

# Deep Trade Agreements and Vertical FDI: The Devil is in the Details

Alberto Osnago<sup>\*</sup>, Nadia Rocha<sup>\*\*</sup> and Michele Ruta<sup>\*\*\*</sup>

<sup>\*</sup>BOCCONI UNIVERSITY AND WORLD BANK

<sup>\*\*</sup>WTO

<sup>\*\*\*</sup>WORLD BANK

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## Abstract

Recent data show that the institutional content of preferential trade agreements (PTAs) has evolved over time. While pre-1990s PTAs mostly focused on tariff liberalization, recent agreements increasingly contain deep provisions in diverse areas such as intellectual property rights, investment, and standards. At the same time, we have witnessed to a remarkable increase in the internationalization of production through foreign direct investment (FDI) and outsourcing. This paper employs the Antràs and Helpman (2008) model of contractual frictions and global sourcing to study how deep trade agreements affect the international organization of production. We then construct new measures of the depth of PTAs and of vertical FDI to test the theory. Consistently with the model, we find evidence that the depth of trade agreements is correlated with vertical FDI and that this is driven by the provisions that improve the contractibility of inputs provided by suppliers, such as regulatory provisions. Because this implication of the model is specific to the so called “property rights” theory of the multinational firm, our findings provide empirical support to this approach vis-à-vis alternative theories of firm boundaries.

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How are trade agreements and the international organization of production related? The recent wave of Preferential Trade Agreements (PTAs) has brought this question to the forefront of trade research and of the trade policy debate. The key insight of this literature is that the “depth” of trade agreements is associated with the international fragmentation of production.<sup>1</sup> This paper adds to this line of work by looking at how the content of trade agreements, that is the specific provisions embedded in PTAs, relates to the way through which goods are traded internationally (i.e. within-firms or arm’s length). The underlying idea is that “deep” trade agreements affect - and are affected by - firms’ make-or-buy decisions, that is whether producers outsource to trading partners’ suppliers or vertically integrate production processes with affiliates in foreign economies.

Trade agreements are usually thought of as reciprocal market access exchanges involving tariff cuts and the reduction of other border measures. But most modern day trade agreements contain provisions that cover a wide array of non-tariff measures, both at the border and behind-the-border. An incomplete list includes: technical barriers to trade (TBT) and sanitary and phytosanitary (SPS) measures, rules on investment and intellectual property rights (IPR) protection, provisions on anti-corruption, competition policy, labor standards, etc. While some of these areas are regulated at the World Trade Organization (WTO), recent PTAs tend to go beyond multilateral rules (see, WTO (2011) for detailed evidence). The literature refers to these new trade agreements as “deep” to distinguish them from traditional PTAs that focus only on market access commitments -sometimes referred to as “shallow”.

Similarly, while most non-experts tend to think of international trade as involving the exchange of final goods produced with (mostly) local inputs, trade has radically changed in the past thirty years in response to a growing international fragmentation of production processes. This phenomenon has been widely documented in a number of studies using different methodological approaches.<sup>2</sup> A variety of technological factors most notably the revolution in information and communication technology (ITC), lie beneath this transformation. But institutions, and in particular trade institutions, are also recognized as a determinant and a consequence of the evolving international trade structure. Orefice and Rocha (2014) show that signing deeper agreements increases trade in parts and compo-

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<sup>1</sup>See Lawrence (1996) and Baldwin (2011) for a discussion of the relationship between PTAs and the international fragmentation of production and Antràs and Staiger (2012) for a first formal model that combines offshoring and the design of trade agreements. A survey of the academic literature and of the policy debate is in WTO (2011).

<sup>2</sup>Different measures are provided by Feenstra and Hanson (1996), Hummels et al. (2001), Johnson and Noguera (2012). Koopman et al. (2014) provide a unifying framework to measure the international fragmentation of production.

nents between PTA members and that, on the other hand, higher levels of trade in parts and components increase the likelihood of signing deeper agreements.

In this paper, we dig further into the relationship between deep trade agreements and the process of internationalization of production. The specific question that we address is how deep agreements relate to the way goods are traded internationally (i.e. inside or outside the boundaries of the firm). When firms choose their global sourcing strategy, a key decision is the extent of control they want to exert over their foreign production processes. Certain firms in certain sectors choose to own foreign assets through vertical Foreign Direct Investment (FDI) as a means to enhance such control.<sup>3</sup> Others offshore production, but instead rely on independent foreign suppliers, a sourcing strategy commonly known as foreign outsourcing. Importantly, these control decisions are associated to different modes of international trade: FDI gives raise to within-firm trade, while foreign outsourcing results in arm's length trade.

As is well understood from the trade and industrial organization literature, the incomplete nature of international contracts affects firms' vertical integration decisions (i.e. FDI versus foreign outsourcing).<sup>4</sup> In the so called "property rights" approach adopted in Antràs (2003) and in much of the international trade literature, ownership is a means to reduce the hold-up problem created by contractual incompleteness. Underlying this notion, there is the idea that contractual frictions are pervasive in international transactions because of differences in legal systems, poor institutional quality in certain countries involved in one end of the transaction and limited enforcement ability. Deep trade agreements reduce contractual uncertainty, because in addition to smoothing differences in contractual institutions (either by setting common rules or by allowing mutual recognition of heterogeneous practices among PTA members) they provide a commitment device for countries with weaker institutions and a mechanism to enforce rules through dispute settlement. By doing so, deep agreements interact with the make-or-buy decisions of firms and, hence, with the way goods are traded internationally.

To guide our empirical analysis on the impact of PTAs on vertical FDI, we employ the model by Antràs and Helpman (2008) (henceforth, AH). AH's framework introduces different degrees of contractual frictions across countries in a model of the international organization of production. This setting allows us to study the impact of improvements in the quality of contracting institutions, such as the ones brought about by a deep PTA, on firms' location and control decisions. The main insight of the theory is that deep provi-

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<sup>3</sup>The theoretical literature has long distinguished market seeking (i.e. horizontal) FDI and efficiency seeking (i.e. vertical) FDI (Markusen (1984), Helpman (1986)). For brevity, unless otherwise specified, whenever we refer to FDI in the rest of the paper, we imply vertical FDI. As is well known, in practice this distinction is not the only relevant one and we will come back to this point in the next section.

<sup>4</sup>There are a number of excellent surveys that discuss different angles of this literature, including Helpman (2006), Antràs (2012), and Antràs and Yeaple (2013).

sions in PTAs may increase or decrease vertical FDI, depending on whether they improve the contractibility of inputs provided by the headquarters (headquarter services) or by the suppliers (components). Provisions that improve the contractibility of headquarter services are, for example, protection of intellectual property rights or investment provisions; provisions that improve the contractibility of components are, for example, standards and other regulatory requirements that promote harmonization or mutual recognition. As we put it in the title: when it comes to the effects of deep agreements on vertical FDI, the devil is in the details (i.e. the content) of the agreement. The reason for this finding is entrenched in the logic of the property rights approach to the boundary of multinational firms. Because ownership is a means to reduce hold-up problems created by contractual incompleteness, it matters if the PTA provisions improve the relative contractibility of different inputs.

We test this theory using a new dataset on the content of PTA provisions and using firm-level information to construct a sectoral measure of vertical FDI. We proxy the depth of an agreement with different indexes and we find that deeper agreements are associated with higher values of vertical FDI. However, once we look at the composition of PTAs, depth per-se is not anymore positively correlated with vertical FDI, whereas the type of provisions included in an agreement matters. In fact, whilst provisions that improve the contractibility of inputs provided by suppliers have a positive relationship with vertical FDI, provisions that improve the contractibility of headquarter services are almost always uncorrelated with FDI.

Our work fits in the broader research effort aiming at understanding the relationship between international trade and institutions (see, Nunn and Treffer (2014) and WTO (2013) for recent surveys). Our findings complement a number of recent works in this area. In particular, Bernard et al. (2010) and Nunn and Treffer (2013) have empirically investigated how contractual frictions affect intra-firm trade. The difference between these studies and our analysis are twofold: first we employ firm-level information to measure vertical FDI, rather than focusing on intra-firm trade. This allows us to expand the analysis to countries other than the US, for which intra-firm trade data are not always publicly available. Second, we focus on changes in contractibility determined by deep agreements rather than by domestic institutions or by other technological determinants of contractibility. Recent empirical work has also looked at the relationship between international agreements -PTAs and bilateral investment treaties (BITs)- and FDI (among others, Blanchard and Matschke (2012); Baltagi et al. (2008); Egger and Merlo (2012)).<sup>5</sup> Overall, these studies show that trade and investment agreements affect and are affected

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<sup>5</sup>Blanchard (2007) and Blanchard (2010) present formal models of FDI and trade agreements. Differently from our work, these models study the implications of international investment for trade/tariff negotiations.

by FDI/offshoring. Aside from the use of a new measure for vertical FDI, our work adds to these findings by focusing on the depth/content of trade agreements, which allows disentangling an important channel through which trade institutions affect the ways goods are traded internationally.

