Gravity estimations with FDI bilateral data: Potential FDI effects of deep preferential trade agreements

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Abstract

This study employs a structural gravity approach to analyse the impact of preferential trade agreements (PTAs) on bilateral foreign direct investment (FDI). We use the UNCTAD global database on bilateral FDI stocks and flows. To control for the heterogenous nature of PTAs, we employ two different indicators of PTA depth: the DESTA and World Bank indicators. We find that 'deeper' or comprehensive PTAs (e.g. including provisions on investment, public procurement and intel- lectual property rights provision) have a significant positive impact on bilateral FDI between partners. For instance, we estimate that the deepest PTA (with an index of seven in the DESTA database) is expected to increase bilateral FDI stocks between signatory countries by around 54%. As an example, we analyse the potential impact on foreign direct investment of the economic co-operation agreement signed by the Pacific Alliance countries (Chile, Colombia, Mexico, Peru) in 2012.

JEL codes: F15 , F21 , F13, C50

Keywords: structural gravity estimation, foreign direct investment, preferential trade agreements

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1 Introduction

In this paper we estimate the potential impact of preferential trade agreements (PTAs) –and other bilateral policies that affect trade and investment– on the bilateral FDI stocks and flows between the countries signing these agreements. We use a structural gravity model of FDI, with bilateral FDI data from UNCTAD (2014) and we control for the presence and depth of preferential trade agreements (PTAs). We employ two databases to account for the heterogeneity of PTAs: the DESTA database (Dür et al., 2014) and the World Bank database (Hofmann et al., 2017).

Preferential trade agreements are mainly associated with the increase in bilateral trade between the participating countries. The impact of preferential trade agreements on foreign direct investment (FDI), however, is less straightforward. Trade and FDI can either complement or substitute each other, depending on the investment motivation (i.e. horizontal, vertical), the specific industry and on the way in which the FDI provisions are shaped in the Regional Investment Facilitation pillar of the agreement. From a theoretical point of view, *horizontal* FDI –where firms replicate domestic activities in a foreign country– are associated with FDI substituting for trade. Thus, in the presence of horizontal FDI, PTAs are expected to decrease FDI flows. On the other hand, *vertical* FDI –where firms split activities between different geographical regions– creates a complementary relationship between trade, PTAs and FDI (cf. Markusen, 2002). More recently, the expansion of global value chains (GVCs), which is a more elaborated form of vertical FDI, has reinforced the positive link between PTAs and vertical FDI.[1]

In practice, however, FDI data is a combination of both vertical or horizontal FDI, since the motivation or purpose of the investments is not usually revealed.[2] In addition, the compilation and reconciliation of bilateral FDI data is a difficult task (IMF, 2003). It is common that countries report different bilateral FDI values than the corresponding partners, and a detailed reconciliation of data and compilation methodologies is required. In this study we employ such a compilation, done by the UNCTAD (2014) database, which provides bilateral data on inward and outward FDI flows and stocks. In particular, our main estimations employ the inward FDI stock data, which fluctuates less and is in general more reliable than year-to-year FDI flow data. However, we also use inward FDI flows to assess the robustness of our results.

Since we cannot separate the FDI data between horizontal and vertical FDI, the expected relation between PTAs, trade and FDI, remain an empirical question. In this regard, Bergstrand and Egger (2007) use a model with three countries, with export and FDI data and find that regional integration has a positive trade effect but a negative effect on FDI. These results, therefore, find support for a substitutability relation between trade and FDI. On the other hand, other studies that employ panel data with a larger set of countries, find the opposite results (Daude et al., 2003; Anderson et al., 2016, 2017). These papers, hence, find empirical support for a complementary relation between both variables, which can include the creation or expansion of GVCs with PTAs. Our paper is closest to Anderson et al. (2017), since our analytical framework is based on their work, but we control for the heterogenous nature of PTAs (instead of including only a dummy variable for the presence of any PTA) and we focus our analysis on the traditional "partial-equilibrium" nature of the gravity model. This allows us to generate a larger number of sensitivity analysis, to confirm the robustness of the effect of PTAs on FDI.[3]

Finally, we apply our econometric results to analyse the impact of the Pacific Alliance on the expected changes in FDI for the region.[4] In general, the Latin

[1]Baldwin and Okubo (2014) go further and divide FDI in six categories. However, the main distinction of complementary and substitutability links between trade and FDI remain.

[2]Alfaro and Charlton (2009) identify between vertical and horizontal FDI flows by employing the implicit information in national input-output tables. However, they only provide information for a small group of countries.

[3]The aim of the Anderson et al. (2016, 2017) papers is more ambitious, as they want to obtain general equilibrium trade and FDI effects of PTAs on real income. For our purposes, we want to focus on the effect of PTAs on FDI and we are not concerned with the trade nor the general equilibrium effects that translate into welfare changes.

[4]The PA was launched in April 2011, officially established in June 2012, but until 2013 an agreement was signed to reduce 92% of tariffs by May 2016 and to eliminate all tariffs by 2020.

America and the Caribbean (LAC) region is lagging in terms of trade in services and FDI related to services with respect to the rest of the World. For instance, services account for much less of the FDI flows than is usually the case 43% compared to two-thirds elsewhere (Hollweg et al., 2016). In the case of Pacific Alliance countries, Sáez et al. (2014) find that for Peru and Colombia the contribution of services in total trade, both in direct exports or value-addition to other exports, is below what should be expected for their economic development level. Therefore, promoting trade and investment in services is a key objective of the Pacific Alliance (PA) and we provide insights into the key drivers and expected FDI impacts for the region.

2 Analytical framework

This section provides details on the structural gravity model for FDI, our quantitative strategy, and the precise empirical specifications that will be applied.

2.1 Theoretical gravity model for FDI

The framework used to assess FDI performance will be based on recent advances in the gravity model literature (cf. Yotov et al., 2016). In particular, we follow the FDI gravity modelling approach developed by Anderson et al. (2016, 2017). Their model shows how trade and FDI are related and how they respond to natural or man-made policy barriers to trade and investment. In this paper, we focus solely on the structural FDI gravity model, its empirical estimation, and the estimated impacts of PTAs on bilateral FDI stocks. These last estimations will allow us to estimate the potential FDI impact of different shallow or deep PTAs.

In particular, the Anderson et al. (2016, 2017) model builds on the technology-capital or knowledge-capital interpretation of FDI.[5] Foreign direct investment is assumed to be comparable with trade in technology services. A given stock of technology capital (patents, blueprints, management skills, etc.) can be used simultaneously in more than one country, on a non-rival basis. The value of the knowledge capital increases when it can be 'leased' to other countries in the form of FDI. Because flows of knowledge capital are to a large extent intangible and therefore difficult to measure, the stock of bilateral FDI will be used as a proxy for the flow of knowledge capital between two countries.[6]

The value of bilateral FDI originating from country i and hosted in country j is represented by FDI_{ij}^{stock}. It is positively affected by the size of the origin country

The Pacific Alliance strategy has two pillars on services and FDI. One of the pillars is to position the Pacific Alliance area as an attractive destination for services investment and services trade. Another is to increase investment and trade in services among the four members of the Alliance and with the rest of the world.

[5] Developed *inter alia* by Markusen (2002) and McGrattan and Prescott (2009, 2010).

[6] The gravity model for trade is based on flow values instead of stock values. Like Anderson et al. (2016, 2017) we use FDI stocks to proxy the FDI-related technology capital flows between partner countries. Bilateral FDI stock data are more widely available and reliable than FDI flow data, which have a large degree of volatility over time (cf. Section 3).

(E_i), because larger economies tend to invest more in technology capital. The bilateral FDI stock is also positively impacted by the size of the destination country (Y_j), because larger economies can in principle absorb more foreign technology. If the size of the aggregate technology capital stock in country i is expressed by M_i then the ratio Y_j/M_i can be regarded as a crude measure of country j's potential absorption capacity for FDI-related technology capital from country i. The free flow of bilateral trade and FDI is hindered by barriers or frictions. For FDI, country j's relative openness for FDI-related foreign technology from country i can be represented by ω_{ij}, which has values between 0 and 1.[7] If $\omega_{ij} = 1$, country j is fully open for entry of technology capital from country i, while in case of $\omega_{ij} = 0$, no technology capital originating from country i is admitted. The aforementioned elements form together the main determinants of bilateral FDI value stock:[8]

$$FDI_{ij}^{stock} = \omega_{ij}^{\eta} \frac{\alpha E_i}{P_i} \frac{Y_j}{M_i} \tag{1}$$

The parameter η is the elasticity of FDI revenue flows with respect to the openness measure. More openness in country j will allow country i's technology stock to be used more often, resulting in more FDI revenues. The remaining elements in equation (1) come from the structural gravity system for trade, in which the FDI determinants are embedded. The parameter α groups a set of fixed parameters from the theoretical model.[9] Finally, P_i is the inward multilateral resistance term of the gravity trade model. It consistently aggregates bilateral trade costs of country i versus all other countries:

$$P_i = \left[\sum_{j=1}^{N} \left(\frac{t_j i}{\Pi_j} \right)^{(1-\sigma)} \frac{Y_j}{Y} \right]^{\frac{1}{1-\sigma}} \tag{2}$$

in which t_{ji} are the bilateral trade-cost frictions, such as the effects of distance and having different languages that increase the costs of bilateral trade; they are expressed as a per unit cost fraction. $Y = \sum Y_j$ is world output or world GDP, used to normalise the size of each Y_j, and σ is the elasticity of substitution from the CES functions that are used to aggregate the multilateral resistance (MR) terms.[10] The intuition here is that inward higher trade frictions in country i increase the opportunity costs of investing in knowledge capital in the origin country, e.g. by making complementary foreign inputs more expensive.

[7] Note that ω_{ij} is the inverse of all factors that work out as barriers to foreign direct investment.

[8] Time indexes are suppressed in this representation. E_i measures the size of country i as total expenditure, including expenditure on development of technology capital; Y_j is a measure for the size of host country j (total nominal output).

[9] These include parameters such as the depreciation rate, the discount factor on the utility function, and other parameters that are used in the underlying theoretical model. See Anderson et al. (2016, 2017) for details.

[10] The $\sigma > 1$ substitution elasticity expresses here that all countries have a preference for variety of products and technology capital by country of origin.

To account for the fact that world trade is a fully integrated system, equation (2) also holds the term Π_j, representing the outward multilateral trade resistances for country j. It aggregates bilateral trade costs of country j versus all other countries, thus completing the full FDI gravity system:

$$\Pi_j = \left[\sum_{i=1}^{N} \left(\frac{t_{ji}}{P_i} \right)^{(1-\sigma)} \frac{E_i}{Y} \right]^{\frac{1}{1-\sigma}} \tag{3}$$

The intuition for understanding the relation of equation (3) with bilateral FDI is that higher relative trade costs in host country j increase its domestic prices and thus lower the country's real potential for absorbing foreign technology capital (FDI).

The Anderson et al. (2016, 2017) model also includes the analysis of domestic welfare impacts of FDI in the home and destination countries via the process of capital accumulation and via creating more product variety or more production efficiency. We do not consider these mechanisms in the present paper, but concentrate on the effects of different PTAs on bilateral FDI. This restriction means that the welfare impacts of having more FDI are probably larger than the effects that that we identify in this paper.

