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Article

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Peter H. Egger and Gerard Masllorens

Abstract

This paper focuses on the effect of preferential trade agreements and their depth on firm-to-firm ownership, in particular, along global value chains. It measures shareholder–affiliate ownership links at the country-sector-pair level to distinguish between vertical and horizontal links. The findings show that preferential trade agreements boost vertical international investment links (both backward and forward) while reducing horizontal investment. Deep preferential trade agreements stimulate investment particularly for sector pairs, where a high input specificity prevails.

JEL classification: F13, F14, F15, F23

Keywords: PTAs, PTA depth, foreign ownership, foreign direct investment

1. Introduction

Preferential trade agreements (PTAs) are a key instrument to conduct trade policy and the main one to extend a preferential treatment to trading partners in the long run. The proliferation of PTAs, particularly since the 1990s, has been well documented (Baier and Bergstrand 2004; Baldwin 2008; Hofmann, Osnago, and Ruta 2017).

Naturally, this led to a vast literature on normative as well as positive aspects of PTAs. In the wake of empirical research on the positive side, studies focused on effects of preferential tariff reductions on trade flows and found a positive response (Baier and Bergstrand 2009; Egger et al. 2011; Caliendo and Parro 2014; Anderson and Yotov 2016).

However, in particular the rising importance of services—where non-tariff barriers (NTBs) apply but tariffs do not—and the efforts to standardize the provisions around, the declarations associated with, and the measurement of NTBs have put non-tariff aspects in PTAs into the limelight, in particular, since the Uruguay Round at the World Trade Organization. This could be seen as the wake of research not only about NTB aspects in PTAs but on the depth of PTAs.

The literature on the depth of PTAs is much younger than that on mainly tariff-reducing PTAs. A small body of theoretical work established normative insights into deep PTAs (Bagwell and Staiger 2001; Maggi and Ossa 2021; Grossman et al. 2021; Parenti and Vannoorenberghe 2022). In parallel with the emergence of theoretical interest on the subject, substantial efforts were made to delineate the key NTB and non-

Peter H. Egger (corresponding author) is a professor at ETH Zurich, CEPR, CESifo, WIFO; his email address is pegger@ethz.ch. Gerard Masllorens is a postdoc at ETH Zurich; his email address is gmasllorens@ethz.ch. This paper has benefited from numerous helpful comments by the editor (Nina Pavcnik) and two anonymous reviewers. Moreover, the authors gratefully acknowledge support from the World Bank's Umbrella Facility for Trade trust fund financed by the governments of the Netherlands, Norway, Sweden, Switzerland, and the United Kingdom. A supplementary online appendix is available with this article at *The World Bank Economic Review* website.

trade provisions in PTAs (see, e.g., Hofmann, Osnago, and Ruta 2017). The measurement of PTA content led to new empirical research on the determinants and effects of PTAs, which essentially meant parting with their binary characterization and focusing on their heterogeneous effects beyond tariff reductions (see the various chapters in Mattoo, Rocha, and Ruta 2020).

While non-goods-trade provisions in "new" PTAs, namely ones that were signed since the 1990s, are frequent and key, much of the work on the consequences of PTAs still focuses on heterogeneous depth-related effects of PTAs on goods trade (see Egger and Nigai 2015; Aichele, Felbermayr, and Heiland 2016; Mulabdic, Osnago, and Ruta 2017; Mattoo, Mulabdic, and Ruta 2022). Some other work focuses on services trade (see Egger and Wamser 2013a; Gootiiz et al. 2020; Borchert and Di Ubaldo 2021), global value chains (see Bruhn 2014; Orefice and Rocha 2014; Berger et al. 2016; Ruta 2017; Laget et al. 2020; Blanchard, Bown, and Johnson 2021), foreign direct investment (see Blanchard 2007; Blanchard and Matschke 2015; Osnago, Rocha, and Ruta 2017, 2019; Kox and Rojas-Romagosa 2020; McCaig, Pavcnik, and Wong 2022), and even poverty, labor, and wage premia (see Goldberg and Pavcnik 2004).

Yet another literature focuses on the effects of non-trade agreements—e.g., of bilateral investment treaties (BITs) or of double taxation treaties (DTTs)—on economic outcome. There, the focus is mainly on foreign direct investment (FDI) and firm ownership (see Blonigen, Oldenski, and Sly 2014; Bhagwat, Brogaard, and Julio 2021), but some earlier work considers even effects on trade flows (see Egger and Wamser 2013b). The mentioned work identifies a generally positive effect of BITs and DTTs on FDI (see Blonigen, Oldenski, and Sly 2014; Bhagwat, Brogaard, and Julio 2021; Kovak, Oldenski, and Sly 2021), on goods and services trade (see Egger and Wamser 2013b), and on the integration in global value chains (see Egger, Erhardt, and Masllorens 2023).[1]

The present paper primarily contributes to the literature on the effect of PTAs on firm-to-firm ownership at the country-sector-pair level. Accordingly, it addresses effects at the interface of direct investment and global value chains (GVCs). Specifically, we analyze effects of entering deep PTAs in a unique data set on the frequency of shareholder-affiliate links across all pairs of 209 countries and 38 sectors over 9 years between 2007 and 2015.[2]

Global input-output tables permit assigning to every shareholder sector and country whether it is up the stream or down the stream of an affiliate sector and country. Hence, every shareholder–affiliate link can be classified as horizontal (within the same sector) or vertical, and in the latter case as forward (the shareholder being up the stream of the affiliate) or backward (the shareholder being down the stream of the affiliate).