The rest of the paper is organized as follows. Section 2 presents the theory of how PTA provisions are related to the international organization of production. Section 3 describes the methodology used to assess the depth and composition of trade agreements and to measure vertical FDI. The empirical analysis and the key findings of the paper are presented in Section 4. Concluding remarks follow.

## 2 Theory: Deep PTAs and the international organization of production

In this section, we briefly present the theory that we use to guide our empirical analysis. Since the model is a simplified version of the well-known model by AH, we only review its most important features and stress the key difference introduced in this paper and the relevant testable implications.

Antràs and Helpman (2004) present a framework to analyze the determinants of firms' global sourcing strategies and describe an equilibrium where firms with different productivity levels choose different ownership structures (outsourcing or vertical integration) and different supplier location (domestic or foreign). AH build on this framework to explicitly model contracting institutions and to allow for partial contractibility of the inputs needed in the production process. The essential idea is that certain characteristics of inputs (or activities needed to supply these inputs) can be written in *ex ante* contracts and verified by a court of law, while others are not contractible. They show that the contractibility of inputs (i.e. the share of contractible input characteristics/activities) plays an important role in the ownership and location decisions of firms. As domestic institutions such as a country's quality of the legal system are a determinant of inputs contractibility, AH find that the global sourcing strategies of firms depend on the domestic institutions of the countries where they operate. We extend the model of AH and allow for the contractibility of inputs to be a function of domestic institutions and the rules embedded in deep trade agreements. This simple extension permits to precisely identify the channels through which different provisions in trade agreements affect the international organization of production.

Following Antràs and Helpman (2004) and Antràs and Helpman (2008), we assume that there are two countries: the North, which is a high-cost country and has good contract-

ing institutions, and the South, which is low-cost but has weaker contracting intuitions relative to the North. Final good producers are located in the North. We focus on a firm that produces a brand of a differentiated product and for notational simplicity we drop the indexes. Demand is generated by CES preferences. Production is Cobb-Douglas using two inputs headquarter services (intangible inputs produced in-house by the final good producer) and components, which can be sourced in the North or in the South. Specifically, final good production is given by:

$$q(\theta) = \theta \left( \frac{h}{\eta} \right)^\eta \left( \frac{m}{1-\eta} \right)^{1-\eta}$$

where  $\theta$  captures firm's productivity;  $\eta \in (0, 1)$  is a measure of the headquarter intensity of technology; and  $m$  and  $h$  are components and headquarter services respectively. The inputs in the latter variable include, for instance, patents or trademarks derived from research and development activities in the North or skill and investment intensive branding and financial activities. Both inputs are brand specific, in the sense that they are customized to fit the needs of this brand and cannot be usefully employed for other brands.

Each input is produced with a continuum of activities in the interval  $[0, 1]$  according to the following technology:

$$\omega = \exp \left[ \int_0^1 \log \omega(i) di \right]$$

where  $\omega = h, m$ .

Following AH, we assume that only activities in the interval  $[0, \eta_\omega]$  are contractible, where  $0 \leq \eta_\omega \leq 1$ . As discussed above, by this we mean that only a fraction of the characteristics of these activities can be specified in enforceable ex ante contracts, while the remaining fraction is non-contractible. As usual in the literature, this assumption can also be interpreted as all activities/characteristics being only partially contractible.<sup>6</sup> For simplicity, we assume full contractibility in the North and focus on incomplete contracting in the South only.<sup>7</sup>

Differences in contractibility across production processes and across countries reflect technological and institutional variation. In particular, we assume that the institutional environment is not only determined by the characteristics of domestic institutions (as in AH),

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<sup>6</sup>See Acemoglu et al. (2007).

<sup>7</sup>As further discussed below, this assumption allows to abstract from the control decision in domestic sourcing.

but also by a number of disciplines that a country commits to in the context of a PTA. To clarify this point, let  $\lambda$  be an index of the quality of domestic institutions and define  $\gamma = (\gamma_1, \dots, \gamma_N)$ , as the set of deep provisions that can be introduced in a trade agreement. Then we can write

$$\mu_h = h(\lambda, \gamma_1, \dots, \gamma_N) \text{ and } \mu_m = m(\lambda, \gamma_1, \dots, \gamma_N)$$

with  $h'(\cdot), m'(\cdot) > 0$ ,

where, without loss of generality, we have ordered the first  $T$  provisions as the ones that affect the contractibility of headquarter services, such as protection of intellectual property rights or investment provisions. The remaining provisions include those PTA rules that affect the contractibility of components, such as standards and other regulatory requirements that promote harmonization or mutual recognition.<sup>8</sup>

A final good producer decides whether to source components ( $m$ ) in the North or in the South and whether to vertically integrate or not. Sourcing components from the South gives raise to within-firm trade under vertical integration or arm's length trade in the case of foreign outsourcing. As we have assumed that there are no contractual imperfections in the North, the choice between vertical integration and outsourcing in the domestic market is immaterial and we, therefore, abstract from it in what follows. Different organizational choices are associated to different fixed costs. Following the literature, these costs are assumed to satisfy:  $f_V > f_O > f_D$ , where  $f_V$  is the fixed cost of FDI,  $f_O$  is the fixed cost of foreign outsourcing and  $f_D$  is the fixed cost of domestic sourcing.

In what follows, we provide an informal discussion of the location/control decision of the final good producer and of the organizational forms that emerge in an industry equilibrium (the full characterization of the equilibrium is in AH).

When a final good producer in the North chooses to source components abroad, it is exposed to weaker contractual institutions in the South. The resulting uncertainty leads to under-investment in the supply of those  $h$  and  $m$  activities that are non-contractible (*a two-sided hold-up problem*).<sup>9</sup> For these activities, the price of the exchange between the final good producer in the North and the supplier of components in the South is decided ex post (i.e. after the initial investments were made) through bargaining. This bargain-

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<sup>8</sup>The marginal impact of domestic and PTA provisions can vary substantially and we are agnostic on the different effects. However, the point that we want to make is that certain PTA provisions will only affect the contractibility of headquarters, while others only impact on the contractibility of components. Naturally, there will be provisions in a trade agreement, such as anti-corruption rules, that (if effective) may well be equivalent to an improvement in the domestic legal system ( $\lambda$ ).

<sup>9</sup>Note that foreign sourcing reduces the contractibility of headquarter services even though they are supplied in the North, because all parts of a contract governing an international transaction are harder to enforce.

ing process determines the distribution of the surplus from the international production relationship. Importantly, how the surplus is divided between the two parties depends on the organizational form of production. Specifically, when the final good producer in the North owns the input supplier (i.e. under FDI), it obtains the larger share of surplus compared to arm's length trade. Conversely, foreign outsourcing increases the share of surplus for the component supplier in the South. Because the expectation of a larger surplus creates stronger incentives to supply inputs, ownership alleviates one side of the two-sided hold-up problem. In this environment, the choice of the organizational form by the final good producer depends on the relative importance that non-contractible headquarter services and components have in the production of the final good. Intuitively, if the supplier's non-contractible activities are relatively more crucial in production, then it is efficient for the final good producer to incentivize the supplier through arm's length contracts. Vertical integration, on the other hand, is the optimal organization structure when non-contractible headquarter services are relatively more important in production.

As firms within a sector vary by productivity ( $\theta$ ) and because different location/control choices imply different fixed costs, the AH model can generate multiple organizational forms within an industry. Specifically, AH show that in sectors with sufficiently high headquarter intensity, final good producers obtain components through domestic sourcing, foreign outsourcing and FDI (Proposition 9(i)). There is a simple intuition for this result. Consider first the location choice. Foreign sourcing has higher fixed costs than domestic sourcing. Therefore, it is optimal for the final good producer to source components in the South only when its productivity is sufficiently high so that the efficiency gains more than compensate the fixed costs. Consider next the control decision. The choice between FDI and foreign outsourcing presents a trade-off between fixed costs and efficient production. On the one hand, vertical integration is associated to higher fixed costs. On the other hand, vertical integration increases the surplus for the final good producer and, therefore, the incentives to invest in non-contractible headquarter activities that are relatively more important in high headquarter intensive sectors. For more productive producers, it is more efficient to pay the fixed cost of vertical integration and reduce the under-investment problem in headquarter intensive activities.

Figure 1 illustrates this result in AH. The figure shows the profits of the final good producers under domestic sourcing ( $D$ ), foreign outsourcing ( $O$ ) and FDI ( $V$ ):

$$\pi_i = Z_i \vartheta - f_i \text{ with } i = D, O, V$$

where  $\vartheta$  is a linear function of the firm's productivity  $\theta$  and  $Z_i$  is a derived parameter that depends on the firm's location/control choice as discussed above. As the figure



shows, firms with low productivity source domestically, those with intermediate levels of productivity choose foreign outsourcing, and firms with even higher productivity vertically integrate in the South.