The FDI gravity model distinguishes two types of frictions that affect bilateral FDI. Both friction impact on bilateral FDI through different channels. First there are the standard bilateral trade frictions (t_{ji}), covered by the common gravity control variables (PTAs, distance, common border, common language and colonial ties), which indirectly also act as FDI barriers. Secondly, there are the explicit FDI barriers that are captured by the FDI-openness measure ω_{ij}. It includes specific FDI barriers such as bureaucratic red tape, protection of national champions, sheltered industries and other restrictive measures, as well as the impact of bilateral investment treaties (BITs) and currency unions. Below we sketch the full set of factors that may affect bilateral FDI and trade, including the non-bilateral frictions:

- The first component is related to characteristics of the country of FDI origin or source country. Possible robust determinants of FDI in the country of origin include labour costs, corporate tax rate, corruption, and bureaucratic red tape, among others. These factors may vary over time.

- The second component includes FDI determinants that are related to the destination or host country. Potentially relevant factors for incoming FDI are corruption levels, internal political tensions, labour costs and human capital abundance, corporate tax rate, bureaucratic red tape, quality of institutions and the ease of doing business. These factors are also time variant.

- The third component includes time-invariant bilateral characteristics common to the standard gravity formulation: distance, contiguity, common language and colonial ties. These factors tend to be time invariant.

- The last component includes time-varying bilateral determinants of FDI. This group includes PTAs, and other trade policy variables: BITs and currency unions.

The inward and outward multilateral resistance terms (P_i and Π_j, respectively) are theoretical constructs that capture general equilibrium effects that are usually not directly observable. In other words, they capture all impact factors in, respectively, the origin and destination countries. The model shows that the frictions in trade system have a separate impact on bilateral FDI, even apart from the FDI openness measure ω_{ij}. In the empirical work we analyse this dual impact, by using the inward multilateral resistance term from the trade sub-model of the gravity system. A higher inward MR in the PA countries (here interpreted as destination countries j for FDI) implies that they will have less imports, higher prices, lower real income, and hence lower E_j and lower Y_j. This is a already a sufficient condition for them to have less FDI absorption capacity, even if we disregard their explicit FDI barriers. Consequently, we use the inward MR of the trade sub-model as a very informative index to identify the national policies that lower the inward MR for trade, and therefore indirectly contribute to more FDI absorption and more FDI inflows. Separately we analyse the impacts of more bilateral FDI openness ($\omega_{ij,t}$).

2.2 Best-practices regarding the structural gravity equation

The empirical gravity equation is used intensively in many empirical trade applications. Important data-related and econometric challenges must be taken into account so that the gravity estimation is neither biased nor inconsistent with its theoretical foundations. We follow the recommendations listed in Yotov et al. (2016).

First, in line with the recent literature we employ a Pseudo-Poisson maximum likelihood (PPML) estimator, because it effectively deals with zero bilateral FDI flows and accounts for the presence of heteroskedasticity in trade data (Santos Silva and Tenreyro, 2006). Thus, we are careful to distinguish sharply between real zero FDI (flows or stocks) and missing (or non-reported, suppressed) data. However, it must be noted a priori that the quality of the data on bilateral FDI flows leaves more uncertainty on this issue than holds for the case of, for instance, bilateral trade flows.

Second, we also follow the best practice of using country-pair-fixed effects to account for any unobservable time invariant trade cost components. Using these pair-fixed effects has been proven to be a better measure of the bilateral trade costs than the standard set of gravity variables (Egger and Nigai, 2015; Agnosteva et al., 2014). In addition, the standard gravity equation applied to bilateral trade flows, points to an endogeneity issue regarding the relation between PTAs and trade. In general, PTAs are more likely between partners that already have intense trade relations. This endogeneity problem will also be present when dealing with FDI flows. Several methods can be used to account for this issue (see for example, Egger et al., 2011; Anderson et al., 2016). Here we first follow the common practice of using pair-fixed effect, which will also deal with the endogeneity of PTAs by accounting for the observable and unobservable linkages between the endogenous trade policy covariate and the error term (Yotov et al., 2016). In addition, the use of only one PTA variable may still give biased results if there are simultaneous other pairwise time-varying factors that could play a role in determining FDI. This is why we combine our PTA indicators with other policy variables such as bilateral investment treaties (BITs).

Third, we use exporter-time and importer-time fixed effects to properly account for multilateral resistance terms in panel data gravity estimations (Olivero and Yotov, 2012). In our application "exporter" will refer to the FDI country of origin (outward FDI stock) and "importer" the FDI destination country (inward FDI stock). Note that as well as accounting for the unobservable multilateral resistance terms, the exporter-time and importer-time fixed effects also absorb the country size variables (E_{jt} and Y_{it}) from the structural gravity system in equations (1-3), in addition to all other observable and unobservable time-varying country-specific characteristics, including different national policies, institutions, and exchange rates (Yotov et al., 2016).

Fourth, we use panel data, which leads to improved estimation efficiency, and more importantly, allows the use of the country-pair-fixed-effects and the exporter-time and importer-time fixed effects methods mentioned above.

Fifth, we must account for the effect of non-discriminatory domestic policies. Even if they are not explicitly discriminating foreign trade and investment, they still are likely to affect the level and pattern of international trade and investment (Kox and Lejour, 2005). To estimate the effects of non-discriminatory trade policy we follow Heid et al. (2015), which estimate the structural gravity model using both international and intra-national trade flows. The same reasoning may apply to FDI flows, and we assume that non-discriminatory policies equivalently influence domestic capital stocks and inward FDI stocks. (Yotov et al., 2016) mention some further reasons why the gravity estimations should include international and intra-national (domestic) flows:

- For theoretically consistent identification of the effects of bilateral trade policies. In particular, for bias-free estimation of the effects of PTAs on trade (and FDI).
- For resolving the 'distance puzzle' by accounting for domestic trading distances

Sixth, since trade (and FDI) flows do not respond immediately to trade policy changes, some authors have criticised the use of panel-data estimations over consecutive years (Trefler, 2004). To avoid this issue, Trefler (2004) used 3-year intervals, while other authors also experimented with 4- and 5-year intervals.[11] In our case, since FDI data is less frequent, scarcer and much more volatile than trade data we

[11] Olivero and Yotov (2012) show that there there are no significant differences when using 3-year and 5-year interval trade data, but that the use of consecutive years yield suspicious estimates of the trade cost elasticity parameters.

use 3-year averages to both smooth the volatility of the series and to better capture the delayed response of FDI to policy changes.[12]

Seventh and final, there is a large number of PTAs and there is significant heterogeneity between them (Horn et al., 2010). Thus, using a simple PTA dummy variable will bias the effects of PTAs on FDI flows, and we need to account for the "depth" of PTAs. Deep PTAs usually include investment provisions that are not present in "shallow" PTAs. We apply several PTA depth indicators, to be detailed in Section 3.3.

2.3 Main regression equation

Based on the seven best practices explained above, the structural model of equations (1) to (3) is then applied to a data panel (with time t) using the following econometric specification:

$$FDI_{ijt} = exp\left[\gamma_1 \mathbf{POL}_{ijt} + \mu_{it} + \mu_{jt} + \mu_{ij}\right] + \epsilon_{ijt} \tag{4}$$

where FDI_{ijt} is the inward FDI stock in country of destination i (the reporting country) from country of origin j (the partner country) in period t (the 3-year average in our base case). Moreover, $\mathbf{POL}_{ijt}$ is a time-variant vector of bilateral policy variables (e.g. PTAs, bilateral investment treaties), μ_{it} are time-varying source-country fixed effect (dummy variables) that control for the outward multilateral resistance terms and countries' output shares, μ_{jt} are time-varying destination-country fixed effects that account for the inward multilateral resistance terms and total expenditure, μ_{ij} are the set of country-pair fixed effects that will absorb all time-invariant gravity covariates from t_{ij} along with any other time-invariant determinants of trade costs that are not observable, and ϵ_{ijt} is a combined error term. Equation (4) will then be our main estimating equation.

2.4 Identifying FDI determinants

After employing equation (4) as our baseline, a stepwise analysis is used to gain additional insights in the drivers of FDI flows. Note that the use of pair-fixed effects in equation (4) effectively absorbs the bilateral time-invariant covariates used in the standard gravity equation (i.e. bilateral distance, contiguity, language and colonial ties), but will not affect the estimation of the trade policy variables that by definition are time-varying. Therefore, we also use the standard gravity equation:

$$FDI_{ijt} = exp\left[\gamma_1 \mathbf{POL}_{ijt} + \gamma_2 \mathbf{C}_{ij} + \mu_{it} + \mu_{jt}\right] + \epsilon_{ijt} \tag{5}$$

where $\mathbf{C}_{ij}$ is the vector of time-invariant bilateral control variables (i.e. distance, language, contiguity, colony).

A comparison of the results from equations (4) and (5) makes it possible to identify the importance of the specific pairwise effects in $\mathbf{C}_{ij}$, and we can build

[12] We also experiment with 4-year averages. In addition, the use of averages uses helps in some cases where there are negative stocks and flows, as explained in Section 3.

upon this to identify additional FDI determinants. In particular, we follow this step-wise approach:

- Step 1: We use the gravity estimation from equation (4) with country-pair fixed effects as our benchmark –since it accounts for all observable and unobservable trade costs. These estimations will provide the information regarding the relative FDI stock position of PA countries (and candidate PA countries), with respect to other comparable countries. In particular, we use the inward multilateral resistance terms as an indicator of country-specific in the destination country that determine FDI inflows taken into account policy variables (i.e. the impact of PTAs) and with respect to comparable country characteristics.
- Step 2: Include additional policy variables: alternative PTA indicators , currency unions, BITs, and other policy indices. This will inform about the potential impact of selected policies on the probability of an increase in FDI flows for the PA countries.
- Step 3: Use the inward multilateral resistance terms from the first step to analyse the impact of different country-specific variables to explain the FDI inflows. We include here indicators for national differences in business costs (costs of doing business, governance and political stability, economic liberalisation) and other FDI determinants (FDI restrictiveness, human capital, logistics and infrastructure development, taxes on income and profit).

This three-step approach is motivated by the fact that the our man structural gravity model uses a series of fixed effects to account for all country-time-specific and country-pair-specific observed and unobserved factors. However, even though this approach generates much better estimates of the overall impact of PTAs on bilateral FDI flows, it does not identify which potential factors are important. In the stepwise approach we can identify variables of which the literature suggests that they are significant FDI determinants and which can be hidden in the fixed effects estimates. If these variables have a specific importance for explaining FDI flows, the outcomes of the augmented SG equations from the second and third steps can be compared to the simple SG outcomes of the first step in order to identify some of the elements that were hidden in the estimated dummy coefficients of the first step. In practice, this means that we will estimate equation (5) using different combinations of the control and policy variables in $\mathbf{C}$ and $\mathbf{POL}$. As explained above, for our purposes the most relevant policy variable is the depth of PTAs, where the estimated coefficient of this variable provides an assessment of the potential impact that the PA treaty can have on bilateral FDI flows.