Theoretical work on the activity of multinational firms provides guidance regarding the expected effect of PTA membership on foreign ownership (see Markusen 2002; Helpman 2006; Egger, Larch, and Pfaffermayr 2007):[3] whereas lower preferential tariffs should reduce the propensity of horizontal ownership, they should increase the propensity of vertical ownership (in both the forward and backward directions). On average, positive effects of PTAs on FDI appear to dominate (Orefice and Rocha 2014; Osnago, Rocha, and Ruta 2017; Kox and Rojas-Romagosa 2020; Laget et al. 2020). This points to a relative dominance of vertical ownership links, consistent with the findings of Alfaro and Charlton (2009). However, the evidence is implicit only, because, as Kox and Rojas-Romagosa (2020) put it, "we cannot separate the FDI data between horizontal and vertical FDI."

1 During the sample period considered here, 371 new BITs came into force. Therefore, we also control for their potential impact.

2 Empirical work on both trade flows and direct investment typically focuses aggregate trade at the country-pair level or on trade at the sector or product and country-pair level. Focusing not only on country pairs but also on selling and purchasing sector pairs is unusual (see Antràs and Chor 2022).

3 Blanchard and Matschke (2015) put forward a political-economy argument regarding the nexus of trade preferences of a country and outward direct investment. They hypothesize and find for the United States that the extension of preferential market access itself may be a function of the sales of a country's foreign affiliates to its domestic market.

In light of the latter, the present study provides three innovations. First, it proposes a new measurement by focusing on the extensive margin of investment in terms of shareholder–affiliate ownership links in a data set with all pairs between 209 countries, as well as all pairs between 38 sectors. Second, it differentiates those links as to be horizontal versus vertical (and then forward versus backward) in the light of GVC data. Third, it identifies parameters and provides insights based on pooling the aforementioned data across 9 years, using a high-dimensional fixed effects design. The latter permits conditioning on a host of unobservable factors, ensuring that the effects of PTAs and their depth can be identified from the time variation in the data only—i.e., from a new membership in PTAs.

The key insights from our study are the following. First, entering a PTA raises the number of new foreign ownership links. Second, the latter is completely driven by vertical links, i.e., ones in the forward or backward integration direction. The effects tend to be somewhat stronger in the forward than in the backward direction. The propensity of horizontal ownership links declines with the formation of PTAs. Third, the effects of PTAs on vertical ownership links increase with a higher PTA depth. Finally, general and deep PTA effects on vertical investment are stronger, if the specificity of inputs for a sector pair that the shareholder and the affiliate belong in is higher on average.

The remainder of the paper is organized as follows. The subsequent section introduces various data sets supporting the empirical work. The Empirical Analysis Section presents estimation results using these data. After, the robustness section is devoted to two specific robustness checks, and the last section concludes with a brief summary of the main findings.

2. Data

In this paper, we use a unique combination of data sets that allow exploration of the effects of PTAs on firm-to-firm ownership links.

First, we utilize data on firm-to-firm ownership links at an annual level from Bureau van Dijk's ORBIS data set. Second, we employ data on PTAs and their depth from the World Bank's Deep Trade Agreement Dataset, forming the explanatory variable(s) of key interest here. The information in the latter is based on a detailed text analysis of PTA-specific content. Along with the data on PTAs, we use those on BITs as provided by UNCTAD. Finally, we use World Input-Output Tables from the World Input-Output Database (WIOD) to obtain different measures of GVC organization in a large set of country and sector pairs.

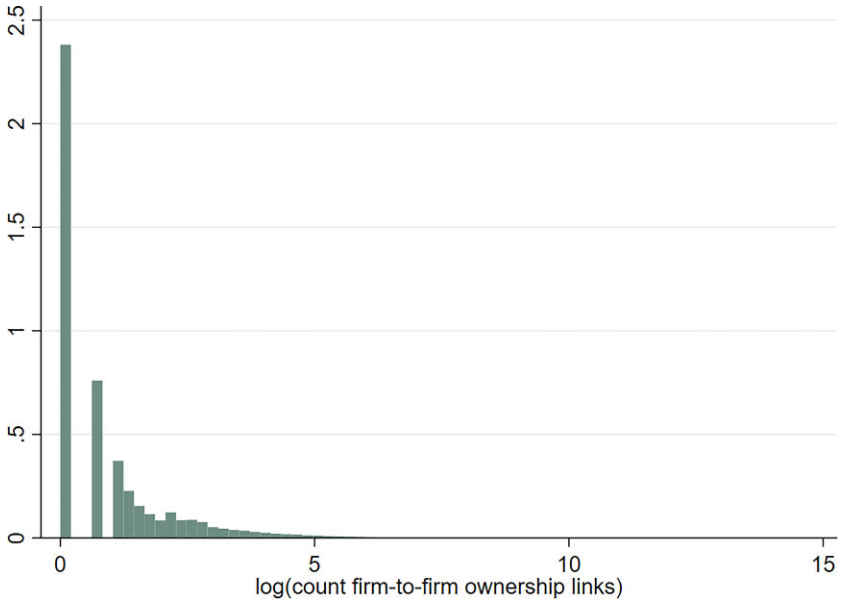
2.1. Firm Ownership Data

Bureau van Dijk's ORBIS database compiles firm-level data on the ownership structure and financial accounts for a large mass of companies across many countries, sectors, and years. We use the data in annual panel form for the period 2007–2015. For the purpose of the analysis in this paper, what is most relevant is the information on the ownership structure of firms. In the data, a firm-to-firm link is recorded and defined as an ownership relation of any kind (regardless of the share of ownership held) between a parent firm located in, say, country j and sector s and an affiliate located in, say, country i and sector r. Clearly, one parent may hold multiple subsidiaries. But also a single subsidiary may be held by more than one parent.