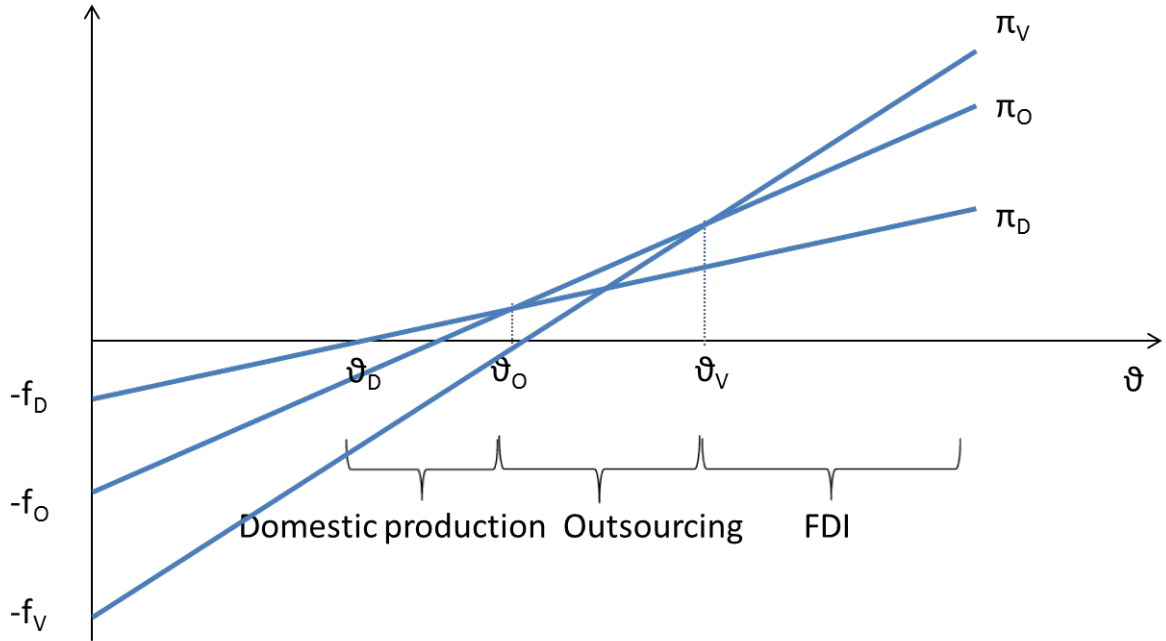


Figure 1: Organization choice in sectors with sufficiently high headquarter intensity

Starting from this industry equilibrium, we investigate how the location/control choice of final good producers is affected by the content of a trade agreement between the North and the South. We do this in two steps. First, we focus on PTA provisions that improve the contractibility of components ( $\mu_m$ ) such as standards and other regulatory requirements that promote harmonization or mutual recognition. AH show that the share of firms doing FDI on the total number of active firms ( $\sigma_V$  in AH) is increasing in  $\mu_m$  (Proposition 9(ii)). The reason is that with better contracting of components, final good producers in the North are less dependent on the power of incentives they can offer to the suppliers of components in the South, thus making vertical integration more attractive. Figure 2 provides a graphical intuition of this effect. The dashed lines represent profits under a PTA that improves the contractibility of components (or, equivalently, that improves disproportionately the contractibility of components relative to headquarter services). Profitability of domestic sourcing ( $Z_D$ ) is not affected by the trade agreement, profitability under vertical integration ( $Z_V$ ) increases more than profitability under foreign outsourcing ( $Z_O$ ), leading to an increase in FDI. Note that while the total share of firms engaging in vertical integration increases, an improvement in the contractibility of components may have an ambiguous impact on the share of global sourcing through FDI versus outsourcing (i.e. on the fraction of imports that are intra-firm). Intuitively, the latter is confounded by the positive impact that improved institutions in the South via a

PTA has on the total number of firms in the North offshoring to the South (the sum of FDI and foreign outsourcing).<sup>10</sup>

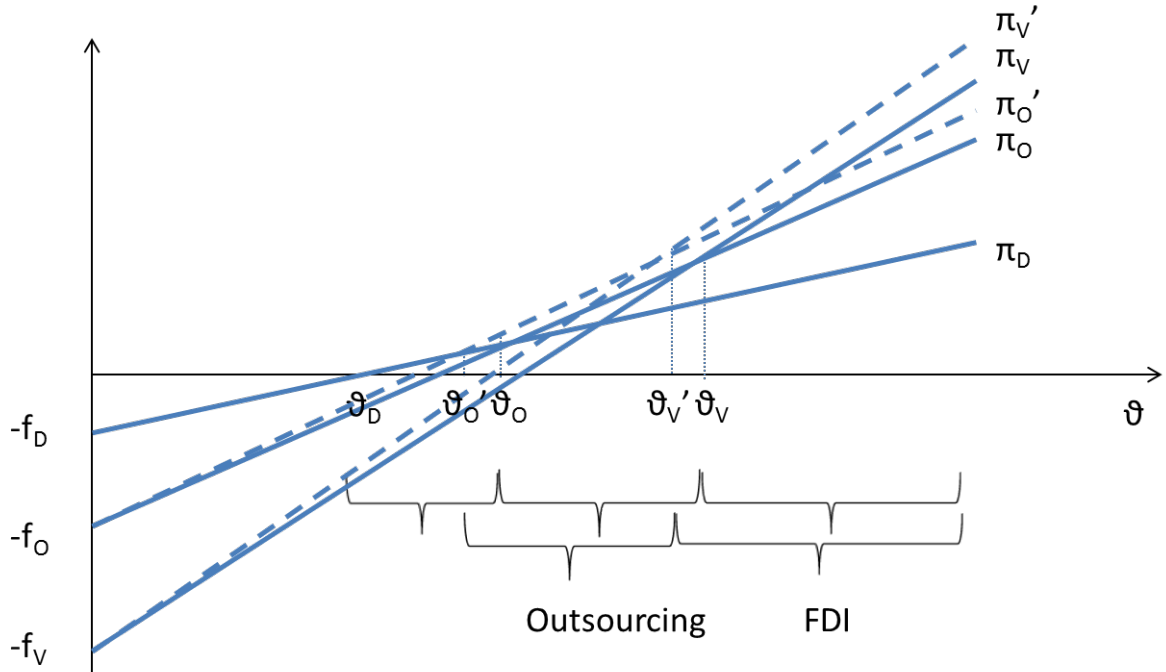


Figure 2: Effects of PTA provisions improving contractibility of components ( $\uparrow \mu_m$ )

Next, we consider the impact on FDI/outsourcing of the provisions in a PTA that improve the contractibility of headquarter services ( $\mu_h$ ) such as protection of intellectual property rights or investment provisions. AH show that the share of firms that engage in FDI over the total number of active firms is decreasing in  $\mu_h$  (Proposition 9(ii)). With better contracting of headquarter activities, under-investment in these services becomes relatively less important, so that a larger share of final good producers value more the incentives that they can provide to component suppliers in the South through outsourcing. The graphical intuition for this case is provided in Figure 3. As before, the dashed lines represent profits under a trade agreement, which in this case only contains provisions that affect (or affect disproportionately) the contractibility of headquarter services. The profitability of firms under vertical integration ( $Z_V$ ) increases less than the profitability under foreign outsourcing ( $Z_O$ ), leading to a decrease in FDI. As the profitability of firms engaging in domestic sourcing is not affected by the PTA, the figure shows that better contracting institutions for headquarter services in the South increase the number of firms in the North that offshore. This implies that the share of global sourcing through FDI versus outsourcing is unambiguously lower.

<sup>10</sup>This ambiguity has limited the ability of empirical studies to test the predictions of the AH model using trade data (see, Nunn and Treffer (2013)).

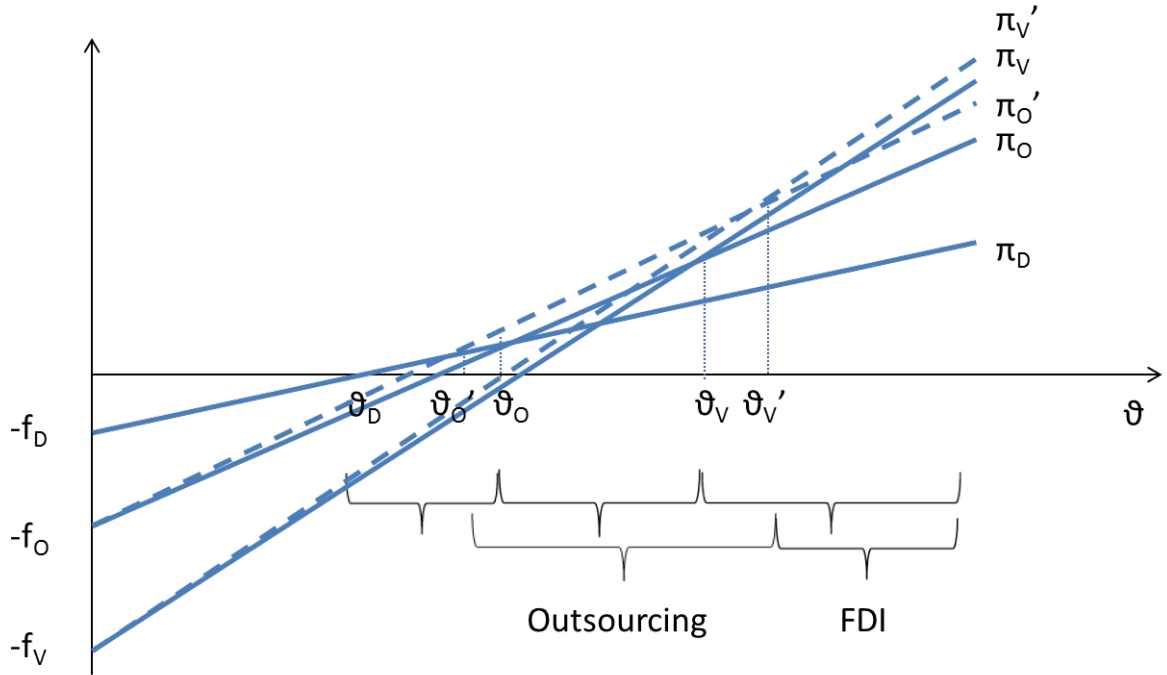


Figure 3: Effects of PTA provisions improving contractibility of components ( $\uparrow \mu_h$ )

