical capital for 2005. We then divide the total level of physical capital by the total number of workers in the country from the Penn World Table, to obtain the measure of physical capital per worker	Author's calculations using Hall and Jones (1999) and Penn World Tables (7.0)	2005
Country population	Total population of the country	Penn World Tables (7.0)	2005
Industry ad valorem freight rate	Ratio of freight rates to total U.S. imports in the industry (6-digit NAICS)	U.S. Imports of Merchandise Database from the U.S. Census Bureau	2005
Rule of law	Rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence	Kaufmann, D., A. Kraay, and M. Mastruzzi, 2006	2005
Index of legal formalism	Measures the number of formal legal procedures necessary to resolve a simple case of collecting on an unpaid check	Djankov, S., R. La Porta, F. Lopez-de-Silanes, and A. Shleifer, 2003, "Courts." The Quarterly Journal of Economics, 118	2000

Number of procedures for enforcing a contract	The list of procedural steps for each economy traces the chronology of a commercial dispute before the relevant court. A procedure is defined as any interaction, required by law or commonly used in practice, between the parties or between them and the judge of court officer. This includes steps to file and serve the case, steps for trial and judgment and steps necessary to enforce the judgment	Doing Business Data Set	2005
Time (in days) for enforcing a contract	Time is recorded in calendar days, counted from the moment the plaintiff decides to file the lawsuit in court until payment. This includes both the days when actions take place and the waiting periods between. The average duration of different stages of dispute resolution is recorded: the completion of service of process (time to file and serve the case), the issuance of judgment (time for the trial and obtaining the judgment) and the moment of payment (time for enforcement of the judgment)	Doing Business Data Set	2005
Cost of enforcing a contract (as a percentage of the claim)	The cost is recorded as a percentage of the claim, assumed to be equivalent to 200% of income per capita. No bribes are recorded. Three types of costs are recorded: court costs, enforcement costs and average attorney fees	Doing Business Data Set	2005
Index of Legal Structure and Security of Property Rights	Index that combines ratings for the following areas: judicial independence, impartial courts, protection of property rights, military interference in rule of law and political process, integrity of the legal system, legal enforcement of contracts and regulatory restriction of the sale of real property. Various sources	Fraser Institute	2005
Index of Property Rights	It measures the degree to which a country's laws protect private property rights and the degree to which its government enforces those laws. It also assesses the likelihood that private property will be expropriated and analyzes the independence of the judiciary, the existence of corruption within the judiciary, and the ability of individuals and businesses to enforce contracts. Various sources	Heritage Foundation	2005
Index of Protection of Intellectual Property Rights	It measures intellectual property protection, patent-protection and copyright piracy level. Various sources	Property Rights Alliance	2005

Appendix B

LAC	East Asia	EU 15	Oceania	South East Asia
Argentina	China	Austria	Australia	Indonesia
Bahamas	Japan	Belgium	New Zealand	Malaysia
Barbados	Korea, South	Denmark		Philippines
Bolivia	Taiwan	Finland		Singapore
Brazil		France		Thailand
Chile		Germany		Vietnam
Colombia		Greece		
Costa Rica		Ireland		
Dominican Republic		Italy		
Ecuador		Luxembourg		
El Salvador		Netherlands		
Guatemala		Portugal		
Guyana		Spain		
Haiti		Sweden		
Honduras		United Kingdom		
Jamaica				
Mexico				
Nicaragua				
Panama				
Paraguay				
Peru				
Trinidad and Tobago				
Uruguay				
Venezuela				