To clean the data set, we eliminate duplicates and also those entities (firms) with relevant information missing on the country or the sector associated with them. Furthermore, we keep a panel of incumbents (observed during the full sample period) and entrants (firms born during the sample period). The latter is important to avoid a bias from truncation associated with a changing coverage of the data. Hence, we focus on changes of the ownership-link structure in the data for and among all those firms in ORBIS, which principally existed throughout the sample period as either independent or linked firm entities.

Finally, we aggregate these firm-to-firm link data at the country-sector-to-country-sector-pair level and fill in zeros for those cells where no ownership links exist. Specifically, we create a variable called $CF_{ij,t}^{rs}$

Figure 1. Histogram of Log (Count Firm-to-Firm Ownership Links).



Source: Authors' calculations using the ORBIS dataset.
Note: The figure shows the histogram of the logarithm of the count of firm-to-firm links.

(shorthand for the "count of firm-to-firm links") that counts the number of firms in country i and sector r that are owned by firms from sector s in country j. In figure 1 we present a histogram of the logarithm of this variable.

Note that, given the number of countries (209) and sectors (38), this data set is huge with $209 \times 209 \times 38 \times 38 = 63$ million observations per year, even after the mentioned aggregation. Across all years covered, this leads to almost 600 million country-pair-sector-pair-year observations in total. The size of this data set prevents use of optimization algorithms underlying the estimation of nonlinear models. Therefore, we focus on separate linear regression models for the frequency of ownership links and the propensity of any ownership link as two types of extensive foreign investment margins within the country-pair-sector-pair cross-sectional cells over the sample period of 2007–2015.

Regarding ownership counts, we focus on non-zero counts and use $\log(\mathrm{CF}^{rs}_{ij,t})$ as an outcome to be able to interpret estimated parameters as elasticities or semi-elasticities. Moreover, we use a binary variable indicating the existence or not of any ownership link, $1(\mathrm{CF}^{rs}_{ij,t})$ as a dependent variable in linear probability models.

2.2. PTA and BITs Data

The Deep Trade Agreement Dataset of the World Bank is the most comprehensive database of PTAs with a focus on their content. It covers 279 PTAs that were signed between 1958 to 2015. The database includes a summary of a full text analysis of each PTA and a classification thereof into 52 different provisions.

An important guiding principle for our empirical analysis is the emphasis of the best-possible exclusion of biases from confounding factors of PTA membership and depth. For that reason, we will sweep any variation from the data in the cross-sectional dimension and exploit the time variation across country-pair-sector-pair units. The latter dictates a focus on new memberships in PTAs after the beginning of the sample period, namely in 2007. However, it should be noted that full formations, or at least enlargements, of almost one-half of the PTAs in the Deep Trade Agreement Dataset have happened since 2007 and before

Table 1. PTAs Coming into Force 2007–2015

Year	PTAs	Total depth	Core depth	WTO-X depth
2007	11	0.415	0.833	0.193
2008	17	0.354	0.784	0.126
2009	18	0.366	0.809	0.132
2010	12	0.359	0.801	0.125
2011	11	0.423	0.808	0.219
2012	15	0.390	0.763	0.192
2013	12	0.466	0.801	0.289
2014	10	0.508	0.844	0.329
2015	6	0.455	0.852	0.245

Source: Authors' calculations using the World Bank's Deep Trade Agreement Dataset.
Note: The table presents yearly statistics on PTAs (Preferential Trade Agreements). The second column reports on the number of new PTAs coming into force. The last three columns represent the average Total depth, Core depth and WTO-X (beyond the current World Trade Organization mandate) depth respectively.

Table 2. New Dyadic PTA Relations Coming into Force by Country in Period 2007–2015 (Top 15 Countries of 122)

Country	New dyadic relations	Total depth	Core depth	WTO-X depth
Romania	95	0.577	0.905	0.403
Bulgaria	95	0.577	0.905	0.403
Rest of EU (each country)	87	0.602	0.907	0.441
Moldova	46	0.641	0.804	0.555
Croatia	44	0.629	0.933	0.469
Korea, Rep.	43	0.440	0.903	0.195
Peru	43	0.620	0.926	0.458
Montenegro	41	0.274	0.775	0.009
Serbia	40	0.259	0.704	0.024
Bosnia and Herzegovina	39	0.253	0.702	0.015
Colombia	39	0.642	0.922	0.494
Costa Rica	38	0.753	0.939	0.654
Honduras	37	0.758	0.913	0.676
El Salvador	34	0.788	0.920	0.719
Guatemala	34	0.784	0.923	0.710

Source: Authors' calculations using the World Bank's Deep Trade Agreement Dataset.
Note: The table presents country statistics on PTAs (Preferential Trade Agreements). In the "New dyadic relations" column it shows the number of new PTAs memberships coming into force. The last three columns represent the average Total depth, Core depth and WTO-X (beyond the current World Trade Organization mandate) depth respectively.