Summing up, the AH model has two clear predictions on the relationship between deep trade agreements and firms' global sourcing strategies:

1. PTA provisions improving the contractibility of components ( $\mu_m$ ) are associated with an increase in profitability under vertical integration relative to outsourcing, leading to an increase in the share of firms engaging in FDI;
2. PTA provisions improving the contractibility of headquarter services ( $\mu_h$ ) are associated with an increase in profitability under outsourcing relative to vertical integration, leading to a decrease in the share of firms engaging in FDI.

In simple words, more than the depth of the agreement, it is its content that determines the choice between vertical integration or foreign outsourcing and that therefore will impact on the structure of trade (intra-firm versus arm's length). As others in the literature have recognized (e.g. Baldwin (2011), WTO (2011), Orefice and Rocha (2014)), the depth of a trade agreement is associated to more offshoring. But its relationship with FDI can, in general, be either positive or negative.

Before we move on to the empirical analysis, there are two considerations that concern the specific structure of the model used in this paper. Both considerations have important implications for the empirical strategy that follows. The first relates to an endogeneity problem. In the model, PTA provisions are introduced as exogenous shocks to the institutional environment. However, as a growing literature shows, international trade itself can

have an impact on institutional choices, including the decision to sign a trade agreement and the depth and content of such agreement.<sup>11</sup> Specifically, negotiations of deep PTA provisions result from a two-level game, where governments interact strategically with special interests in the domestic arena and with other governments in the international arena, much like the tariff negotiations analyzed in Grossman and Helpman (1995). In this set up, countries that have stronger FDI relationships may have a greater incentive to introduce in a trade agreement language that facilitates vertical integration. The correlations in Predictions 1 and 2 are still valid, but we need to recognize that the direction of causality may run in both ways, from the content of a trade agreement to the composition of trade and vice versa. We will come back to this point in Section 4.

The second consideration is that Predictions 1 and 2 are specific to the “property rights” theory of the firm Grossman and Hart (1986) underlying the AH model. Importantly, prediction 1 stands in contrast to the “transactions cost” approach on the boundary of the firm (Williamson (1975) and Williamson (1985)), which underpins several studies on the international organization of production (e.g. Grossman and Helpman (2005), and Costinot et al. (2011)). As discussed above, in the property rights approach what matters in the make-or-buy decisions of firms is the relative contractibility of different inputs. This is the deep reason why improvements in the contractibility of components increase FDI: creating incentives for the suppliers of headquarter services through vertical integration becomes a relatively more important problem when PTA disciplines improve the contractibility of components. To the contrary, in the transactions cost approach, vertical integration is an efficient response to any type of contracting difficulties. Therefore, PTA provisions that improve the contractibility of headquarter services and/or components are predicted to always lower FDI and increase outsourcing. The empirical analysis that follows, therefore, provides an indirect test of the two theories.

### 3 Data description and methodology

We begin our empirical analysis by describing the data on the depth of trade agreements and on vertical FDI.

#### 3.1 Depth and composition of PTAs

Preferential Trade Agreements are usually thought of as bilateral or multilateral agreements that aim at the reduction in tariffs. Recently, the economic literature started to

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<sup>11</sup>For recent surveys, see Nunn and Treffer (2014) and WTO (2013), chapter C.6.

examine in more detail the composition of trade agreements, allowing us to distinguish between shallow and deep agreements. Shallow agreements are those agreements that guarantee reciprocal decreases in tariffs. Following Horn et al. (2010) and WTO (2011), we define deep agreements as those agreements covering multiple provisions that go beyond tariff liberalization.<sup>12</sup>

The WTO constructed a dataset on the content of preferential trade agreements by mapping a total of 52 disciplines across 100 PTAs signed between 1958 and 2011. The agreements included in the dataset cover more than 90% of world trade.<sup>13</sup> Due to availability of FDI data, we focus our analysis on three countries, Germany, Japan, and USA. We therefore work with a sub-sample of 57 agreements: 35 signed by the European Union, 11 by Japan, and 11 by the USA. Table A.1 in the appendix lists all the mapped agreements included in our analysis.

In order to conduct quantitative analysis, it is necessary to have a measure of the depth of an agreement. We follow the approach used by Orefice and Rocha (2014) and we quantify the depth of an agreement in three different ways. First, we count the number of legally enforceable provisions covered in a PTA.<sup>14</sup> The higher the number of provisions in an agreement, the deeper is the agreement. The other two measures of depth are constructed using principal component analysis (PCA).<sup>15</sup> PCA allows us to construct two indexes that contain the provisions with the highest degree of commonality across the spectrum of deep agreements. The *Top5* index includes TRIPS, IPR, countervailing measures, state trading enterprise, and movement of capital provisions, whereas the *Top10* index includes also public procurement, competition policy, anti-dumping, investment, and state aid.

In order to analyze the relationship between the content of PTAs and FDI, we distinguish between two types of provisions, namely *h*- and *m*-provisions, according to whether these provisions are likely to affect headquarter services or the production of parts and components. We think of headquarter activities to be, for example, related to research and development, brand management, innovation, and financial decisions. Therefore, we consider GATS, TRIPS, IPR, investment, and movement of capital as *h*-provisions. On the other hand, the production of parts and components are likely to be affected

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<sup>12</sup>Horn et al. (2010) identify up to 52 provisions in US and EU agreements.

<sup>13</sup>The database has been assembled by the Economic Research division of WTO for the World Trade Report 2011, available at [http://www.wto.org/english/res\\_e/publications\\_e/wtr11\\_dataset\\_e.htm](http://www.wto.org/english/res_e/publications_e/wtr11_dataset_e.htm)

<sup>14</sup>As in Horn et al. (2010) legal enforceability is based on the language used in the agreements. Commitments expressed with a clear, specific and imperative legal language, can more successfully be invoked by a complainant in a dispute settlement proceeding, and therefore are more likely to be legally enforceable. In contrast, not clearly formulated legal language might be related with policy areas that are covered but that might not be legally enforceable.

<sup>15</sup>Principal Component Analysis is a procedure that orthogonally transforms a number of possibly correlated variables into a number of uncorrelated variables called principal components. This transformation is defined in a way such that the first principal component accounts for the highest level of variability in the data.

by standards and custom regulations. Thus we classify SPS, TBT, consumer protection, customs, and export taxes provisions as  $m$ -provisions.

Table 1 below shows the frequencies of each  $h$ - and  $m$ -provisions in the 57 agreements taken into consideration. The table shows that there is some variation in the type of provisions covered in the agreements. For example, only 22 agreements have TBT measures, whereas almost all of them have a provision regarding customs. Figure 4 plots the share of agreements that include  $h$ - and  $m$ -provisions by country. All the agreements signed by the EU contain customs provisions but only 11% of them cover consumer protection. On the other hand, all agreements signed by the US and Japan deal with consumer protection. Provisions regarding GATS and customs are included in all Japanese agreements, whereas all US agreements include TRIPS. Whilst the least frequent provision in the agreements signed by Japan is export taxes (45% of agreements), in US agreements they are investment, movement of capital, and TBT (around 80% of the agreements). Finally, the less frequent provisions in EU agreements are TBT and SPS, covering less than 1 third of the mapped agreements.

Table 1: Frequencies of  $h$ - and  $m$ -provisions in PTAs

$h$ -provisions	N. of Agreements	$m$ -provisions	N. of Agreements
GATS	32	SPS	22
TRIPS	43	TBT	24
IPR	39	Consumer protection	26
Investment	31	Customs	56
Movement of capital	41	Export taxes	42

### 3.2 Identification and Measurement of Vertical FDI

The model outlined in Section 2 ultimately gives predictions on the share of firms engaging in vertical FDI relative to outsourcing. Since we do not have information about the total number of firms and on the extent of outsourcing in an economy, we test the first part of the predictions regarding the profitability of vertical integration by focusing on a measure of positive flows of vertical FDI.