3 Data

Data availability is a serious issue with regard to FDI (IMF, 2003). This is one of the reasons that not many gravity analyses have been applied to FDI flows, because gravity analysis has to be based on bilateral flows. However, most data sources on FDI (e.g. UNCTAD, the World Bank's World Development Indicators) only provide inflows or outflows from/to the Rest of the World. These data are therefore unfit for gravity analysis. Moreover, the gravity analysis requires the information of the full world FDI matrix (although some simplification is possible by grouping together minor countries/regions). Only a few sources offer consistent time series for bilateral FDI flows.[13]

3.1 FDI bilateral data compilation

We use UNCTAD's Bilateral FDI Statistics (UNCTAD, 2014), which provides systematic FDI data for 206 countries, covering inflows, outflows, inward stocks ("instock") and outward FDI stocks ("outstock"). These UNCTAD data is collected mainly from national sources when available, if not available it is complemented with data from partner countries (mirror data) as well as data from other international organisations.

These data are available as 206 individual country excel spread sheets, which include separate sheets for the four FDI categories: inflows, outflows, instock and outstock. We processed each country specific-excel files and compile all of them into a Stata database file. This database has available information for the years 2001 to 2012, and all the data are in US$ millions. The database distinguished between zero flows ("–") and missing data (".."). In addition, each country has a limited (non-exhaustive) number of partners reported. In other words, if a country-pair does not have any reported FDI data for any given year in the sample period, then it is simply not reported in the excel files.[14] There are also regional aggregates (i.e. Southeast Asia, Oceania) with reported data, that are not always assigned (partially or fully) to individual countries within that region. Likewise, the total FDI values (assigned to "World") usually do not sum up to the individual countries' total.

We follow the data procedure and theoretical framework from Anderson et al. (2016) and thus, we also use mainly the inward stock data from UNCTAD –which is also the FDI category with most data availability– and complement this information with the "mirror" outward stock data (when inward stock is missing or zero). This "mirroring" procedure extends the sample country from 206 to 217, by including

[13] An alternative database, which has information at the industry level and has been used in some papers to estimate FDI gravity models is the *FDImarkets* database (www.fdimarkets.com) of the Financial Times. However, this database has two main limitations: it only reports announced (instead of actual) investments and it only has information on green-field investment rather than on total FDI. Even though the sectoral/industry dimension of t, *FDImarkets* can be valuable for a more detailed analysis, these serious database limitations does not allow for the country-wide analysis we conduct in this paper.

[14] We take these data points as "missing" for the moment, but they could be assumed to be "zeros".

countries that are not individually reported by the UNCTAD database, but for which there is outward data from a partner country (e.g. Andorra, Faroe Islands). For sensitivity analysis we can also use the UNCTAD bilateral FDI flows, instead of the inward stocks.[15]

Our compiled UNCTAD database consists then of 217 countries, 12 years (2001 to 2012), 80071 total observations, 7923 total country-pairs with and average number of observations by country-pair of 10.1 Of this there are 2322 negative values (3% of total observations) and 26,434 zero values (33%). For the Pacific Alliance countries (Chile, Colombia, Mexico and Peru), we have 3640 total observations, with 377 country-pairs, and an average of 9.7 observations per pair. This includes information on 100 (origin) countries with FDI stocks in the PA countries, and 65 (destination) countries with FDI stocks from PA.

In Table 1 we present the results FDI inward stocks for the PA countries and for comparative reasons, a group of selected countries, mainly in Latin America.

Table 1: Inward FDI stocks by host country, in US$ million

	Inward FDI stocks				**as share of GDP (current US$)**			
Host country	**2001-2003**	**2004-2006**	**2007-2009**	**2010-2012**	**2001-2003**	**2004-2006**	**2007-2009**	**2010-2012**
Chile	22,447	48,977	101,010	148,187	31.1%	39.0%	57.7%	60.2%
Colombia	7,757	11,985	20,102	25,397	8.0%	8.4%	8.8%	7.7%
Mexico	82,489	129,439	208,071	335,026	11.4%	14.9%	20.5%	29.5%
Peru	13,611	14,305	17,858	22,640	24.7%	18.5%	15.6%	13.3%
Argentina	49,909	63,017	80,155	95,502	30.3%	31.7%	24.5%	19.1%
Bolivia	813	1,606	3,629	7,836	10.1%	16.2%	23.1%	33.3%
Brazil	82,802	148,190	231,256	699,871	15.3%	16.7%	14.6%	28.8%
Costa Rica	1,967	2,844	6,687	16,313	11.9%	14.0%	22.8%	38.8%
Ecuador	1,595	1,705	2,846	4,746	5.6%	4.1%	4.9%	6.0%
Panama	8,289	9,973	15,713	23,048	63.4%	60.4%	65.4%	67.0%
Paraguay	916	1,257	2,374	3,572	13.4%	13.8%	14.8%	15.4%
Uruguay	4,736	5,927	9,103	10,742	30.5%	35.1%	32.0%	23.1%
Venezuela	17,983	16,514	24,729	31,693	18.0%	11.2%	8.5%	8.7%
China	432,548	599,897	831,801	1,149,665	29.0%	25.7%	18.8%	15.5%
USA	1,347,843	1,656,561	2,022,859	2,461,747	12.2%	12.7%	13.9%	15.8%

Source: Own calculations using UNCTAD bilateral FDI database.

We observe that Mexico has the largest FDI inward stocks from the PA region, followed by Chile. But Chile has a relatively large share of FDI with respect to GDP that is twice the share for Mexico. On the other hand, Peru and Colombia are both lagging behind in terms of inward FDI, with relatively low FDI stocks –even by Latin American standards.

When we look at the within PA region FDI inward stocks (see Table 2), we observe that the FDI flows have been steadily increasing within the region.[16] Specially in Colombia the inward FDI stocks have increased the most and have become the

[15]An additional source of information, used by Anderson et al. (2016) that we can use later to complement the UNCTAD data, is the FDI data from the International Direct Investment Statistics database, which is constructed and maintained by the Organisation for Economic Co-operation and Development (OECD).

[16]Note that in the period 2001-2005 there are five country-pair cells with missing values (Chile-Mexico, Chile-Peru, Colombia-Peru, Mexico-Chile and Mexico-Peru, and two cells in the period 2006-2008 (Colombia-Peru and Mexico-Peru). In the Table 2 these are taken as zero values.

largest within PA stocks by 2010-2012. On the other hand, the relative importance of the intra-PA flows varies much by country. For Colombia, the intra-PA FDI flows is very large, representing almost two-thirds of Colombia's total FDI stock. For Peru the intra-PA are also significant but much less important than for Colombia, ranging from 24 to 39%. On the contrary, the intra-PA FDI are just 1% or less of the total FDI inward stock in Mexico, and less than 10% for Chile during this period.

Table 2: Inward FDI stocks by host country from Pacific Alliance partners, in US$ million

	Inward FDI stocks with PA partners				**as share of total inward stocks**			
Host country	**2001-2003**	**2004-2006**	**2007-2009**	**2010-2012**	**2001-2003**	**2004-2006**	**2007-2009**	**2010-2012**
Chile	0	560	3,821	13,537	0.0%	1.1%	3.8%	9.1%
Colombia	0	305	4,932	15,919	0.0%	2.5%	24.5%	62.7%
Mexico	0	513	2,023	3,423	0.0%	0.4%	1.0%	1.0%
Peru	3,210	4,145	6,536	8,733	23.6%	29.0%	36.6%	38.6%

Note that there are missing data on bilateral inward stocks, so not all values are zero. Source: Own calculations using UNCTAD bilateral FDI database.

To obtain the domestic capital stock data, we employ the 2017 version of the IMF Investment and Capital Stock Dataset (IMF, 2015). These real investment and capital stock series are given in constant international dollars using constant (2011) PPP exchange rates (to make the series comparable across countries). The series are also presented in national currency, but to be comparable to our FDI data, we need to convert these values to US dollars. For this we use the PPP conversion factor from the WDI database.[17]

We then construct 3- and 4-year average FDI inward stock values to be used in our main econometric specification. Note that there is a very small proportion (less than 3%) of stock values in the UNCTAD database that are negative. This issue can be explained by looking into the three elements included in the FDI flow and stock values:

1. Greenfield direct investments/disinvestments
2. Changes in intra-company loans or leases or franchise fees between holding and subsidiaries
3. Changes in valuation of foreign subsidiaries (either changes in equity valuation or appreciation/depreciation of real investment stock, or acquisition changes of local minority-owned subsidiaries (<10% owned)

In particular, the last two elements can result in negative flows and even stocks. Using the average data over 3 or 4 years solves part of this problem. However, since the PPML regressions cannot be performed over negative values, we set the remaining negative values equal to zero.

[17]These are the purchasing power parity conversion factors for GDP taken from the 2011 World Bank International Comparison Program (ICP).

3.2 Control variables for the gravity estimations

We then link the FDI database with country and regional identifiers (ISO-3 codes, country number codes and geographical identifiers) and we obtain additional control variables –to be used in the gravity regressions) from the CEPII database (Head et al., 2010). These include variables such as distance, contiguity, language, colonial past, and other dyadic variables (which we do not use so far in the regressions).

The CEPII database does not have information for small countries that are offshore financial hubs, mainly in the Caribbean and Europe (e.g. Anguilla, US Virgin Islands, Liechtenstein, Monaco, Isle of Man, Guernsey, Jersey). Therefore, we exclude these countries, and lose around four thousand observations, to have a final sample of around 76115 observations.

3.3 Policy variables

The main policy variable we analyse is the presence and depth of PTAs. Regarding the impact of free trade agreements, their depth and heterogeneity we use the DESTA database (Dür et al., 2014). We take care of the endogeneity of free trade agreements (see Egger et al., 2011; Yotov et al., 2016). Apart from the widely used DESTA database PTA depth index, we also use the most recent World Bank PTA depth database (Hofmann et al., 2017) to check the robustness of our results. Finally, we also use the recently updated version of Mario Larch's Regional Trade Agreements Database (Egger and Larch, 2008) for robustness analysis. In the following subsections, we describe both databases and other policy variables we employ in our analysis.

3.3.1 DESTA database

To obtain information on the presence of PTAs for country dyads and in their heterogeneity, we use the Design of Trade Agreements (DESTA) database (Dür et al., 2014). This database has systematically collected data on almost 790 agreements, which are then codified to identify PTAs and create a PTA depth index (according to the number of seven types of provisions present or not in the agreement). In this sense, the depth index has values between zero (no PTA) to seven (deep PTA, when all seven provisions are covered).[18]

The most recent database (March 2017) covers the time period between 1948 and 2016. Since many of the "base" agreements, are later modified (by accessions, withdrawals, amendments, consolidations, or are currently under negotiation) there are 6176 entries in the database.[19]

[18]Note that the DESTA depth indicator is a "count" indicator but not an accumulative indicator. Hence, any PTA with two provisions, no matter which, will have a depth index of two.

[19]Since this number refers to unique country pairs, then we have 12352 observations when we allow each observation to have its dual country-pair, i.e. DESTA orders each country pair by alphabetical order. So for example, a German-Dutch treaty will only appear as DEU-NLD in DESTA, but we also include its dual observation: NLD-DEU, so it can match are dual country dyads from the FDI database.

Some adjustments have been made to the original DESTA database. Most importantly, even though the PA was officially launched on April, 2011, established in 2012, but not until 2013 where tariff reductions negotiated. Furthermore, it is not until 2016 that there will be the first trade liberalisation process (i.e. 92% tariff reduction). In the DESTA database the treaty is recorded as entering entered into force in 2012 and is classified as having six of the seven treaty provisions (all except "competition"). We correct this by changing the treaty's entry year as 2016, instead of 2012.