2015 (112 PTAs). These changes in PTAs account for around 4,000 new dyadic relations within PTAs (see table 1) that involve a large set of countries (see table 2).[4]

In our empirical analysis, we define different measures to account for PTAs. One measure is simply an indicator variable, $PTA_{ij,t}$, that equals unity whenever there is a PTA in force between countries i and j in year t, and zero otherwise. This measure of PTAs does not take into consideration the intrinsic heterogeneity across PTAs.

To account for the latter, we make use of the rich set of provisions coded in the Deep Trade Agreement Dataset and define various variables to measure the depth of every PTA. More concretely, we classify the different provisions into two groups: (a) WTO+ which includes provisions already covered by the WTO (14 provisions), and (b) WTO-X which includes those provisions that go beyond the current WTO mandate (38 provisions). Moreover, there are some provisions that have been recognized in previous

4 Recall that with 209 countries, the full a global PTA would span $209(209-1)$ possible international bilateral relations. Hence the change in PTA links during the sample period may be considered to be non-trivially large.

Table 3. Descriptive Statistics

	Positive ownership-link sample		Ownership propensity sample	
Variable	Mean	Standard deviation	Mean	Standard deviation
$CF^{rs}_{ij,t}$	39.836	1,347.332	0.221	54.065
$\log(CF^{rs}_{ij,t})$	0.896	1.277	–	–
$1(CF^{rs}_{ij,t} > 0)$	–	–	0.009	0.094
$PTA_{ij,t}$	0.457	0.498	0.303	0.459
Total $depth_{ij,t}$	0.310	0.363	0.163	0.283
Core $depth_{ij,t}$	0.421	0.474	0.240	0.391
WTO-X $depth_{ij,t}$	0.251	0.314	0.122	0.241
$BIT_{ij,t}$	0.288	0.453	0.331	0.471
$Backward^{rs}_{j}$	0.039	0.065	0.014	0.036
$Forward^{rs}_{j}$	0.039	0.067	0.014	0.04
Input $specificity^{r}$(affiliate)	0.612	0.152	0.571	0.161
Input $specificity^{s}$(parent)	0.626	0.150	0.571	0.161

Source: Authors' calculations using the World Bank's Deep Trade Agreement, the WIOD, the UNCTAD IIA mapping and the ORBIS dataset. Note: This table provides descriptive statistics for the variables used in the regressions below. CF is a shorthand for the "count of firm-to-firm links"; PTA stands for Preferential Trade Agreements; Total depth is the PTAs' Depth; Core depth is the PTAs' core depth (WTO+ plus competition policy, investment, movement of capital, and intellectual property rights); WTO-X depth is the PTAs' WTO-X depth (provisions beyond the current World Trade Organization mandate); BIT stands for Bilateral Investment Treaties; Backward and Forward measure the average input and output coefficient, respectively; Input specificity affiliate/parent measures the degree of differentiation of the goods produced by the sector.

studies (Baldwin 2008; Damuri et al. 2012) as being more relevant than others. This group of provisions are named "core" and include WTO+ plus competition policy, investment, movement of capital, and intellectual property rights (18 provisions). Based on the aforementioned information, we define three different measures of PTA depth:

$$\text{Total depth} = \frac{\sum_{p=1}^{52} \text{Provision}_p}{52},$$

$$\text{Core depth} = \frac{\sum_{c=1}^{18} \text{Provision}_c}{18},$$

$$\text{WTO-X depth} = \frac{\sum_{x=1}^{34} \text{Provision}_x}{34}, \tag{1}$$

where Provision_v with $v \in \{p, c, x\}$ indicates in a binary way, whether a given provision belongs in a specific group of PTAs or not.

Table 2 lists for a set of countries (singular or in a block) changes in the three aforementioned PTA-depth measures during the sample period 2007–2015 due to new PTA memberships of the listed economies. The figures indicate that for some countries there was quite an increase in trade-integration depth associated with new PTAs. However, the table also indicates that there is quite some heterogeneity among the new PTA memberships in terms of PTA depth.

While the focus here is on PTAs, we also control for BITs in the regressions. However, there is no similar metric of depth for BITs as for PTAs, and we consider them in a binary way through a variable we call $BIT_{ij,t}$, which is unity whenever a BIT is in force between countries i and j in year t and zero otherwise. BITs are not infrequent in the data. We will see in table 3 that somewhat more than 30 percent of the country-pair-sector-pair observations in the overall data are covered by a PTA and a BIT in the average year between 2007 and 2015 in the data, irrespective of whether there are any ownership links or not. However, we will identify parameters from changes only. Table 1 suggests that 112 new PTA links came into force between the country pairs in the data. As indicated above, 371 new BITs came into force over

the same time span. However, it should be noted that new PTA links are typically formed by expansions of pre-existing PTAs, while new BIT links are formed by entirely new BITs on average. The reason is that BITs are bilateral between two countries, while most PTAs are multilateral among more than two economies. The preferential market access granted in terms of the size of the integrated market covered under a PTA is often nontrivially large for that reason.