In order to quantify vertical FDI flows we apply the methodology proposed by Alfaro and Charlton (2009), used also by Lanz and Miroudot (2011), using firm level data obtained from the ORBIS dataset. The Bureau van Dijk collects information about location, ownership, detailed sector level, and operational data (e.g. revenues) for more than 100 million firms in Europe, Americas, and Asia-Pacific region.

We restrict our analysis to subsidiaries in any country of the world owned by parent firms

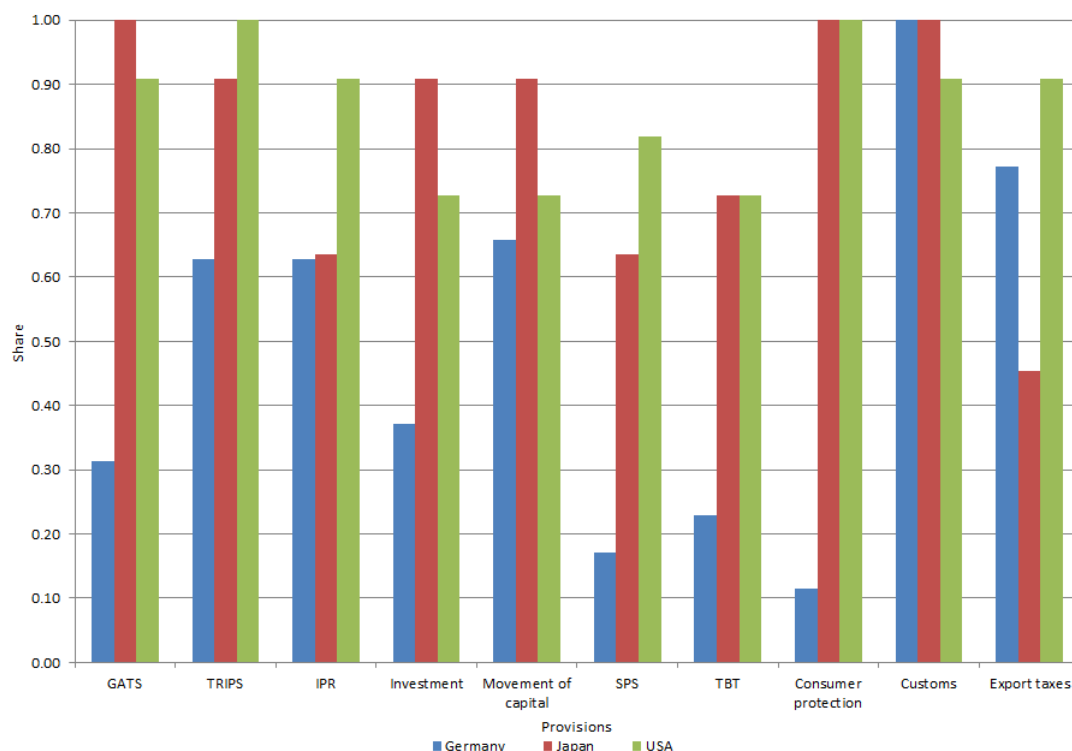


Figure 4: Frequency of  $h$ - and  $m$ -provisions in trade agreements by country

located in Germany, Japan, or USA respectively, for the years 2003, 2007, and 2011.<sup>16</sup>

Alfaro and Charlton (2009) methodology allows to identify three types of foreign direct investment, namely vertical, horizontal and complex.<sup>17</sup> Simply put, horizontal FDI is an activity of a foreign-owned subsidiary producing in the same NAICS 6-digits sector of the parent firm. Vertical FDI instead arises when the production of the subsidiary is an input for the production done by the parent firm. In Alfaro and Charlton's words, vertical FDI are defined "as the activity of the foreign-owned subsidiaries in industries upstream from the parent industry (according to the US input-output matrix)". If the activity of the subsidiary satisfies both these criteria, then the FDI is defined as complex. The remaining case in which the subsidiary produces in a different sector of the parent which is not an input is classified as non-identified investment.<sup>18</sup>

More formally, the definition of FDI is based on the intersection of the sets of primary sectors of the parent firm and its subsidiary. Let  $S$  be the set of 6-digits NAICS codes

<sup>16</sup>We select firms such that only industrial parent firms are included in our dataset. This is done in order to exclude individuals, government, or financial institutions owners.

<sup>17</sup>See appendix A for a definition of ownership and additional details about our measure of vertical FDI.

<sup>18</sup>Non-identified links can also be thought as conglomerates. Indeed, Herger and McCorriston (2013) define relationships between firms that neither share the same industry nor are they linked through the supply chain as conglomerate cross border acquisitions.

of the subsidiary and  $P$  be the set of 6-digits NAICS code of the parent. An element  $x$  of  $S$  is an input of an element  $z$  of  $P$  ( $x \rightarrow z$ ) if the total requirements coefficient of the US-Input-Output (IO) table is bigger than 0.03.<sup>19</sup> Given these definitions, we can formally identify the 4 types of connections between the parent and the subsidiary:

- i. Horizontal FDI: if  $S$  and  $P$  share any element (i.e. if  $S \cap P \neq \emptyset$ );
- ii. Vertical FDI: if any element of  $S$  is an input of any element of  $P$  (i.e. if  $\exists x, z$  s.t.  $x \rightarrow z$  where  $x \in S$  and  $z \in P$ );
- iii. Complex FDI: if  $S$  and  $P$  share any element and any element of  $S$  is an input of any element of  $P$  (i.e. if  $S \cap P \neq \emptyset$  and  $\exists x, z$  s.t.  $x \rightarrow z$  where  $x \in S$  and  $z \in P$ );
- iv. Non-identified: if none of the above is satisfied.

For each subsidiary and parent we know the unique core industry at 4-digit NAICS 2007 level and a set of 6-digits NAICS primary codes.<sup>20</sup> To identify the link between two firms, we use the sets of primary codes of a subsidiary and its parent. If the two sets intersect and all the sectors of the subsidiary are not inputs of any sector of the parent, then these firms are linked by a horizontal relationship. Instead, if the subsidiary operates in at least a sector that is an input for any sector of the parent, then the firms are in a vertical relationship. If, moreover, the two sets intersect then the FDI is complex.

Table 2 summarizes the number of subsidiaries in each FDI category. Around 13 per cent of the subsidiary firms in our data are linked to their parents through a vertical link. A slightly bigger share of subsidiaries, almost 14 per cent, is involved in horizontal FDI. The majority of firms, 72 per cent, are classified in a non-identified relationship. Comparing our numbers to the reference literature, Lanz and Miroudot (2011) find that in OECD countries 12.8% of total foreign direct investments links are horizontal, 12.9% vertical, 14.8% complex and 59.5% are not identified; in Alfaro and Charlton (2009) the shares are 23%, 25%, 11%, and 41% respectively. A possible explanation of the high share of non-identified links can be the presence of conglomerates. Conglomerates are formed by firms that are neither horizontally related through sharing the same industry nor are they vertically connected through the supply-chain. As Herger and McCorriston (2013) suggest a possible reason behind the formation of conglomerates lies in financial frictions or corporate governance problems such as principal-agent issues between shareholders and management. In fact, they document an increase of conglomerate cross-border acquisitions due to financial diversification needs.

Figure 5 below confirms one of the main points made by Alfaro and Charlton (2009). At

<sup>19</sup>The threshold has been chosen following Alfaro and Charlton (2009).

<sup>20</sup>The cardinality of the set of primary codes is not fixed ex-ante. Some firms report only one primary 6-digits code, some subsidiaries provide up to 36 primary codes.



Table 2: Distribution of Vertical, Horizontal, and Complex FDI

Type	Number of Subsidiaries	Share
Vertical	25230	13.11
Horizontal	26904	13.98
Complex	776	0.40
Non-identified	139603	72.52

a more aggregate level, it is striking to notice that most of subsidiaries and parents that are in a vertical relationship operate in the same core industry. The figure focuses only on parents and subsidiaries both operating in manufacturing sectors for visual clarity; however a similar pattern can be detected even if we include all sectors. This is to illustrate that if we look at an aggregate level we would be detecting a lot less vertical FDI and probably misreport those foreign investments as horizontal FDI.