A second major adjustment relates to the EU. DESTA incorrectly fails to consider the EU as a PTA, so for all EU member states we had to correct this. Every EU country-pair has a PTA with each other, and furthermore, we classify this PTA as a deep PTA (with value seven). Here we also account for the year of accession of new member states (2004 for ten new members states, and 2007 for Bulgaria and Romania). A third correction is that DESTA does not consider the EU-Central America Association Agreement to be implemented, but the "trade pillar" has been provisionally applied since the end of 2013 (differing by Central American country), so we take this PTA to be implemented since 2014.[20] Also the Central America PTA is already in effect since 1993, since the implementation of the "Protocolo al Tratado General de Integración Económica Centroamericana (Protocolo de Guatemala)".

When we link our bilateral FDI database to the DESTA database we account for the "entry-year": the year in which the agreement entered into force. So for country-pairs with FDI data, we can identify which agreement was in place, if any, for each of the 12 years in our sample period. Note that each country pair can have more than one treaty, and in some special cases, they can have two treaties implemented on the same year (in this last case, we take only the treaty with the highest depth index).

In addition, we also construct a dummy PTA variable using the information provided by DESTA. When the depth index is larger than zero and the PTA is implemented, we consider it to have an PTA. Otherwise we set PTA=0 (when there is no DESTA information, the depth index is zero or the treaty has not been implemented yet). Moreover, when there is no information on the depth index (e.g. because there was no match between a country-pair in the FDI database and the DESTA database) we assign the depth index a value of zero.

Finally, we also employ each of the seven components of the DESTA depth index, which are dummy variables that flag the presence of the following provisions in the FTA: $full_pta$, provisions on common (trade) standards, services trade provisions, competition provisions, provisions on public procurement, provisions on investment and provisions on intellectual property rights. Using individually each of these provisions we can isolate which component is more important to explain FDI inflows.

[20] The agreement consists of two other pillars: political dialogue and cooperation, which are not relevant for our purposes.

3.3.2 World Bank horizontal depth PTA database

Recently, the World Bank (Hofmann et al., 2017) compiled a database that includes 279 preferential trade agreements (PTAs) signed by 189 countries and reported to the WTO between 1958 and 2015. The database builds on the methodology developed by Horn et al. (2010) and it explicitly reports if each PTA includes any of up to 52 provisions on different policy areas and the legal enforceability of each provision. Thus, in total the database provides information over 104 variables (52 provisions and their legal enforceability).

Some of these provisions relate to policy areas that fall under the current mandate of the WTO –referred to as "WTO plus" or "WTO+" in the literature. This for instance includes topics related to anti-dumping measures, export taxes, customs regulations, technical barriers to trade (TBT) and sanitary and phytosanitary standards (SPS). It also reports provisions outside the WTO mandate (i.e. "WTO extra" or "WTO-X") which includes a wider range of policy areas, such as investment provisions and environmental standards.

This rich source of information allows the construction of different PTA depth indexes, based on the type of provision (WTO+, or WTO-X) or on the classification of "core" provisions, which is based on what the literature (e.g. Baldwin, 2008; Damuri, 2012)consider to be the more significant or "core" provisions from an economic point of view: all the WTO+ provisions, in addition to four WTO-X provisions (competition policy, investment, movement of capital, and intellectual property rights protection).

To account for the depth of a PTA we use four indexes, which are based on the three original indexes developed in Hofmann et al. (2017), plus an additional index.

- The first two indexes are the "total depth" indexes, which are the simple count of legally enforceable provisions included in a PTA (defined as *wb_tot_le*) and the simple count of the 52 provisions (*wb_tot_pr*). The first was originally included in Hofmann et al. (2017) and we construct the second index for robustness purposes.

- The "core depth" variable (*wb_core*), which follows and counts the total number of "core" provisions that are included and legally enforceable in a PTA.

- The "PCA depth" index (*wb_pca*) based on principal component analysis (PCA) to obtain an index for the variability in the data.

Finally, we also create a dummy variable (PTA_wb), with the value of one for those dyads where a FTA is present in the World Bank database.

3.3.3 Additional sources of policy indicators

As an alternative source of policy variables we also use the the following CEPII database indicators:

- "PTA_wto": taken from the WTO's Regional Trade Agreements Information System (RTA-IS), with data updated until 2015.
- "PTA_hmr": taken from Head et al. (2010) is an PTA dummy variable with available data until 2006.
- "PTA_bb": taken from Baier and Bergstrand (2007) and updated in 2009.[21] It takes four values: Free Trade Agreement (=1), Customs Union (=2), Common Market (=3) and Economic Union (=4). These data are available until 2005.
- GATT/WTO membership: is a dummy variable that distinguished if the origin of country ("gatt_o") or the destination country ("gatt_d") is a member of the GATT and/or WTO. We construct three dummy variables using these data: "gatt_b" is one if both countries are GATT/WTO members, "gatt1" is one if one of the two countries is a member and "gatt0" is equal to one if neither is a member.
- Common currency: indicates thee presence of currency unions taken by the dataset from de Sousa (2012).
- World Development Indicators (WDI) on the cost of doing business that has the following individual indicators:
  - Cost of business start-up procedures (as a percentage of GNI per capita) for both the origin ("entry_cost_o") and the destination ("entry_cost_d") country
  - Number of start-up procedures to register a business for country of origin ("entry_proc_o") and destination ("entry_proc_d").
  - Time (in days) required to start a business, also for country of origin ("entry_time_o") and destination ("entry_time_d").
  - Number of days plus procedures to start a business ("entry_tp_o" and "entry_tp_d").

As an alternative source of PTA data we also use Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008). This database distinguishes between different degrees of trade integration: partial scope agreements (PS), traditional PTAs, customs unions (CU) and economic integration agreements (EIA). There are also combinations of these variables (e.g. CU and EIA, PTA and EIA) and a composite indicator "RTA", which is equal to one if any one of PS, PTA, CU or EIA is in place, and zero otherwise.

Following Anderson et al. (2016) we also construct an indicator (dummy) variable for the existence of a bilateral investment treaties (BITs) from the original UNCTAD data on international investment agreements.[22]

[21] `http://www3.nd.edu/~jbergstr/DataEIA2009/EIA_Data_June30_2009.zip`.

[22] Taken from the International Investment Agreements Navigator: `investmentpolicyhub.unctad.org/IIA`.

We also use the FDI Regulatory Restrictiveness Index from the OECD.[23] This index measures statutory restrictions to foreign direct investment in 62 countries and it is available for following years: 1997, 2003, 2006, 2010-2016.

In addition, we employ the Worldwide Governance Indicators (2015 update) from Kaufmann et al. (2010). They constructed aggregate indicators of six broad dimensions of governance: i. voice and accountability; ii. political stability and absence of violence/terrorism; iii. government effectiveness; iv. regulatory quality; v. rule of law; and vi. control of corruption. These six aggregate indicators are based on 31 underlying data sources that report on the perceptions of governance using a large number of survey respondents and expert assessments worldwide. Finally, we also use the Fraser Institute Economic Freedom of the World (cf. Gwartney et al., 2014)

Finally, we also use data from the World Bank's World Development Indicators (WDI) database on human capital levels: the abour force with basic (lab_bas) and advanced (lab_adv) education as a percentage of the total working-age population. We also use the overall logistics performance index (where a value of one denotes low performance and five is high performance), which proxies for trade infrastructure on ports, airports, roads, customs and border crossing. To proxy for taxes paid by multinationals we use the WDI variable on taxes on income, profits and capital gains as a percentage of revenue.

4 FDI gravity results

In this section, we present the results of our three-step approach, which was explained in Section 2.4.

4.1 Main results

In our first step we estimate our preferred econometric specification from Equation 4. To estimate the PPML regressions we use Zylkin's STATA ado files (cf. Larch et al., 2017), which provide a much faster estimation than the normal STATA command. The results of our main estimating equation (4) are presented in Table 3. Here we observe that the DESTA depth index has a positive and significant effect on inward FDI stocks, while the PTA dummy variable (constructed using the DESTA database) is also positive and significant when using country-pair fixed effects (equation 4).

The regressions reported in Table 3 use the automatic three-way clustering option (by exporter-id, importer-id, and time-id), but the results are robust to different specification from the PPML command from Larch et al. (2017) –i.e. robust standard errors, clustered standard errors by country pairs and when it is assumed that the pair fixed effects apply symmetrically to flows in both directions. Given the high correlation between the PTA dummy and the PTA depth indicators, we do not regress them together.

[23] The methodology used to calculate the FDI Index is explained in Kalinova et al. (2010) and the data is taken from: `http://www.oecd.org/investment/fdiindex.htm`.

Table 3: Main FDI gravity regressions using 3-year average inward FDI stocks

	eq. 4: country-pair FE		**eq. 5: standard gravity**		
Variables:	(1)	(2)	(3)	(4)	(5)
FTA_depth	0.062***			0.290***	
	(0.018)			(0.017)	
FTA		0.323***			0.695***
		(0.070)			(0.098)
ln_DIST			-0.867***	-0.431***	-0.775***
			(0.076)	(0.063)	(0.074)
CNTG			0.882***	0.579***	0.691***
			(0.148)	(0.134)	(0.127)
LANG			1.476***	1.392***	1.462***
			(0.080)	(0.084)	(0.079)
CLNY			2.633***	2.619***	2.643***
			(0.089)	(0.088)	(0.086)
Observations	26,320	26,320	27,291	27,291	27,291
R-squared	1.000	1.000	0.997	0.998	0.997

Notes: Dependent variable: FDI inward stocks, using 3-year averages. PPML estimations. Columns 1 and 2 use automatic three-way clustering by exp-id, imp-id, and time-id. Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. Origin-country-time (μ_{it}), destination-country-time (μ_{jt}), and country-par (μ_{ij}) fixed effects are not reported. FTA and FTA_depth are taken from the DESTA database.
Source: Own estimations using UNCTAD bilateral FDI, DESTA and CEPII databases.

In columns (3) to (5) we give the results of a regression specification with the "standard" gravity variables, where ln_DIST is the log of the weighted distance indicator, $CNTG$ is the contiguity dummy (for countries that share a common border), $LANG$ is the common language dummy and $CLNY$ is the dummy that identifies a common coloniser post 1945.[24] In these specifications both the PTA depth and PTA dummy variables are also positive and significant, but with a much higher coefficient values. These last results suggests that not controlling for non-observable time-invariant factors (as done when we use the country-pair fixed effects in columns 1 and 2 of Table 3), over-estimates the impact of PTAs on FDI flows. Therefore, we work primarily with the country-pair fixed effect specification, which provides more accurate estimated coefficients of the impact of PTAs on inward FDI stocks.

The robustness of results with this baseline regression was tested by two variants that we show in the Appendix (Tables 9 and 10). In these tables, we use 4-year averages and the yearly FDI data, instead of the 3-year averages as in Table 3. Most

[24] As explained above all these standard gravity variables are taken from the CEPII gravity database. When we use "comleg" variables from the CEPII database (i.e. common legal origins before and after transition) also result in positive and significant coefficients when used together with the other bilateral time-invariant variables (results not presented).

of the coefficients retain similar values and significance levels, which lend robustness to our main results. In Table 11 in the Appendix we also present the baseline results using an alternative for our bilateral policy variable (PTA). Instead of the DESTA indicators, Table 11 uses the PTA indicators from the World Bank database. All PTA depth indicators are significant when we use the country-pair fixed effect specification and also when we use the standard gravity approach with additional explanatory variables. Hence, our baseline can be considered as very robust.