2.3. Global Value Chain Data

The WIOD data set is a widely used source for global input-output tables. We use the information contained in the 2016 release which covers 43 countries and 56 ISIC Rev. 4 2-digit sectors (across primary production, manufacturing, and services). In order to match the WIOD data with the information contained in ORBIS, we aggregate the 56 sectors up so as to obtain 38 sectors. Moreover, we group the countries into 22 major world regions[5] according to the detailed United Nations geoscheme and substitute coefficients for those countries in ORBIS which are not specifically contained in WIOD by the respective annual group average.[6]

For a more formal account of the WIOD-data construction for the present purpose, let us closely follow the notation in Antràs and Chor (2018) and define a world economy with J countries (indexed by i or j) and S sectors (indexed by r or s). Also, let us use $Z^{rs}_{ij,t}$ for the total value of inputs used by country j's sector s originating from country i's sector r in year t; $F^{r}_{i,t}$ and $Y^{r}_{i,t}$ are the total value of the final goods sold and the gross output (including final and intermediate goods) by industry r in country j, respectively.[7]

These basic definitions serve to define two measures which are informed by and reflective of a country-sector pair's positioning in the global value chain. These measures are the following.[8]

Input coefficient. Given that $Z^{rs}_{ij,t}$ is measured in US dollars, it is useful to define a currency-free, normalized input coefficient $a^{rs}_{ij,t} = Z^{rs}_{ij,t}/Y^{s}_{j,t}$. We can aggregate $a^{rs}_{ij,t}$ across supplying countries to obtain

$$a^{rs}_{j,t} = \sum_{i=1}^{J} a^{rs}_{ij,t} = \frac{\sum_{i=1}^{J} Z^{rs}_{ij,t}}{Y^{s}_{j,t}}. \tag{2}$$

The latter measures the normalized inputs used by sector s of country j in its production sourced from sector r as the supplier in year t, regardless of its geographic origin. In what follows, we associate a high input coefficient $a^{rs}_{j,t}$ for a parent firm in j and s holding an affiliate in r with backward integration.

Output coefficient. By the same token, we can define $b^{rs}_{ij,t} = Z^{rs}_{ij,t}/Y^{r}_{i,t}$ as a currency-free, normalized output coefficient. This can be aggregated across using countries j to obtain

$$b^{rs}_{i,t} = \sum_{j=1}^{J} b^{rs}_{ij,t} = \frac{\sum_{j=1}^{J} Z^{rs}_{ij,t}}{Y^{r}_{i,t}}. \tag{3}$$

The latter measures the normalized output sold by country i's sector r to sector s at year t, regardless of the country the purchasing company is located in. In what follows we associate a high output coefficient $b^{rs}_{i,t}$ of a parent firm in i and r with an affiliate in j with forward integration.

For the analysis at hand, we compute $a^{rs}_{j,t}$ and $b^{rs}_{i,t}$ for all years covered by the WIOD and then use the average thereof for each cross-sectional unit $\{rsj\}$ and $\{rsi\}$, respectively.

5 Northern America, Central America, Caribbean, South America, Northern Africa, Western Africa, Middle Africa, Eastern Africa, Southern Africa, Southern Europe, Western Europe, Northern Europe, Eastern Europe, Western Asia, Central Asia, Southern Asia, Eastern Asia, Southeastern Asia, Australia and New Zealand, Micronesia, Polynesia, and Melanesia.

6 Hence, country-to-country input-output coefficients for economies not contained in WIOD are imputed based on group aggregates. As well as this, the WIOD itself includes some imputed data.

7 The WIOD distinguishes three components of gross output—namely, intermediate uses, final uses, and net inventories—instead of just two (intermediate and final uses). Therefore, we follow Antràs et al. (2012) in applying a "net inventory" correction.

8 Antràs et al. (2012) demonstrate that these measures are equivalent to those proposed by Fally (2011).

Therefore we define

$$\text{Backward}_j^{rs} = \frac{\sum_{t=1}^{T} a_{j,t}^{rs}}{T}, \tag{4}$$

$$\text{Forward}_j^{rs} = \frac{\sum_{t=1}^{T} b_{j,t}^{rs}}{T}. \tag{5}$$

2.4. Other Data and Descriptive Statistics

Apart from the data on the dependent variables on firm-to-firm links, on PTA membership and depth, on BIT membership, and on the (backward versus forward) direction of potential ownership links depending on sector pairs for a country, we use measures of the sector-level input specificity of the sectors associated with potential parents and affiliates.

The latter will only be used as control variables later on. We follow Nunn (2007) in measuring and interpreting input specificity to reflect the degree to which inputs are customized and cannot be easily substituted for by other suppliers. For this, we first classify every potential input as differentiated or not, following Rauch (1999).[9] Then we compute the input specificity for each sector, capturing which share of total inputs used are differentiated inputs. The idea is that a sector that consumes a high share of differentiated inputs will have a higher degree of specificity, as conjectured in Nunn (2007).

Table 3 provides the means and standard deviations of all mentioned variables in the two data samples considered, the larger one with the binary indicator for any versus no firm-to-firm ownership links and the one with the log count of positive links. For example, the statistics indicate that the PTA propensity is higher in the subsample with positive ownership links than in the overall data set. Also the overall depth measure is twice as high in the positive-links subsample than in the overall data. This is consistent with a positive effect of PTA membership on ownership links. Interestingly, the fraction of country-pair-sector-pair-year observations under a BIT is smaller in the subsample with positive ownership links than in the big sample. This is consistent with PTAs being more important for firm integration than is the case for BITs on average.