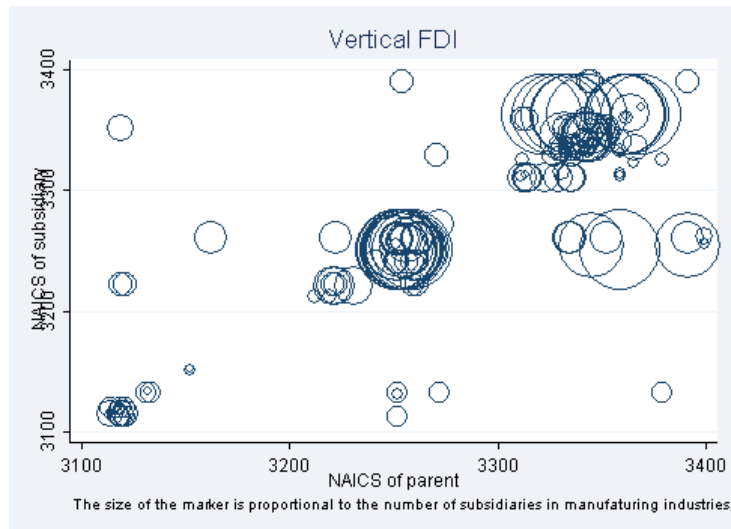


Figure 5: Vertical FDI

How do we measure the value of vertical foreign direct investment? Ideally, we would like to have information on intra-firm trade. Unfortunately, these data are not available. We, therefore, quantify foreign direct investment from country  $i$  (US, Japan, or Germany) in sector  $k$ , at time  $t$  as the aggregate value of the revenues of subsidiaries operating in sector  $k$  and country (destination)  $j$  ( $FDI_{ijkt}$ ). For example, vertical FDI of the automobile sector in the US is the sum of revenues of all the US-owned subsidiaries that produce car inputs, such as plastic, seat-belts, glass, and so on, in a foreign country.<sup>21</sup>

<sup>21</sup>Despite the fact that there is no availability of intra-firm trade data in the ORBIS database, total revenues of vertically integrated subsidiaries are a good proxy for it. In fact, the correlation between our data on vertical FDI and related party trade from the Bureau of Economic Analysis is 0.69.

## 4 Empirical findings

In this section we empirically investigate the relationship between deep agreements and internationalization of production. First, we analyze whether deeper agreements have a positive impact on vertical FDI. Then, we go a step further and evaluate whether particular provisions included in a trade agreement are related to firms decisions on whether to vertically integrate or not. In particular, we test whether  $m$ -type provisions are positively related to increases in vertical FDI.

### 4.1 PTA Depth and Vertical FDI

We first look at whether and how deeper agreements attract more FDI. In order to do this, we estimate the following equation:

$$FDI_{ijkt} = \beta_1 DEPTH_{ijt} + \beta_2 INSTITUTIONS_{jt} + \beta_3 \log(Tariff)_{ijkt} + \beta_4 BIT_{ijt} + \gamma_1 X_{jt} + \gamma_2 X_{ij} + \delta_k + \delta_{it} + \epsilon_{ijkt} \quad (1)$$

where  $k$  is the parent's sector,  $t$  is time,  $i$  and  $j$  are country indexes ( $i$  for the "origin" country and  $j$  for the "destination" country). As we already mentioned above, our dependent variable,  $FDI_{ijkt}$ , is the log of the value of the revenues of all subsidiaries in a particular sector  $k$ . In the regressions that follow we consider only positive values of FDI, focusing therefore only on the intensive margin of vertical FDI as a measure of the profitability of vertical integration.

$DEPTH_{ijt}$  is a variable that captures the depth of the agreements. More precisely, it can either be a dummy equal to one if there is a PTA, the number of provisions included in the PTA, or the log of one of the two indexes constructed using the principal component analysis previously described.  $INSTITUTIONS_{jt}$  are captured by the variable Rule of Law from the Worldwide Governance Indicator database. We also control for the level of tariffs imposed by the origin country  $i$  (Germany, Japan and the US) on imports of product  $k$ . This variable helps us to separate the impact of our PTA variable that goes beyond pure tariff liberalization.  $BIT_{ijt}$  is a dichotomous variable capturing the existence of a bilateral investment treaty between  $i$  and  $j$  at time  $t$ .  $X_{jt}$  is a vector of controls for characteristics of the destination country that vary over time. It includes GDP, GDP per capita and destination country remoteness.<sup>22</sup>  $X_{ij}$  are country-pair variables such as geographical distance, contiguity, common language, colonial relationship.

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<sup>22</sup>Remoteness is constructed following Head (2003) and Freund and Rocha (2010):  $Remote_{jt} = \frac{1}{\sum_{s \neq j}^S GDP_{st} / Dist_{js}}$  where  $S$  is the set of all countries in the world.

A series of fixed effects are included in the regression in order to control for potential omitted variables bias. Specifically,  $\delta_k$  and  $\delta_{it}$  are sector and country-time fixed effect respectively. It is important to notice that the industry fixed effects  $\delta_k$  are at the 4-digits NAICS, a more aggregate level with respect to the 6-digits level of disaggregation of FDI. This is done in order to be able to include a variable that captures the level of headquarter intensity of the sector, defined as  $\eta$  in equation 1. In particular, we measure  $\eta$  as the ratio between total capital expenditures and total wage at the industry level using data from the Annual Survey of Manufactures in 2007 provided by the U.S. Census Bureau and we introduce a dummy equal to one if  $\eta$  is above the average in the regressions.<sup>23</sup>

Country-time fixed effects are used to control for time variant country specific factors such as domestic policies that might affect the location and control decisions of parent firms. Together with the variables capturing the remoteness of the destination country, these fixed effects control for the multilateral trade resistance.<sup>24</sup> Finally, in all regressions standard errors are clustered at the 6-digits sector level.

Table 3 reports the estimated OLS coefficients on the impact of deep integration and FDI.<sup>25</sup> The results in column 1 show that having a trade agreement is associated with higher levels of FDI. Signing a trade agreement corresponds to an increase in FDI of 77 percent. Also the depth of an agreement is positively associated with foreign direct investment. Columns 2 to 4 report the coefficients for different measures of depth, namely the number of provisions, *Top5*, and *Top10* indexes. In particular, column 2 shows that including one additional provision in the agreement is associated with an increase in FDI of 1.85%. Since the indexes *Top5* and *Top10* are in logs, an increase of one per cent in the index is associated with an increase of 0.57 and 0.51 per cent respectively.

The other coefficients reported in the table are consistent with the theory: capital intensive sectors are more likely to be vertically integrated and better domestic institutions, using rule of law as a proxy, are positively correlated with FDI. The correlation between BITs and FDI is worth further comments. Bilateral investment treaties are usually thought to be an important channel through which countries can attract foreign direct investment. However, the empirical literature on the topic is inconclusive. In particular, a recent paper by Baker (2012) shows that BITs had a positive impact on FDI until the mid-1990s.<sup>26</sup> In

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<sup>23</sup>The same data from the ASM have been used in Nunn and Treffer (2013) where they examine the importance of the relative contractibility of headquarter services and supplier inputs.

<sup>24</sup>An alternative way to control for general equilibrium effects in a similar context is presented in Egger et al. (2011). Their estimation strategy deals also with endogeneity of trade agreements and the presence of numerous zeros in the bilateral trade data matrix.

<sup>25</sup>The results presented in the paper focus only on the positive flows of FDI. When using the pseudo-Poisson maximum likelihood (PPML) methodology proposed by Santos Silva and Tenreyro (2006) to take into account zero flows, the coefficient of PTA becomes non-significant while the number of provision is still positive and significant.

<sup>26</sup>See also the discussion about the literature on BITs and FDI in Baker (2012).

Table 3: Vertical FDI and Deep Integration

	FDI (log of revenues in 1000\$)			
	(1)	(2)	(3)	(4)
PTA	0.573** (0.227)			
N. of Provisions		0.0185*** (0.00662)		
log(Top 5)			0.572* (0.304)	
log(Top 10)				0.508** (0.225)
Rule of Law	0.319** (0.124)	0.295** (0.121)	0.292** (0.122)	0.300** (0.123)
Tariff (log)	0.0420 (0.235)	-0.0588 (0.236)	-0.0110 (0.231)	-0.00303 (0.231)
BIT	0.0622 (0.143)	0.0331 (0.138)	-0.00897 (0.139)	0.00571 (0.141)
Dummy=1 if $\eta > \text{avg}$	0.779*** (0.280)	0.775*** (0.281)	0.777*** (0.280)	0.777*** (0.280)
Observations	4,816	4,777	4,777	4,777
R-squared	0.244	0.240	0.239	0.239
Industry-4dig FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes

Country-year fixed effects are referred to the country of the parent firm. All regressions control for distance, contiguity, colony relationship, common language, a dummy for China, GDP, GDP per capita, and remoteness of the country of the subsidiary. Robust standard errors in parentheses are clustered at the 6 digits NAICS level.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

line with this result, the coefficient of the BIT dummy in our regressions is not significant.

Results not reported in the table show that the coefficients of GDP, common language, and the dummy for China are positive and significant. On the other hand, contiguity is negatively correlated with vertical FDI. The coefficients of all the other variables, namely distance, GDP per capita, colonial relationship, and remoteness are not statistically different from zero.

So far we have said nothing about the direction of causality. The control decisions of firms are expected to respond to the depth of PTAs, but firms may lobby for deeper integration. Moreover, countries tend to sign similar agreements in order to avoid potential trade diversion. We deal with this potential endogeneity issue by using an instrumental variable approach. More precisely, we instrument PTA depth between country  $i$  and country  $j$  with the weighted average depth of all the agreements signed by  $i$  and  $j$  with any other country excluding the agreement between  $i$  and  $j$ . This type of instrumental variable approach has already been used in the literature (see, for instance, Orefice and Rocha (2014)).