To facilitate the interpretation of the estimated regression parameters for the policy variables using the PTA depth indicators from DESTA, we translate them in a percentage effect on the dependent variable (inward FDI), using the following formula:

$$V = (exp^{\hat{\gamma}} - 1) * 100 \tag{6}$$

where V is the FDI effect (in percentages) of each individual indicator, with $\hat{\gamma}$ being the estimated coefficient by indicators. In Table 4 we present the result for the PTA depth indicator when different depth values are used. Recall that the DESTA database is ranked from one (shallow PTA) to seven (deepest PTA). For instance, the implementation of the deepest PTA is estimated to increase the bilateral inward FDI stock of the host country by approximately 54%, while a shallow PTA (with DESTa index of one) will only increase bilateral FDI by 6%. The average effect of the PTA, which is estimated using the PTA dummy variable, has an impact of 38% on bilateral FDI flows between the countries that signed the PTA.

Table 4: FTA impact on FDI by value of FTA depth indicator

variable	**estimated coefficient**	**significance levels**	**Number of observations**	**FDI effect (percentage)**
DESTA depth index				
depth=1	0.062	***	26,320	6.4
depth=2	0.124	***	26,320	13.2
depth=3	0.186	***	26,320	20.4
depth=4	0.248	***	26,320	28.1
depth=5	0.310	***	26,320	36.3
depth=6	0.372	***	26,320	45.1
depth=7	0.434	***	26,320	54.3

Notes: Values taken from Table 5. Source: Own estimations using UNCTAD bilateral FDI, DESTA and CEPII databases.

It should be kept in mind that we are conducting a "partial equilibrium" analysis here, were only the bilateral stocks change after a change in the bilateral policy variable. The multilateral resistance terms in the gravity model take into account each country's relative opportunity cost for FDI investing. However, a partial analysis cannot capture all knock-on welfare effects of more FDI via domestic consumption prices and production efficiency. For example, if a PTA (such as the Pacific Alliance) creates a more integrated market area (via deeper PTAs and FDI inflows) it may also attract more FDI from non-member countries. However, to analyse these additional effects, a "general equilibrium" analysis has to be conducted, which is beyond of the scope of this study.

4.2 Assessing the FDI impact of different policy variables

In our second-step we further analyse the impact of the policy time-varying indicators. For this purpose we run a set of PPML regressions using the country-pair fixed effects specification including an alternative set of policy indicators. First, we use the individual components of the DESTA PTA depth indicator: full_PTA, standards, services, competition, procurement, investment and intellectual property rights (see Section 3.3.1). Second, we use the trade policy indicators from the CEPII database (see Section 3.3.3). The simple variable correlations are presented in the Appendix (Table 12). It is interesting to observe that the correlation between the DESTA PTA dummy and depth indicators (PTA and PTA_depth, respectively) and the PTA indicators from the CEPII database are relatively low (around 0.6). The individual DESTA index components are highly correlated with the depth index (PTA_depth) but less with the dummy PTA. To analyse the impact of the investments provision in the DESTA database (D_inv) we also combine this variable with the PTA depth indicator (D_depth_inv) and the PTA WTO dummy (D_wto_inv).

In Table 5 we show the list of coefficients for each policy variable included individually when running equation 4 with 3-year inward FDI averages, including domestic stocks and domestic dummy variables set to one. We use again the formula from Equation 6 to obtain the expected FDI effects of each policy variable. From Table 5 we observe that of the DESTA depth index all provisions have significant and positive estimated coefficients, and all have very similar impacts, except for the public procurement provision (*D_proc*). It is important to note that the intellectual property provisions have the largest FDI impact (44.5%), which is higher than the investment provisions (35.5%). When all seven provisions are included (D_depth7) the effect increases to 47.6%. When we combine the investment provisions with the depth index (*D_depth_inv*) we also find that this has an additional 5% positive impact on FDI.

The impact of FTA_depth is not linear, i.e. increases in the PTA index do not seem to have a linear and continuous effect on FDI. From Table 4 we observe that the expected effect of a PTA with index 6 is 45% while the (D_depth6) is not significant when we isolate the PTAs with depth index 6 (D_depth6). This can be explained by the fact that most PTAs with depth 6 usually lack the procurement provision, which has the lowest impact. Table 5 also analyses the FDI impact of some PTA indicators. The only one that is significant is "PTA_wto" –the PTA indicator from the WTO's Regional Trade Agreements Information System. Two other alternative PTA indicators are "PTA_hmr" (the PTA dummy variable taken from Head et al., 2010) and "PTA_bb" (taken from Baier and Bergstrand, 2007). The former has the wrong sign (negative) and the latter is not found to be statistically significant. The possible explanation is that these indicators have only limited data available and/or

Table 5: FDI impact of different policy variables

variable	estimated coefficient	significance levels	Number of observations	FDI effect (percentage)
FTA_depth	0.062	***	26,320	n.a. \1
FTA	0.323	***	26,320	38.1
D_full	0.321	***	26,320	37.9
D_stds	0.306	***	26,320	35.8
D_inv	0.304	***	26,320	35.5
D_serv	0.285	***	26,320	33.0
D_proc	0.165	*	26,320	17.9
D_comp	0.292	***	26,320	33.9
D_ip	0.368	***	26,320	44.5
D_depth_inv	0.050	***	26,320	5.1
D_wto_inv	0.312	***	26,319	36.6
D_depth6	0.042		26,320	4.3
D_depth7	0.389	***	26,320	47.6
fta_wto	0.104	**	26,319	11.0
fta_bb	0.012		4,671	n.a. \1
fta_hmr	-0.165	**	11,048	-15.2
comcur	-0.156		26,320	-14.4
gatt_b	-0.380	**	26,320	-31.6
gatt1	0.347	**	26,320	41.5
gatt0	0.146		26,320	15.7

Notes: All coefficients are estimated using the main equation 4 with 3-year FDI averages, domestic flows and domestic dummies set to one (or zero in the case of the WDI entry barriers). \1 These indicators are not dummy variables and hence, the FDI effect depends on the specific variable value. Source: Own estimations using UNCTAD bilateral FDI, DESTA and CEPII databases.

use different methodologies from the more recent DESTA database. Moreover, having a common currency "comcur" does not have a significant impact on FDI flows, and membership of the GATT/WTO only has a positive and significant effect if only one of the countries is a member. Surprisingly, if both countries are members, the effect is negative, which could be explained by substitution effects between expected increased trade and FDI flows with the presence of mainly horizontal (market access) FDI.

We now turn to another bilateral policy variable, the impact of having a bilateral investment treaty (BIT). We find mixed evidence that this variable can explain bilateral FDI. When we use our main country-pair fixed effects specification, the BITs coefficient is positive and significant when using the 4-year FDI averages and the yearly data, but not when using our main 3-year FDI average specification. On the other hand, the coefficient is significant but negative for all specifications when using the standard gravity specification (see Table 6). The values and significance of the BITs coefficient is very similar when combining the BITs indicator with the FTA depth and the FTA dummy variables (not shown), but the FTA indicators have higher coefficients than the BITs indicator. These mixed results are common on the literature. Some studies, for example Bergstrand and Egger (2013) find a positive impact of BITs using the standard gravity specification, but did not use country-pair fixed effects to account for unobservable bilateral country determinants. On the other hand, Haftel (2010) argues that only BITs in force (i.e. mutually ratified) have a positive effect on FDI inflows, while those agreements that are not in force (only signed) do not have an effect.

Table 6: FDI gravity regressions using BITS for different econometric specifications and inward FDI stocks for 3-year and 4-year averages and yearly data

	3-year average		**4-year average**		**yearly data**	
variables	(1)	(2)	(3)	(4)	(5)	(6)
BITs	0.288	-1.523***	0.332***	-1.534***	0.271*	-1.489***
	(0.184)	(0.067)	(0.124)	(0.077)	(0.155)	(0.040)
ln_DIST		-0.848***		-0.837***		-0.838***
		(0.076)		(0.086)		(0.045)
CNTG		0.798***		0.837***		0.801***
		(0.149)		(0.172)		(0.089)
LANG		1.187***		1.153***		1.188***
		(0.083)		(0.095)		(0.049)
CLNY		2.590***		2.605***		2.604***
		(0.094)		(0.108)		(0.055)
Observations	26,320	27,291	19,526	20,349	75,248	77,512
R-squared	1.000	0.997	1.000	0.997	1.000	0.997

Notes: Dependent variable: FDI inward stocks. PPML estimations using automatic three-way clustering by exp-id, imp-id, and time-id for the country-pair fixed effects. Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. Origin-country-time (μ_{it}) and destination-country-time (μ_{jt}) fixed effects are not reported. BITs data are taken from UNCTAD. Source: Own estimations using UNCTAD bilateral FDI, DESTA and CEPII databases.

Another possible explanation for these results is that BITs are by construction different from FTA agreements and they also signal country specific FDI investment risks. BITs are set to guarantee private investments from one country into another country by means of different instruments, such as protection from expropriation, free transfer of means, fair and equitable treatment, foreign investors fair and equitable, non-discriminatory, most-favoured-nation and national treatment, and sometimes the use of investor-state dispute settlement (ISDS) mechanisms (cf. UNCTAD, 2007). In this regard, a core objective of BITs is to reduce the investment risks of FDI by establishing transparency about what those risks are in a particular country (Bergstrand and Egger, 2013). Thus, BITs are more likely to be established when countries want to protect firms that want to investment in other countries deemed to be considered risky; and not much to protect North-North investment, for which the national legal system is usually provides enough protection to foreigners. For example, the US had BIT agreements with many Eastern European countries before their EU accession, but do not have BITs with their main trading partners (e.g. old EU members, Canada, China, Japan and Mexico.) Under these circumstances, the BITs indicator may be signalling country-specific investment risks that are picked up by the country-pair fixed effects (where the coefficients are positive and significant), but not in the standard gravity specification, where the coefficient becomes negative and the impact of signing a BIT agreement does include the investment risks.

4.3 Inward FDI multilateral resistances

In our final step, we obtain the inward multilateral trade resistances (MRs) coefficients that are associated with the PA countries as FDI destination countries. The inward MR terms are taken from the trade sub-model of the structural gravity system. They capture each destination country's relative inward trade obstacles, because the latter reduce the bilateral FDI flows. Appendix B describes the coherence of the structural FDI and trade sub-models of the Anderson et al. (2016, 2017) structural gravity system. The annual inward MRs provide a direct answer to our first research question, by analysing how FDI investment flows to specific-countries, once controlling for country-specific variables that change over time (i.e. bilateral trade costs, GDP and income per capita) and FTAs. Moreover, the inward MR also include the effects of trade obstacles that are invariant over time, like distance, contiguity, shared language and history. Therefore, a higher inward MR in the PA countries (here interpreted as destination countries j for FDI) implies that they will have less imports, higher prices, lower real income, and hence lower E_j and lower Y_j. This is a already a sufficient condition for them to have less FDI absorption capacity, even if we disregard their explicit FDI barriers $\omega_{ij,t}$.