3. Empirical Analysis: PTA Effects on Firm-to-Firm Ownership in GVCs

In this section we explain our empirical strategy and present the main results of the analysis.

3.1. Regression Design

It will be useful to introduce the generic dependent variable $Y_{ij,t}^{rs} \in \{\log(\text{CF}_{ij,t}^{rs}), 1(\text{CF}_{ij,t}^{rs} > 0)\}$. The variable $\log(\text{CF}_{ij,t}^{rs})$ is defined only for positive ownership counts for each observation, and $1(\text{CF}_{ij,t}^{rs} > 0)$ is a binary indicator, which is unity for (any) positive ownership counts and zero otherwise. We will refer to the variation in $\log(\text{CF}_{ij,t}^{rs})$ and $1(\text{CF}_{ij,t}^{rs} > 0)$ as being informative about the positive count (the extent) and the propensity of any foreign ownership, respectively.

Note that in the data the number of all observations $\{rs, ij, t\}$ is 100,828,240 observations in total. Of the latter, positive firm-to-firm ownership counts exist for only 985,731 observations. In the interest of computational feasibility, we will employ $Y_{ij,t}^{rs}$ generally in linear regressions, irrespective of whether we focus on positive counts with $\log(\text{CF}_{ij,t}^{rs})$ or on the propensity of any firm-to-firm ownership.[10] In what

9 The product classification of Rauch (1999) is based on the SITC 5-digit level. We use the concordance tables provided by UNCTAD to map 5-digit SITC-product categories into 2-digit ISIC sectors to match the data from WIOD on GVCs and on firm-to-firm ownership links in ORBIS.

10 Note that $\text{CF}_{ij,t}^{rs}$ is a count variable in nature. Ideally, with such variables a count data model—e.g., a Poisson model or a negative binomial model—would be applied (see Winkelmann 2008). However, given the number of observations

follows, we will report on the results based on variants of the regression of the form

$$\begin{aligned} Y^{rs}_{ij,t} = {} & \text{PTA-measures}_{ij,t}\beta_{\text{PTA-measures}} + \text{GVC-measures}^{rs}_{j}\beta_{\text{GVC-measures}} \\ & + \text{PTA-measures}_{ij,t} \times \text{GVC-measures}^{rs}_{j}\beta_{\text{Interact}} + \beta_{\text{BIT}}\text{BIT}_{ij,t} \\ & + \sum_{t=2007}^{2015} \beta_{\text{Domestic},t}\text{Domestic}_{ij,t} + \eta_{ij} + \gamma^{rs} + \omega^{r}_{i,t} + \nu^{s}_{j,t} + \epsilon^{rs}_{ij,t}, \end{aligned} \tag{6}$$

where $\text{PTA-measures}_{ij,t}$ is a vector of various measures on PTAs as introduced above and depending on the specification, $\text{GVC-measures}^{rs}_{j}$ is a vector of GVC measures of input-output coefficients, $\text{BIT}_{ij,t}$ is the binary indicator for the presence of a ratified BIT between countries i and j, and $\text{Domestic}_{ij,t}$ is an indicator which is unity whenever $i = j$ in year t. All parameters β are regression coefficients, $\{\eta_{ij}, \gamma^{rs}, \omega^{r}_{i,t}, \nu^{s}_{j,t}\}$ are fixed effects which vary across the indicated index configurations, and $\epsilon^{rs}_{ij,t}$ is a disturbance term. We will generally only report on the parameters β, and they will always be identified using the high-dimensional set of fixed effects (FE) mentioned above.

3.2. PTA Effects on Firm Integration along GVCs

First, we employ the variation in input and output coefficients for each country pair and sector. Recall that a higher input coefficient indicates a larger degree of backward integration (as the affiliate is an important supplier of goods as used by the parent), while a higher output coefficient indicates a larger degree of forward integration (the affiliate is an important customer of inputs as produced by the parent). We can identify the main effect of the respective input and output coefficients on firm-to-firm integration apart from their interaction effects with $\text{PTA-measures}_{ij,t}$.

We will present effects on the positive counts and the propensity of any firm-to-firm ownership in separate tables.

Table 4 reports on the ownership-count effects of $\text{PTA-measures}_{ij,t}$ as such and interacted with the vertical-integration measures. The table is horizontally organized in four columns of results, where the first column is devoted to the binary measure of PTA membership and the others are devoted to measures of PTA depth.

The binary PTA indicator carries a positive coefficient (semi-elasticity). Hence, PTAs are associated with more firm-to-firm integration, consistent with the unconditional evidence from table 3. A larger degree of intersectoral dependence in the forward-integration direction also boosts the number of ownership links. However, we do not find evidence of a strong and robust interaction between PTA membership and the backward integration direction.

Whereas the measurement of PTAs in the first column of table 4 does not acknowledge their heterogeneity depending on their depth, the remaining columns do by defining $\text{PTA-measures}_{ij,t}$ to contain one of the elements in $\{\text{Total depth}_{ij,t}, \text{Core depth}_{ij,t}, \text{WTO-X depth}_{ij,t}\}$. The latter measures are always used in the main effects as well as in the interactions with the GVC measures, as was the case in the first column of the table. The associated results in all columns of table 4 suggest that PTA membership raises the number of ownership links, in particular, in the forward-integration direction. Moreover, the last three columns of the table suggest that forward integration becomes more attractive with deeper PTAs.