For example, to instrument the depth of the agreement US-Peru we use the average depth of the agreements signed by Peru with all other countries excluding the US and the agreements signed by the US with all other countries excluding Peru. Each agreement of Peru (USA) is weighted with an index of similarity between Peru (USA) and its partners. More formally, if we define as the set  $S$  of all countries excluding country  $i$  and  $j$ , the instrument is constructed as follows:

$$DEPTH_{ijt}^{IV} = \frac{\sum_{s \in S} w_{ist} DEPTH_{ist} + \sum_{s \in S} w_{jst} DEPTH_{jst}}{N_{it} + N_{jt}}$$

where  $N_{it}$  is the number of mapped agreements of country  $i$  in year  $t$  excluding the agreement with  $j$ ,  $N_{jt}$  is the number of mapped agreements signed by country  $j$  in year  $t$  excluding the agreement with  $i$  and  $w_{ist}$  and  $w_{jst}$  are weights that take into account the GDP similarity between country  $i$  and  $s$  and between country  $j$  and  $s$  in time  $t$ .<sup>27</sup>

The rationale of this instrument comes from the domino effect theory of PTAs first introduced by Baldwin and Jaimovich (2010). If a pair of countries signs an agreement to increase FDI, then a third country would like to sign a similar agreement to avoid investment diversion. We expect that the higher the level of integration between a country  $j$  and its partners, the higher the probability that country  $i$  will sign a PTA of similar

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<sup>27</sup>More precisely:  $w_{pst} = \log \left( 1 - \left( \frac{GDP_{pt}}{GDP_{pt} + GDP_{st}} \right)^2 - \left( \frac{GDP_{st}}{GDP_{pt} + GDP_{st}} \right)^2 \right)$  for  $p \in \{i, j\}$ .

depth with  $j$  to avoid trade diversion effects.<sup>28 29</sup>

Table 4 reports the results of the 2-SLS regressions.<sup>30</sup> The coefficients of all our measures of depth remain positive and significant suggesting that deeper integration is an important factor driving the make-or-buy decision of firms.

Table 4: Vertical FDI and Deep Integration

	(1)	(2)	(3)	(4)
	FDI (log of revenues in 1000\$)			
PTA	1.229*** (0.318)			
N. of Provisions		0.0558*** (0.0102)		
log(Top 5)			2.351*** (0.465)	
log(Top 10)				1.538*** (0.296)
Rule of Law	0.382*** (0.123)	0.370*** (0.126)	0.389*** (0.125)	0.389*** (0.125)
Tariff (log)	0.106 (0.210)	-0.133 (0.233)	0.0266 (0.220)	0.0389 (0.220)
BIT	0.161 (0.136)	0.223 (0.145)	0.157 (0.140)	0.147 (0.139)
Dummy=1 if $\eta > \text{avg}$	0.773*** (0.277)	0.754*** (0.284)	0.752*** (0.282)	0.759*** (0.281)
Observations	4,816	4,692	4,692	4,692
R-squared	0.240	0.232	0.229	0.233
Industry-4dig FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes

Country-year fixed effects are referred to the country of the parent firm. All regressions control for distance, contiguity, colony relationship, common language, a dummy for China, GDP, GDP per capita, and remoteness of the country of the subsidiary. Robust standard errors in parentheses are clustered at the 6 digits NAICS level.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

The main message of this section is that deeper agreements matter for the decision of

<sup>28</sup>A similar argument has been provided by Chen and Joshi (2010). In a three-country theoretical model the authors highlight the importance of third-country effects in the formation of new PTAs. They examine how the incentives of a county pair to enter into a PTA with each other vary depending on whether the two countries already have existing PTAs with the third country.

<sup>29</sup>Potential direct effects of agreements with third parties are reduced by the system of weights that we use in the construction of the instrument. For example, for the agreement between the US and Peru, higher weights are given to agreements between Peru and other similar developing countries and to agreements between the US and other developed countries.

<sup>30</sup>The results of the first stage regressions are in the annex table A.2.

firms to vertically integrate in a foreign country. Taking this into account, does vertical FDI depend on the type of provisions included in deep agreements? In other words, is the content of PTAs related with firms decisions on whether to do vertical FDI or to foreign outsource? We examine this central issue in the next subsection.

## 4.2 PTA Content and Vertical FDI

The type of provisions included in a PTA is related to the firm's choice between vertical integration or foreign outsourcing: i) PTA provisions improving the contractibility of components ( $\mu_m$ ) are associated with an increase in the profitability of FDI relative to outsourcing, and ii) PTA provisions improving the contractibility of headquarter services ( $\mu_h$ ) are associated with an increase in the profitability of outsourcing relative to vertical integration. While we expect to find a positive relationship between  $\mu_m$  and FDI as a proxy of vertical integration, the relationship between FDI and  $\mu_h$  is less clear-cut.

We classify provisions into two different categories. The first set of provisions, also called  $h$ -provisions, contains those disciplines that improve the contractibility of headquarter services (i.e. the ones that increase  $\mu_h$ ). As discussed in Section 3.1, this set includes GATS, TRIPS, IPR, investment, and movement of capital. The second set of provisions, also called  $m$ -provisions, comprises PTA provisions that potentially address the contractibility of components (i.e. the ones that increase  $\mu_m$ ). In this group we include measures that relate to SPS, TBT, consumer protection, customs, and export taxes.

Once we have distinguished the two types of provisions, we construct a number of indexes,  $\mu_h$  and  $\mu_m$ , that capture to which extent an agreement includes disciplines aiming at the improvement of the contractibility of headquarter services or intermediate inputs respectively. We construct these indexes in two alternative ways. First, we create a dummy  $\mu_\omega$  that is equal to one if there is at least one provision of the  $\omega$ -type in the PTA, where  $\omega = h, m$ . Second, we use a discrete variable constructed as follows:

$$Discrete \mu_\omega = \begin{cases} 2 & \text{if all provisions of } \omega\text{-type in PTA} \\ 1 & \text{if at least one provision of } \omega\text{-type} \\ 0 & \text{otherwise} \end{cases}$$

Table 5 reports the estimated OLS coefficients of the following regression:

$$\begin{aligned}
FDI_{ijkt} = & \beta_1 \mu_{h,ijt} + \beta_2 \mu_{m,ijt} + \beta_3 DEPTH_{ijt} + \beta_4 INSTITUTIONS_{jt} + \\
& + \beta_3 \log(Tariff)_{ijkt} + \beta_4 BIT_{ijt} + \gamma_1 X_{jt} + \gamma_2 X_{ij} + \\
& + \delta_k + \delta_{it} + \epsilon_{ijkt}
\end{aligned} \tag{2}$$

Columns 1 to 3 show the results when we capture  $\mu_{h,ijt}$  and  $\mu_{m,ijt}$  with dummy variables. The last three columns report the OLS coefficients when  $\mu_{h,ijt}$  and  $\mu_{m,ijt}$  are discrete. In all regressions we include the total number of provisions covered in a PTA ( $DEPTH_{ijt}$ ) in order to detect whether depth per-se is still correlated with vertical FDI once we consider the composition of the agreements. The rest of variables and fixed effects included in the regressions are identical to the ones described in the previous subsection. We control, in fact, for rule of law, GDP, GDP per capita, contiguity, distance, colonial relationship, common language, a dummy for China, remoteness, and BITs. In order to deal with potential omitted variables, we also include country-year and industry fixed effects. The only difference with respect to the regressions in section 4.1 is the disaggregation of the industry fixed effects. In fact, we now use 6-digits NAICS industry fixed effects. As a consequence of this, we cannot include anymore the variable that captures the capital intensity of an industry.<sup>31</sup>

Accordingly to what is predicted by the theory, the results in table 5 show that, once we look more in detail the composition of agreements and we consider separately different sets of provisions,  $h$ - and  $m$ -provisions are related to vertical integration in different ways. The variables that capture the presence of provisions that improve the contractibility of inputs always have a positive and significant coefficient. The results in column 6 suggest that only provisions that improve the contractibility of components are positively related to vertical FDI.<sup>32</sup> Including at least one provision in the agreement or moving from an agreement with some provision to one with all  $m$ -provisions increases FDI by 77 percent. As to headquarter provisions, instead, the correlation is absent in most of the specifications. There is a negative and statistically significant coefficient only in column 3, where we include both the dummies  $\mu_h$  and  $\mu_m$ . This result is in line with the theory:  $h$ -provisions do not seem to have a strong relationship with vertical FDI.

These results confirm the predictions of the "property rights" model: the composition of PTAs and different sets of provisions included in an agreement are related to FDI in different ways. Moreover, it is important to notice that once we go into the details of

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<sup>31</sup>As a robustness check, we also run the regressions with industry fixed effects aggregated at the 4-digits level and capital intensity. Results are in line with the ones reported in the table and capital intensive sectors are more likely to engage in FDI.

<sup>32</sup>The results of PPML show that only the coefficient of *Discrete*  $\mu_m$  is positive and significant.