In Table 7 we show the inward MRs for the PA countries and some selected countries to compare with. We also estimate the effects of these coefficients on the expected effects on FDI using the formula from Equation 6.

We can obtain several conclusions from this table. First, in general the inward MRs have been decreasing in the (unweighted) full sample (global) average, from an FDI impact of around 14% at the beginning of the 2000s to around 10% in 2010-2012. This decreasing trend has been, in general, more pronounced for most Latin American countries, with the exception of Peru, Panama and Uruguay. In particular, some countries have experienced very substantial decreases in the inward MRs (i.e. Bolivia, Brazil, Costa Rica, Ecuador and Paraguay). These countries were above the global inward MR averages in 2000-2003, but below this average in 2010-2012. On the other hand, in rich OECD countries (e.g. USA) and China, the inward MRs have been increasing over time.[25]

Second, the Pacific Alliance countries have relatively high inward MRs that are above the global average during the full sample period, even though they MR terms

[25]The data with the full sample of countries is available upon request.

Table 7: Pacific Alliance and selected countries, inward multilateral resistance (MR) terms

	Inward MRs				FDI effects (%)	FDI effects (%)
Host country	**2001-2003**	**2004-2006**	**2007-2009**	**2010-2012**	**in 2001-2003**	**in 2010-2012**
Chile	0.139	0.134	0.119	0.106	14.9	11.2
Colombia	0.128	0.126	0.094	0.102	13.6	10.7
Mexico	0.174	0.179	0.149	0.112	19.0	11.8
Peru	0.120	0.141	0.136	0.125	12.8	13.3
Argentina	0.163	0.174	0.161	0.133	17.7	14.2
Bolivia	0.164	0.118	0.091	0.064	17.8	6.6
Brazil	0.192	0.204	0.167	0.086	21.1	8.9
Costa Rica	0.136	0.172	0.111	0.061	14.6	6.3
Ecuador	0.103	0.127	0.094	0.064	10.9	6.6
Panama	0.110	0.172	0.128	0.119	11.6	12.6
Paraguay	0.166	0.179	0.095	0.063	18.1	6.5
Uruguay	0.072	0.109	0.124	0.127	7.5	13.5
Venezuela	0.140	0.154	0.106	0.090	15.1	9.4
China	0.092	0.128	0.155	0.165	9.6	18.0
USA	0.143	0.178	0.179	0.162	15.4	17.6
Sample mean	0.129	0.119	0.105	0.094	13.8	9.9

Notes: Taken from the country-pair fixed effect specification using 3-year FDI averages (results in column 1 in Table 3). Source: Own estimations using UNCTAD bilateral FDI, DESTA and CEPII databases.

were decreasing over the period. The exception is Peru where the inward MRs have increased over time and are in the period 2010-2012 the highest among PA countries (13.3% effect on FDI). The other three PA countries have inward MRs that reduce FDI inflows by around 11%, which is still above the global average.

The inward MRs values are very similar when using the PTA dummy instead of the PTA depth indicator (as in Table 7), however, the inward MRs values significantly increase when using the standard gravity specification (columns 3 to 5 in Table 3, which reflects the importance of the unobserved FDI costs that are captured by the country-pair fixed effects.[26]

For explaining the MRs and their relation with the PA countries, we employ the following indicators, which can be considered to be FDI determinants:

- The World Development Indicators (WDI) on the cost of doing business. We use here only the indicators for the destination countries.
- The OECD's FDI Regulatory Restrictiveness Index. It is available for all OECD countries and some additional selected countries (included Colombia

[26]Results not shown but are available upon request.

and Peru). It has data for 1997, 2003 and 2006, and uninterrupted annual data from 2010-2015.[27]

- The Worldwide Governance Indicators (WGI). We use five of the six indicators (we only exclude "voice and accountability") and we take the yearly estimate for each indicator.
- Fraser Institute Economic Freedom of the World (EFW) index. Here we take the summary index for each relevant year.
- The World Bank's World Development Indicators (WDI) database on the following variables:
    1. Human capital levels proxied by the labour force with basic (lab_bas) and advanced (lab_adv) education
    2. The overall logistics performance index
    3. Taxes on income, profits and capital gains as a percentage of revenue.

We then run simple OLS regressions using the estimated inward multilateral resistance terms from our main gravity specification (i.e. column 1 in Table 3). However, most of these variables are highly correlated with each other –in particular the WGI and the EFW variables. So we cannot combine them in a single regression. A summary of these regressions is presented in Table 8. We find that the FDI regulatory restrictiveness index (FDI_restr) has a positive and significant impact on the inward MR terms, as expected. More FDI regulatory restrictions will reduce the inward resistance to FDI inflows. We find the same result for the four WDI entry costs (number of procedures and/or days to start a business). However, the governance variables and the EPW index all have a positive and significant impact on the inward MRs, which means that more political stability, government effectiveness, regulatory quality, rule of law, control of corruption and larger economic freedom is related to higher resistance to inward FDI stocks. This result is counterintuitive, and is probably related to the latest trend of increased inward MR terms in rich OECD countries, which usually have the highest values for the WGI and EPW indices.[28]

When we use the additional potential FDI determinants from the WDI database, we also find that some of these indicators have a counterintuitive coefficient value: the more workers with a basic and advanced education (as a percentage of the total workforce) and the better the logistics performance of the country, the higher the inward MR terms. A potential problem with these indicators is that the coverage is less complete (i.e. much fewer number of observations than the other indicators) and skewed toward OECD countries that have better statistics. Hence, these indicators

[27] To fit these data with our 3-year average data, we take the index for 2010 as our value for 2009. The FDI restrictiveness indicator is available by industry group (agriculture, manufacturing and services) but we only use the total economy indicators.

[28] We find the same results when we standardised these indexes –i.e. when they have been rescaled to have a mean of zero and a standard deviation of one.

can also be biased by the latest trend of increased inward FDI resistance in OECD countries. On the other hand, the coefficient on the taxes on income and profits has a positive and significant coefficient, which is as expected: higher taxes that can be levied over business operations from multinationals are associated with higher inward MR terms.[29]

Table 8: OLS regression results for individual determinants of inward multilateral resistance terms

variable	**estimated coefficient**	**significance levels**	**Number of observations**	**R-squared**
FDI_restr	0.683	***	14,104	0.459
entry_cost_d	0.001	***	21,351	0.075
entry_proc_d	0.014	***	21,351	0.702
entry_time_d	0.002	***	21,351	0.325
entry_tp_d	0.002	***	21,351	0.401
Political stability	0.033	***	27,056	0.037
Government effectiveness	0.063	***	27,050	0.194
Regulatory quality	0.071	***	27,050	0.225
Rule of law	0.051	***	27,057	0.121
Control corruption	0.043	***	27,050	0.099
EFW index	0.020	***	21,708	0.884
Advanced education	0.002	***	13,278	0.930
Basic education	0.003	***	13,269	0.799
Overall logistics index	0.038	***	6,712	0.918
Taxes on income & profits	0.004	***	21,586	0.716

Notes: The dependent variable is the estimated inward MRs from Table 3 using 3-year FDI averages. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. Source: Own estimations using UNCTAD bilateral FDI, DESTA, the WDI data on the cost of doing business, the OECD's FDI Regulatory Restrictiveness Index (*FDI_restr*), the Worldwide Governance Indicators and the Fraser Institute Economic Freedom of the World (EFW) index.

When we run the same regressions but using only a Latin America sub-sample, we find that the WGI governance quality indicator have all a negative coefficient (see Table 13 in the Appendix). Thus, better governance in these countries is associated with lower inward MRs. However, the economic freedom index, the human capital and logistics index are still positive and significant. In the case of the human capital and logistics indicators the coverage is very limited for Latin American countries.

[29]However, it is important to recall that many multinationals operate on special export processing zones and/or other special regimes that exonerate foreign companies from paying corporate taxes or provide deductions with respect to the rates paid by national companies.

Nevertheless, these remaining counterintuitive results for the Latin America subsample warrant some further research, which is beyond the scope of this study.

5 Sensitivity estimations

To analyse the robustness of our results to different specification, we run a series of additional sensitivity tests, which are explained below. Note however, that we already ran our main econometric specification using different yearly averages for inward FDI (3- and 4-year averages) and also using the yearly data, and in addition, we employed different specifications in the PPML regressions: using the automatic three-way clustering option, robust standard errors, clustered standard errors by country pairs and assuming symmetry in the pair fixed effects.

5.1 Excluding domestic stocks

We estimate our main specifications excluding the "domestic inward" stocks taken as the country's capital stock data. In Table 14 in the Appendix we present the results. As expected, we find that the coefficients from the standard gravity equations are significantly different from those obtained when we control for the domestic investment stocks. For instance, the impact of the PTA depth indicator is still significant but substantially smaller –by a factor of 10– than before and the PTA dummy indicator is not non-significant and even negative. Moreover, the coefficients for the standard gravity variables (distance, contiguity, language and colony) are smaller as well. This highlights the importance of controlling for domestic capital stocks in the gravity estimations as explained in the best-practices taken from Yotov et al. (2016). In particular, using domestic capital stocks we can control for the effects of non-discriminatory trade policy, consistent identify the effects of PTAs and other bilateral trade policies and to obtain a bias-free estimation of the effects of PTAs on FDI inward stocks.

5.2 Using FDI flow data instead of stock data

The UNCTAD Bilateral FDI database also provides data on FDI inflows and outflows. In addition, we employ the World Bank's WDI data on gross fixed capital formation (GFKF) to account for the domestic investment flows. We then use these FDI inflow data in our main econometric specification using 3-year average FDI inflows and country-pair fixed effects. The results are shown in Table 15 in the Appendix. We find that the coefficients for the PTA depth and dummy indicators are still significant and positive, but with lower coefficient values and statistical significance. But in general the results are very similar and convey the same message that implementing an PTA increases bilateral FDI inflows. Moreover, when we exclude the domestic investment flows, we find again that the econometric results are substantially changed –i.e. now the PTA depth indicator is negative and not significant– which reinforces the importance of including domestic flows or stocks in the econometric specification.

5.3 Alternative PTA dummy variables

We use alternative PTA dummy information from Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008). His database distinguishes between different degrees of trade integration: partial scope agreements (PS), traditional PTAs, customs unions (CU) and economic integration agreements (EIA). In Table 16 in the Appendix we summarise our results using these indicators when we use our main econometric specification (i.e. 3-year average FDI inward stocks using country-pair fixed effects). There we find confirmation of our main results that using a dummy for the presence of some kind of trade agreement ("RTA" in Table 16) has a positive and significant effect on FDI inflows, with a coefficient value of 0.313 that is very similar to our PTA-dummy coefficient value (0.323). In addition, using these indicators we also find that deeper integration ("CU & EIA") has the largest effect on FDI (129%), which is a combination of the large impacts of being inside a customs union (119%) and economic integration agreement (48%). However, we also find that traditional shallow trade agreements (PTA) do not have a statistically significant impact.[30] This also reinforces our findings that the depth of the trade agreements is crucial to explain the FDI impact, and provides more accurate information than just using dummy variables for the presence of an PTA.