Next we turn to the results regarding the propensity of any ownership links being formed depending on a PTA coming into force. We consider this margin in table 5. The latter is structured in the same way as table 4, except for involving the binary ownership indicator as the dependent variable.

included in conjunction with the dimensionality of the fixed effects we will condition on in the empirical models, it turned out to be computationally infeasible to estimate nonlinear models. Therefore, we decided in favor of estimating linear models.

Table 4. Positive Ownership Counts: Vertical Integration in Global Value Chains

log(number of firm-to-firm connections ($CF^{rs}_{ij,t}$))	PTA	Total depth	Core depth	WTO-X depth
$Backward^{rs}_{j}$	0.017	−0.031	−0.013	−0.046
	(0.104)	(0.102)	(0.103)	(0.101)
$Forward^{rs}_{j}$	0.448***	0.407***	0.420***	0.406***
	(0.111)	(0.109)	(0.110)	(0.108)
$PTA\text{-}measures_{ij,t}$	0.022**	0.045**	0.019*	0.065**
	(0.010)	(0.021)	(0.012)	(0.031)
$PTA\text{-}measures_{ij,t} \times Backward^{rs}_{j}$	-0.175*	−0.138	−0.135	−0.122
	(0.100)	(0.136)	(0.106)	(0.155)
$PTA\text{-}measures_{ij,t} \times Forward^{rs}_{j}$	0.161*	0.372***	0.243**	0.467***
	(0.095)	(0.130)	(0.101)	(0.149)
$BIT_{ij,t}$	0.013	0.013	0.013	0.013
	(0.011)	(0.011)	(0.011)	(0.011)
Country-pair FE	✓	✓	✓	✓
Industry-pair FE	✓	✓	✓	✓
Shareholder-country-industry-year FE	✓	✓	✓	✓
Subsidiary-country-industry-year FE	✓	✓	✓	✓
Domestic-year FE	✓	✓	✓	✓
Obs.	990,033	990,033	990,033	990,033
R^2	0.564	0.564	0.564	0.564

Source: Authors' calculations using the World Bank's Deep Trade Agreement, the WIOD, the UNCTAD IIA mapping and the ORBIS dataset.
Note: The table shows OLS regressions with high-dimensional fixed effects. In all columns, the dependent variable is the log of the number of firm-to-firm connections. The explanatory variables are Backward and Forward, PTA measures, their interaction terms and BIT. PTA measures change by column: in column (1) PTA is a dummy variable, in column (2) we use PTAs' total depth, in column (3) we employ PTAs' core depth and in column (4) we use PTAs' WTO-X depth. Standard errors are clustered at the country-industry-pair level and reported in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 5. Ownership Propensity: Vertical Integration in Global Value Chains

1(number of firm-to-firm connections ($CF^{rs}_{ij,t}$))	PTA	Total depth	Core depth	WTO-X depth
$Backward^{rs}_{j}$	−0.006***	−0.017***	−0.015***	−0.013***
	(0.002)	(0.002)	(0.002)	(0.002)
$Forward^{rs}_{j}$	0.039***	0.034***	0.035***	0.037***
	(0.002)	(0.002)	(0.002)	(0.002)
$PTA\text{-}measures_{ij,t}$	−0.004***	−0.008***	−0.005***	−0.009***
	(0.000)	(0.000)	(0.000)	(0.000)
$PTA\text{-}measures_{ij,t} \times Backward^{rs}_{j}$	0.120***	0.287***	0.190***	0.343***
	(0.003)	(0.005)	(0.004)	(0.007)
$PTA\text{-}measures_{ij,t} \times Forward^{rs}_{j}$	0.085***	0.202***	0.131***	0.244***
	(0.002)	(0.004)	(0.003)	(0.006)
$BIT_{ij,t}$	−0.001***	−0.001***	−0.001***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Country-pair FE	✓	✓	✓	✓
Industry-pair FE	✓	✓	✓	✓
Shareholder-country-industry-year FE	✓	✓	✓	✓
Subsidiary-country-industry-year FE	✓	✓	✓	✓
Domestic-year FE	✓	✓	✓	✓
Obs.	111,505,680	111,505,680	111,505,680	111,505,680
R^2	0.193	0.194	0.194	0.194

Source: Authors' calculations using the World Bank's Deep Trade Agreement, the WIOD, the UNCTAD IIA mapping and the ORBIS dataset.
Note: The table shows OLS regressions with high-dimensional fixed effects. In all columns, the dependent variable is binary, indicating the existence or not of any ownership link. The explanatory variables are Backward and Forward, PTA measures, their interaction terms and BIT. PTA measures change by column: in column (1) PTA is a dummy variable, in column (2) we use PTAs' total depth, in column (3) we employ PTAs' core depth and in column (4) we use PTAs' WTO-X depth. Standard errors are clustered at the country-industry-pair level and reported in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

The results suggest a relatively stronger influence of backward integration than of forward integration for the propensity of any ownership.

The mentioned evidence is consistent with earlier findings on trade integration and subsequent global-value-chain integration. For example, Ruta (2017) finds that preferential trade integration boosts global-value-chain integration and input trade, in particular with deeper trade agreements. Shepherd (2019) confirms the latter with a focus on Asia. Sposi, Yi, and Zhang (2021) show that trade integration does not only boost value-chain integration, but also triggers an amplification effect through capital accumulation. However, they abstract from direct investment in this regard.