Table 5: Vertical FDI and the content of PTAs

	FDI (log of revenues in 1000\$)					
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy $\mu_h = 1$ if at least one $h$ provision	0.399 (0.424)		-0.943* (0.515)			
Dummy $\mu_m = 1$ if at least one $m$ provision		0.751** (0.374)	1.479*** (0.457)			
Discrete $\mu_h$				0.106 (0.244)		-0.0254 (0.233)
Discrete $\mu_m$					0.561** (0.230)	0.570*** (0.213)
N. of Provisions	0.00659 (0.0150)	-0.00215 (0.0115)	0.00783 (0.0148)	0.0128 (0.0177)	0.00162 (0.00832)	0.00303 (0.0184)
Rule of Law	0.235** (0.107)	0.255** (0.109)	0.263** (0.108)	0.230** (0.106)	0.272** (0.109)	0.272** (0.109)
Tariff (log)	-0.131 (0.224)	-0.0700 (0.227)	-0.0743 (0.231)	-0.154 (0.231)	-0.112 (0.216)	-0.116 (0.237)
BIT	-0.109 (0.116)	-0.0991 (0.117)	-0.0819 (0.115)	-0.106 (0.116)	-0.0589 (0.124)	-0.0576 (0.123)
Observations	6,888	6,888	6,888	6,888	6,888	6,888
R-squared	0.333	0.334	0.334	0.333	0.334	0.334
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Country-year fixed effects are referred to the country of the parent firm. All regressions control for distance, contiguity, colony relationship, common language, a dummy for China, GDP, GDP per capita, and remoteness of the country of the subsidiary. Robust standard errors in parentheses are clustered at the 6 digits NAICS level.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

the composition of PTAs, deeper integration per-se is not anymore correlated with the organizational decisions of firms. This was expected since the theory predicts that deeper agreements are related to more offshoring but it does not provide any clear prediction about the relationship with vertical FDI.

Regarding the unreported coefficients, only GDP, common language, and colonial relationship present a positive correlation with FDI; on the other hand, contiguity is, in some cases, negatively correlated with vertical FDI. Finally, as before, BITs seem not to be correlated with foreign direct investments.

So far, we simply looked at the correlation between  $\mu$ 's and vertical FDI. The model does not have clear predictions on the direction of causality. Table 6 reports the results of 2-SLS regressions using an instrument constructed similarly to the instrument for the depth of agreements.<sup>33</sup> More precisely our instrument for the content of PTAs is the weighted average  $\mu$  of all the agreements signed by  $i$  and  $j$  with any other country excluding the agreement between  $i$  and  $j$ . As before, the weight of each agreement  $w_{ijt}$  is a weight that takes into account the GDP similarity between country  $i$  and  $j$  in time  $t$ . The coefficients of  $\mu_m$  remain positive and significant in each specification. The coefficient of  $\mu_h$ , instead is not significant and it has the expected sign only when we use the discrete variable.

## 5 Conclusion

We use the AH model to guide our analysis on the relationship between deep trade agreements and the international organization of production. Then we test the theory by combining a new dataset on the depth and content of PTAs and a measure of vertical FDI derived from detailed sector-level information for more than one million firms worldwide.

Consistently with the theory, we establish two main findings. First, deep trade agreements are associated to an increase in FDI. Second, PTA provisions that improve the contractibility of components relative to headquarter services are associated to more FDI. However, once we look at the content of PTAs, deep integration is not associated to more vertical FDI anymore. In other words, it is the content more than the depth of PTAs that affects the way goods are traded internationally -i.e. within-firms or at arm's length. As this result is consistent with the "property rights" approach to the boundaries of multinational firms, but not with the "transaction cost" theory, it provides evidence in support of the first approach.

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<sup>33</sup>The results of the first stage regressions are in the annex Table A.3.

Table 6: Vertical FDI and content of PTAs: 2-SLS results

	FDI (log of revenues in 1000\$)					
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy $\mu_h = 1$ if at least one $h$ provision	2.131*** (0.491)		-2.388 (1.606)			
Dummy $\mu_m = 1$ if at least one $m$ provision		2.452*** (0.431)	4.551*** (1.415)			
Discrete $\mu_h$				-2.184*** (0.661)		-0.342 (0.411)
Discrete $\mu_m$					2.106*** (0.371)	2.493*** (0.378)
N. of Provisions	-0.0357* (0.0202)	-0.0487*** (0.0174)	-0.0367* (0.0204)	0.228*** (0.0573)	-0.0351** (0.0152)	-0.0244 (0.0248)
Rule of Law	0.323*** (0.107)	0.348*** (0.107)	0.363*** (0.106)	0.281** (0.113)	0.441*** (0.114)	0.462*** (0.109)
Tariff (log)	0.0465 (0.196)	0.176 (0.208)	0.212 (0.215)	-0.768** (0.347)	0.0476 (0.212)	0.0195 (0.230)
BIT	-0.0623 (0.111)	-0.0721 (0.110)	-0.0572 (0.110)	0.198 (0.136)	0.124 (0.126)	0.164 (0.127)
Observations	6,764	6,764	6,764	6,764	6,764	6,764
R-squared	0.326	0.328	0.325	0.279	0.323	0.319
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Country-year fixed effects are referred to the country of the parent firm. All regressions control for distance, contiguity, colony relationship, common language, a dummy for China, GDP, GDP per capita, and remoteness of the country of the subsidiary. Robust standard errors in parentheses are clustered at the 6 digits NAICS level.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

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## A Appendix - Measurement of FDI

For our sample of countries and year, ORBIS records the revenues of 125,212 subsidiaries for which we can identify 42,984 ultimate owner parents. The definition of ownership provided in the ORBIS database “concerns the minimum percentage that must characterize the path from a subject company up to its ultimate owner” The example in Figure 6 illustrates this definition. The numbers between firms represent how much the firm at the bottom of the arrow owns of the firm at the arrowhead. Therefore, considering a path of minimum ownership of 25.01%, the ultimate owner of firm 4 is firm 1, while, considering a path of minimum ownership of 50.01% the ultimate owner of firm 4 is firm 3.<sup>34</sup>

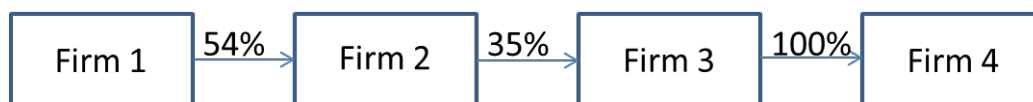


Figure 6: ORBIS definition of ownership

It is important to note here the difference with the measure of FDI in Alfaro and Charlton (2009). In fact, as a measure of FDI, they use the value of sales aggregated at the sector of the subsidiaries. While their approach measures the value of FDI done in an industry, our way of aggregating firms’ revenues allows us to evaluate the amount of FDI done by an industry. Following the previous example, they look at the total value of sales of all the firms in the plastic, seat-belts, or glass sector. On the contrary, since we are interested in the reasons why firms in a particular sector do more FDI, we aggregate revenues at the sector of the lead firm. In other words, instead of looking at the total amount of FDI done by firms in the car industry and wine sector in the production of glass, we focus on the amount of FDI done by firms in the cars (or wine) industry in all sectors that produce the inputs needed to produce cars (or wine).

<sup>34</sup>These thresholds are the only ones available in ORBIS. In our analysis we use the 25.01% threshold.





Table A.2: Vertical FDI and Deep Integration: First stage

	PTA	N. of Provisions	log(Top 5)	log(Top 10)
	(1)	(2)	(3)	(4)
PTA <sup>IV</sup>	0.017*** (0.0005)			
N. of Provisions <sup>IV</sup>		6.877*** (0.348)		
Top 5 <sup>IV</sup>			3.551 (0.221)	
Top 10 <sup>IV</sup>				3.242 (0.189)
F-stat (p-value)	0.000	0.000	0.000	0.000
Observations	4,816	4,777	4,777	4,777

Robust standard errors in parentheses are clustered at the 6 digits NAICS level.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A.3: Vertical FDI and content of PTAs: First stage

	Dummy $\mu_h$	Dummy $\mu_m$	Dummy $\mu_h$	Discrete $\mu_h$	Discrete $\mu_h$	Discrete $\mu_h$
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy $\mu_h$ <sup>IV</sup>	4.584*** (1.755)		-19.995*** (4.537)			
Dummy $\mu_m$ <sup>IV</sup>		5.110*** (1.184)	21.482*** (3.359)			
Discrete $\mu_h$ <sup>IV</sup>				-20.101*** (1.916)		-19.224*** (1.958)
Discrete $\mu_m$ <sup>IV</sup>					3.208** (1.133)	13.990*** (2.211)
F-stat (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
			Dummy $\mu_m$			Discrete $\mu_m$
Dummy $\mu_h$ <sup>IV</sup>			-8.997** (3.950)			
Dummy $\mu_m$ <sup>IV</sup>			12.060*** (2.517)			
Discrete $\mu_h$ <sup>IV</sup>						-2.451** (1.084)
Discrete $\mu_m$ <sup>IV</sup>						3.067** (1.115)
F-stat (p-value)			0.000			0.000
Observations	6,764	6,764	6,764	6,764	6,764	6,764

Robust standard errors in parentheses are clustered at the 6 digits NAICS level.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1