5.4 Using lead and lagged variables

We can also run sensitivity analysis using lagged and lead values for our PTA indicators for the yearly data. The intuition is that the specific impact of an PTA can happen some years before or after the agreement enters into force. Thus, we run our main specification using country-pair fixed effects with the yearly data using one to three lags and one to three leads (forward in time). We find that signing a PTA has an effect on FDI flows already three years before and up-to three years after. In particular, all our lagged and lead variables yield a positive and significant coefficient for the PTA depth variable (see Table 16 in the Appendix). We obtain the same results when we use the PTA dummy variable. The effects are of a similar magnitude but slightly higher one year before (L1) and one year after (F1) the PTA has been implemented. This suggests both an anticipatory effect on multinationals to establish its presence in the country beforehand, but also after the trade agreement has been signed. In the case of the Pacific Alliance, which entered into force in 2016, then we expect that already in 2013 the FDI inflows where being positively affected by the agreement and will continue to have a positive impact at least until 2019.

[30] This could signal that shallow agreements, which only partially tackle tariff reductions and seldom have trade facilitation and behind-the-border measures that reduce NTBs are not enough to encourage multinationals to invest in the country.

6 Summary and policy implications

We now summarise our main results and their policy relevance and potential implications. First, we found that implementing a PTA has a positive effect on FDI inflows and inward stocks, even when the main purpose of such agreements is to increase bilateral trade between the signing partners. More recent deep trade agreements –that include investments, public procurement and intellectual property rights provisions– are also expected to have a larger positive impact on both trade and FDI flows. In this respect, we find that the deeper the PTA the larger the expected bilateral FDI effects. This answers our second research question

This means that the signing of a PTA such as the Pacific Alliance trade agreement (with a DESTA index of six) is expected to have a positive effect on the bilateral FDI between the four partners. Using our empirical methodology, we estimate that bilateral FDI flows between Chile, Colombia, Mexico and Peru will increase by approximately 45% or almost double in the following years. This will be particularly important for Peru and especially Colombia, which have a large share of FDI coming from other PA countries. In the period 2010-2012, 63% of all inward FDI stocks in Colombia came from within the PA, while the same figure is of 39% for Peru. The PA initiative was launched back in 2011, established in 2012, but not until 2013 where tariff reductions negotiated, and they only came into effect in 2016 (which is also the year that the agreement was officially notified as a PTA in the WTO). However, we find that PTA agreements have an effect up to three years before the official entry into force of the agreement and also up to three years after the implementation.

In addition, we find that the potential impact of the PA agreement is substantial, with almost a doubling of the intra-PA FDI inward stocks with respect to the values reported in 2012, the latest period with available data. In this respect, our gravity estimation methodology allows use to estimate expected FDI shock by looking to the past experience for similar PTA treaties in the past. For this we rely on the DESTA database (updated in the spring of 2017) to distinguish preferential trade agreements by design, active mechanisms, and depth. Our results, moreover, are robust to different specifications. For instance, using FDI inflows instead of FDI inward stock and employing different PTA databases that have been originally compiled by CEPII, Egger and Larch (2008), and more recently the World Bank (Hofmann et al., 2017).

Using the inward multilateral resistance terms from our gravity estimations we do find that direct investment flows between Pacific Alliance members fall short of what could be expected on the basis of comparable economic factors in other countries. Once we account for the bilateral distance to trading partners, the presence of a border, of a common language or of a common coloniser, plus the existence of current PTAs, we find that the four PA members have higher inward resistance to FDI flows than the global sample and even, with respect to many Latin American countries, where the trend has been of a sharp decrease on inward FDI resistance. Nevertheless, we find only relatively small decreases in the PA members, and in Peru these inward resistances have even increased. On the other hand, the trend in richer OECD countries and China has been of a rise on the inward FDI resistances, which can signal a shift on the speed of globalisation that could also be related to the global trade slowdown (cf. Hoekman, 2015)

Analysing possible FDI determinants that can be related to these inward FDI resistance terms, we find that restrictive FDI regulations (using the Regulatory Restrictiveness Index from the OECD), the cost –in terms of number of procedures and number of days– of starting new businesses (using the World Banks' WDI indicators) and the national level of taxes on income, profit and capital gains (taken also from the WDI database) are strongly correlated to the inward resistance terms. Moreover, when analysing the Latin America as a region, we also find the general indicators of governance –i.e. political stability and absence of violence and terrorism, government effectiveness, regulatory quality, rule of law and control of corruption are indeed strongly related to the inward FDI resistances. On the other hand, higher economic liberalisation (taken from the Fraser Institute Economic Freedom of the World index) can increase these inward FDI resistance terms, but more research is needed to fully comprehend these mechanisms, and those of human capital levels and infrastructure and logistics performances.

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A Additional tables

Table 9: Main FDI gravity regressions using 4-year average inward FDI stocks

	eq. 4: country-pair FE		**eq. 5: standard gravity**		
variables	(1)	(2)	(3)	(4)	(5)
FTA_depth	0.034**			0.284***	
	(0.017)			(0.019)	
FTA		0.266***			0.742***
		(0.094)			(0.112)
ln_DIST			-0.859***	-0.432***	-0.764***
			(0.086)	(0.071)	(0.084)
CNTG			0.912***	0.599***	0.699***
			(0.171)	(0.154)	(0.145)
LANG			1.462***	1.408***	1.451***
			(0.092)	(0.096)	(0.091)
CLNY			2.640***	2.627***	2.651***
			(0.103)	(0.102)	(0.099)
Observations	19,526	19,526	20,349	20,349	20,349
R-squared	1.000	1.000	0.997	0.998	0.997

Notes: Dependent variable: FDI inward stocks, using 4-year averages. PPML estimations. Columns 1-2 use automatic three-way clustering by exp-id, imp-id, and time-id, other columns use robust standard errors. All SE reported in parentheses: *** p<0.01, ** p<0.05, * p<0.1. Origin-country-time (μ_{it}), destination-country-time (μ_{jt}) and country-pair (μ_{ij}) fixed effects are not reported. FTA and FTA_depth are taken from the DESTA database. Source: Own estimations using UNCTAD bilateral FDI, DESTA and CEPII databases.

Table 10: FDI gravity regressions using yearly FDI inward stock data

	eq. 4: country-pair FE		**eq. 5: standard gravity**		
variables	(1)	(2)	(3)	(4)	(5)
FTA_depth	0.058**			0.288***	
	(0.026)			(0.010)	
FTA		0.300***			0.725***
		(0.084)			(0.058)
ln_DIST			-0.853***	-0.417***	-0.756***
			(0.045)	(0.037)	(0.044)
CNTG			0.895***	0.578***	0.691***
			(0.088)	(0.079)	(0.075)
LANG			1.463***	1.391***	1.450***
			(0.047)	(0.050)	(0.047)
CLNY			2.645***	2.630***	2.656***
			(0.053)	(0.052)	(0.051)
Observations	75,248	75,248	77,512	77,512	77,512
R-squared	1.000	1.000	0.997	0.998	0.997

Notes: Dependent variable: yearly FDI inward stocks. PPML estimations. Columns 1-2 use automatic three-way clustering by exp-id, imp-id, and time-id, other columns use robust standard errors. All SE reported in parentheses: *** p<0.01, ** p<0.05, * p<0.1. Origin-country-time (μ_{it}), destination-country-time (μ_{jt}) and country-pair (μ_{ij}) fixed effects are not reported. FTA and FTA_depth are taken from the DESTA database. Source: Own estimations using UNCTAD bilateral FDI, DESTA and CEPII databases.

Table 11: Main FDI gravity regressions using 3-year average inward FDI stocks and FTA indicators the World Bank database

	eq. 4: country-pair FE					eq. 5: standard gravity				
Variables:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FTA_wb	0.398***					0.880***				
	(0.083)					(0.098)				
wb_tot_le		0.030***					0.066***			
		(0.008)					(0.003)			
wb_tot_pr			0.026***					0.054***		
			(0.007)					(0.002)		
wb_core				0.033***					0.095***	
				(0.008)					(0.007)	
wb_pca					0.163***					0.388***
					(0.040)					(0.021)
ln_DIST						-0.755***	-0.167***	-0.302***	-0.538***	-0.373***
						(0.073)	(0.061)	(0.062)	(0.067)	(0.062)
CNTG						0.624***	0.524***	0.671***	0.569***	0.593***
						(0.125)	(0.137)	(0.137)	(0.133)	(0.133)
LANG						1.464***	1.437***	1.366***	1.409***	1.460***
						(0.079)	(0.083)	(0.083)	(0.081)	(0.079)
CLNY						2.610***	1.800***	1.981***	2.607***	2.341***
						(0.086)	(0.075)	(0.074)	(0.085)	(0.074)
Observations	26,320	26,320	26,320	26,320	26,320	27,291	27,291	27,291	27,291	27,291
R-squared	1.000	1.000	1.000	1.000	1.000	0.997	0.998	0.998	0.998	0.998

Notes: Dependent variable: FDI inward stocks, using 3-year averages. PPML estimations. Columns 1 to 5 use automatic three-way clustering by exp-id, imp-id, and time-id. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. Host-country-time (μ_{it}) and origin-country-time (μ_{jt}) fixed effects are not reported. The $FTA_w b$ dummy and the FTA depth indicators ($wb_t ot_l e$, $wb_t ot_p r$, $wb_c ore$, and $wb_p ca$) are estimated using the World Bank database (Hofman et al. 2017). Source: Own estimations using UNCTAD bilateral FDI, World Bank FTA depth and CEPII databases.

Table 12: Correlations of policy variables

	l i_ave3	FTA	FTA_de h	D_full	D_stds	D_inv	D_serv	D_proc	D_comp	D_ip	D_dept v	D_wto_ v	D_main	D_depth6	D_depth7	fta_wto	fta_bb	fta_hmr	gatt_o	gatt_d	gatt_b	gatt1	gatt0	comcur	bits
ln_fdi_ave3	1																								
FTA	0.2563	1																							
FTA_depth	0.3929	0.8089	1																						
D_full	0.3068	0.8654	0.8717	1																					
D_stds	0.2565	0.9457	0.8095	0.7998	1																				
D_inv	0.3779	0.601	0.8938	0.6846	0.5831	1																			
D_serv	0.3699	0.6873	0.9356	0.7784	0.6731	0.8446	1																		
D_proc	0.3795	0.5974	0.896	0.6747	0.6318	0.7842	0.8425	1																	
D_comp	0.3546	0.6461	0.9093	0.7344	0.6317	0.8569	0.892	0.7988	1																
D_ip	0.4069	0.5603	0.8637	0.6459	0.591	0.8202	0.7642	0.8521	0.7275	1															
D_depth_inv	0.4008	0.5918	0.9104	0.6773	0.5936	0.9846	0.8457	0.8395	0.8651	0.8788	1														
D_wto_inv	0.1813	0.4459	0.6571	0.5117	0.4289	0.7419	0.6274	0.5569	0.6419	0.5852	0.7244	1													
D_main	0.4007	0.526	0.8573	0.6078	0.5562	0.8752	0.7637	0.8506	0.7768	0.9389	0.9372	0.6278	1												
D_depth6	0.0302	0.1357	0.1818	0.1568	0.1435	0.2072	0.1974	0.1836	0.133	0.0998	0.1853	0.1212	0.0891	1											
D_depth7	0.407	0.5105	0.8423	0.5899	0.5398	0.8493	0.7427	0.8544	0.79	0.9111	0.9199	0.6091	0.9704	-0.0446	1										
fta_wto	0.1241	0.6297	0.5691	0.6931	0.5738	0.3903	0.5147	0.4269	0.4732	0.3775	0.3799	0.6186	0.3259	0.0654	0.3162	1									
fta_bb	0.1827	0.5313	0.5684	0.5953	0.4946	0.477	0.519	0.4302	0.5183	0.4492	0.4741	0.6826	0.4203	-0.0073	0.4252	0.7648	1								
fta_hmr	0.1194	0.6062	0.5668	0.664	0.5821	0.3914	0.5161	0.4301	0.4788	0.3758	0.379	0.612	0.3206	0.0655	0.3114	0.9535	0.7739	1							
gatt_o	0.0414	0.0987	0.092	0.068	0.1078	0.0739	0.0925	0.0725	0.0891	0.0577	0.0649	0.1176	0.0433	0.0389	0.0366	0.0952	0.1179	0.1087	1						
gatt_d	0.0542	0.1676	0.1682	0.1494	0.1719	0.1381	0.1643	0.1385	0.1512	0.1152	0.1322	0.1507	0.1081	0.0265	0.1074	0.1343	0.1453	0.1515	0.0014	1					
gatt_b	0.0672	0.2138	0.1984	0.182	0.2176	0.1574	0.1894	0.1568	0.1775	0.128	0.1466	0.1972	0.1131	0.0461	0.1082	0.19	0.2067	0.2132	0.6191	0.74	1				
gatt1	-0.0603	-0.2209	-0.1938	-0.1943	-0.2182	-0.149	-0.1783	-0.1486	-0.1679	-0.1207	-0.1388	-0.1873	-0.1069	-0.0428	-0.1026	-0.2033	-0.211	-0.2259	-0.5177	-0.6607	-0.9528	1			
gatt0	-0.0276	0.0055	-0.0307	0.0248	-0.0158	-0.0395	-0.0507	-0.039	-0.0454	-0.0339	-0.0369	-0.048	-0.0291	-0.0146	-0.0268	0.0271	-0.0029	0.0237	-0.3752	-0.3139	-0.2323	-0.0739	1		
comcur	0.1791	0.2013	0.2991	0.235	0.2138	0.2786	0.2674	0.2804	0.286	0.3013	0.3034	0.3529	0.3229	-0.0195	0.3337	0.2537	0.5691	0.2594	0.0355	0.064	0.0721	-0.0664	-0.024	1	
bits	-0.0765	0.0196	-0.043	0.0215	0.0017	-0.0776	-0.0491	-0.0646	-0.0417	-0.0771	-0.0828	0.0037	-0.0931	0.0232	-0.0865	0.0913	-0.0222	0.087	0.0662	-0.0607	0.0043	-0.0111	0.0214	-0.1166	1

Source: UNCTAD bilateral FDI, DESTA and CEPII databases.

Table 13: Latin America sub-sample, OLS regression results for individual determinants of inward multilateral resistance terms

variable	estimated coefficient	significance levels	Number of observations	R-squared
FDI_restr	0.958	***	1,315	0.646
entry_cost_d	0.002	***	2,327	0.333
entry_proc_d	0.010	***	2,327	0.837
entry_time_d	0.001	***	2,327	0.575
entry_tp_d	0.001	***	2,327	0.627
Political stability	-0.076	***	2,779	0.166
Government effectiviness	-0.030	***	2,779	0.017
Regulatory quality	-0.001		2,779	0.000
Rule of law	-0.080	***	2,779	0.237
Control corruption	-0.049	***	2,779	0.070
EFW index	0.018	***	2,779	0.880

Notes: Includes only Latin American countries, excluding all Caribbean countries but the Dominican Republic. The dependent variable is the estimated inward MRs from Table 3 using 3-year FDI averages. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. Source: Own estimations using UNCTAD bilateral FDI, DESTA, the WDI data on the cost of doing business, the OECD's FDI Regulatory Restrictiveness Index (FDI_restr), the Worldwide Governance Indicators and the Fraser Institute Economic Freedom of the World (EFW) index.

Table 14: Main FDI gravity regressions using 3-year average inward FDI stocks, excluding domestic investment stocks

	eq. 4: country-pair FE		**eq. 5: standard gravity**		
variables	(1)	(2)	(3)	(4)	(5)
FTA_depth	0.006**			0.041***	
	(0.003)			(0.013)	
FTA		-0.025			0.653***
		(0.041)			(0.083)
ln_DIST			-0.548***	-0.483***	-0.386***
			(0.037)	(0.047)	(0.043)
CNTG			0.573***	0.536***	0.469***
			(0.092)	(0.091)	(0.081)
LANG			0.498***	0.522***	0.527***
			(0.082)	(0.083)	(0.086)
CLNY			1.821***	1.792***	1.853***
			(0.249)	(0.233)	(0.212)
Observations	25,567	25,567	26,488	26,488	26,488
R-squared	0.987	0.987	0.675	0.677	0.700

Notes: Dependent variable: FDI inward stocks, using 3-year averages. PPML estimations. Columns 1-2 use automatic three-way clustering by exp-id, imp-id, and time-id, other columns use robust standard errors. All SE reported in parentheses: *** p<0.01, ** p<0.05, * p<0.1. Origin-country-time (μ_{it}), destination-country-time (μ_{jt}) and country-pair (μ_{ij}) fixed effects are not reported. FTA and FTA_depth are taken from the DESTA database. Source: Own estimations using UNCTAD bilateral FDI, DESTA and CEPII databases.

Table 15: FDI gravity regressions using 3-year average FDI inflows

	eq. 4: country-pair FE		**eq. 5: standard gravity**		
variables	(1)	(2)	(3)	(4)	(5)
FTA_depth	0.039*			0.203***	
	(0.022)			(0.057)	
FTA		0.187**			0.687**
		(0.088)			(0.282)
ln_DIST			-0.533***	-0.250	-0.427**
			(0.164)	(0.162)	(0.166)
CNTG			1.028**	0.826**	0.880**
			(0.416)	(0.369)	(0.358)
LANG			0.898***	0.846***	0.867***
			(0.233)	(0.226)	(0.223)
CLNY			3.106***	3.124***	3.147***
			(0.257)	(0.236)	(0.232)
Observations	20,069	20,069	26,436	26,436	26,436
R-squared	1.000	1.000	0.997	0.998	0.998

Notes: Dependent variable: FDI inflows, using 3-year averages. PPML estimations. Columns 1-2 use automatic three-way clustering by exp-id, imp-id, and time-id, other columns use robust standard errors. All SE reported in parentheses: *** p<0.01, ** p<0.05, * p<0.1. Origin-country-time (μ_{it}), destination-country-time (μ_{jt}) and country-pair (μ_{ij}) fixed effects are not reported. FTA and FTA_depth are taken from the DESTA database. Source: Own estimations using UNCTAD bilateral FDI, DESTA CEPII and WDI databases.

Table 16: FDI impact of alternative policy variables and different lags and leads in yearly data

	estimated coefficient	significance levels	Number of observations	FDI effect (percentage)
Larch's indicators				
Customs Union (CU)	0.786	***	26,320	119.5
Free trade agreement (FTA)	0.115		26,320	12.2
Economic Integration Agreement (EIA)	0.394	***	26,320	48.3
Partial scope agreement (PS)	0.374	***	26,320	45.4
CU & EIA	0.829	***	26,320	129.1
FTA & EIA	0.158		26,320	17.1
RTA \2	0.313	***	26,320	36.8
Lagged (L) and forward (F) FTA_depth				
FTA_depth_L1	0.055	**	69,187	5.6
FTA_depth_L2	0.049	**	63,123	5.1
FTA_depth_L3	0.046	***	56,986	4.7
FTA_depth_F1	0.053	***	67,092	5.4
FTA_depth_F2	0.051	***	58,601	5.3
FTA_depth_F3	0.039	***	49,232	4.0

Notes: Yearly lags on the FTA_depth indicator are denoted by (L1, L2 and L3) for one, two and three-years respectively. Accordingly, yearly leads (forward) are denoted by F1, F2 and F3. \2 RTA=1 if any one of CU, FTA, EIA or PS is in place, and 0 otherwise. All policy coefficients are estimated using the main equation 4 with 3-year FDI averages, domestic flows and domestic dummies set to one (or zero in the case of the WDI entry barriers). All the lags and leads coefficients are estimated in the same manner but using yearly data. Source: Own estimations using UNCTAD bilateral FDI and BIts databases and Larch's Regional Trade Agreements Database.

B The relation between the structural gravity sub-models for trade and FDI

The gravity model for FDI is analogous to the gravity trade model, but not the same. The gravity trade model is developed by Anderson and van Wincoop (2003) who were the first to introduce the so-called multilateral resistance (MR) terms. The MR terms express in fact that world trade is a closed system, and that trade costs in one country have an impact in all other countries, whatever small this impact may be. The same holds for shocks in the economic size of a particular country: it changes the relative trade (dis)advantages in all countries. The MR terms are sophisticated interaction terms that can be interpreted as the relative inward (outward) trade costs, relative to all other countries, and given the size distribution of countries. The structural gravity system for bilateral trade can be summarised in the next three equations:[31]

$$X_{ij} = \frac{Y_i E_j}{Y} \left(\frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \tag{7}$$

$$P_j^{1-\sigma} = \sum_{i=1}^{N} \left(\frac{t_{ij}}{\Pi_i} \right)^{1-\sigma} \frac{Y_i}{Y} \tag{8}$$

$$\Pi_i^{1-\sigma} = \sum_{j=1}^{N} \left(\frac{t_{ij}}{P_j} \right)^{1-\sigma} \frac{E_j}{Y} \tag{9}$$

where X_{ij} stands for bilateral trade from origin country i and going to destination country j. The economic size variables (E, Y) for the partner countries and the bilateral trade cost variable t_{ij} are identical with the FDI model presented in Section 2.1, and reproduced below for the reader's reference.

$$FDI_{ij}^{stock} = \omega_{ij}^{\eta} \frac{\alpha E_i}{P_i} \frac{Y_j}{M_i} \qquad ;\forall i, j \tag{10}$$

$$P_i = \left[\sum_{j=1}^{N} \left(\frac{t_j i}{\Pi_j} \right)^{(1-\sigma)} \frac{Y_j}{Y} \right]^{\frac{1}{1-\sigma}} \qquad ;\forall i \tag{11}$$

$$\Pi_j = \left[\sum_{i=1}^{N} \left(\frac{t_{ji}}{P_i} \right)^{(1-\sigma)} \frac{E_i}{Y} \right]^{\frac{1}{1-\sigma}} \qquad ;\forall j \tag{12}$$

An important difference is that the FDI sub-model has no outward multilateral resistance in the bilateral FDI equation (10), whereas equation (7) holds the trade-cost term $\frac{t_{ij}}{\Pi_i P_j}$ in which both MR terms are represented.[32] It should be noted that

[31] Time indexes are suppressed, for brevity.

[32] Anderson et al. (2017), p.15: "The reason is the non-rival nature of technology capital, in contrast to goods sales: goods sold to j from i cannot be used elsewhere whereas i's technology used in j has no effect on its utilisation elsewhere. Our model assumes that the origin sells the use of its technology to the destination at its value to the buyer at zero cost to itself".

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