Interestingly, conditional on PTA membership, BITs tend to reduce the propensity of any ownership, according to this table. However, this result is not robust to controlling for time effects (see Robustness 2 below). In any case, that the effect of BITs is weaker than that of PTAs does not come as a surprise after inspection of the unconditional descriptive statistics in table 3.

Table 5 suggests that, across all three measures of PTA depth, the propensity of any ownership link being present rises, and more strongly so in the backward- rather than the forward-integration direction.

3.3. PTA Effects on Integration in GVCs and Input Specificity

In this subsection, we assess the role of input specificity for the effect of PTAs on vertical integration. In this context, we employ the input specificity measures introduced in Other Data and Descriptive Statistics Section. Specifically, we use triple-interaction terms between the PTA membership (binary or depth) measures, the GVC measures, and the measure of input specificity in the regressions with log ownership counts (table 6) or the binary ownership indicator (table 7) as the dependent variable. In discussing the results, we focus on the coefficient on the interaction effect between PTA depth and input specificity on the one hand and on the triple-interaction terms on the other hand.

The results regarding the log firm-to-firm ownership count in table 6 suggest that a higher specificity of inputs—when supplied by the shareholder to the affiliate or vice versa, depending on the direction of ownership—increases the firm-to-firm integration frequency in the forward direction, while it reduces it in the backward direction.

In table 7, we focus on the extensive, new firm-to-firm-ownership margin. The corresponding results indicate that a higher input specificity raises the effect of any PTA membership and that of a higher PTA depth on the propensity of there being any new ownership links. The effect tends to be generally bigger in the forward than in the backward integration direction.

Hence, overall, PTAs—and particularly deeper ones—raise the propensity of any firm integration, specifically in the forward-integration direction. This is even more the case when the inputs supplied by the parent to the affiliate are more specific and customized than otherwise.

These findings are in line with the literature on firm ownership based on the property-rights approach (see Grossman and Hart 1986; Hart and Moore 1990). Following this approach, Antràs (2003) and Helpman (2006) discuss the importance of input specificity in the case of incomplete contracts and find that the decision to (backward) integrate or not depends on its effects on the incentives to the supplier to produce a specialized input. Therefore, a higher input specificity as such could lead to more or less integration.

Acemoglu et al. (2010) develops a model rooted in the property-rights approach that explicitly allows for both forward and backward integration. Furthermore, the model considers different determinants for the integration decision, including input specificity. That model predicts that a higher input specificity is associated with more integration. Egger, Erhardt, and Masllorens (2023) follow this model and find robust evidence in the same direction. Overall, we consider our results in line with those findings.

Table 6. Positive Ownership Counts: Vertical Integration in GVCs and Input Specificity

log(number of firm-to-firm connections ($CF^{rs}_{ij,t}$))	PTA	Total depth	Core depth	WTO-X depth
$Backward^{rs}_{j}$	1.035***	0.962***	1.014***	0.944***
	(0.362)	(0.355)	(0.358)	(0.352)
$Forward^{rs}_{j}$	-0.293	-0.461	-0.408	−0.531
	(0.381)	(0.376)	(0.379)	(0.373)
Input specificity $affiliate^{r}$ × $Backward^{rs}_{j}$	1.093*	1.317**	1.249**	1.435**
	(0.631)	(0.621)	(0.626)	(0.613)
Input specificity $parent^{s}$ × $Forward^{rs}_{j}$	−1.464**	−1.449**	−1.495**	−1.459**
	(0.61)	(0.598)	(0.603)	(0.590)
$PTA\text{-}measures_{ij,t}$	0.532***	0.744***	0.540***	0.856***
	(0.036)	(0.055)	(0.039)	(0.067)
$PTA\text{-}measures_{ij,t}$ × $Backward^{rs}_{j}$	0.528	0.982**	0.617*	1.259**
	(0.346)	(0.476)	(0.369)	(0.544)
$PTA\text{-}measures_{ij,t}$ × $Forward^{rs}_{j}$	−1.566***	−1.974***	−1.485***	−2.249***
	(0.34)	(0.471)	(0.361)	(0.541)
$PTA\text{-}measures_{ij,t}$ × Input specificity $affiliate^{r}$	−0.218***	−0.354***	−0.249***	−0.416***
	(0.039)	(0.058)	(0.043)	(0.068)
$PTA\text{-}measures_{ij,t}$ × Input specificity $parent^{s}$	−0.583***	−0.753***	−0.571***	−0.843***
	(0.038)	(0.055)	(0.041)	(0.065)
$PTA\text{-}measures_{ij,t}$ × Input specificity $affiliate^{r}$ × $Backward^{rs}_{j}$	−1.474**	−2.197***	−1.532**	−2.649***
	(0.614)	(0.839)	(0.651)	(0.955)
$PTA\text{-}measures_{ij,t}$ × Input specificity $parent^{s}$ × $Forward^{rs}_{j}$	3.020***	4.054***	3.004***	4.682***
	(0.62)	(0.859)	(0.658)	(0.983)
$BIT_{ij,t}$	0.013	0.013	0.013	0.012
	(0.011)	(0.011)	(0.011)	(0.011)
Country-pair FE	✓	✓	✓	✓
Industry-pair FE	✓	✓	✓	✓
Shareholder-country-industry-year FE	✓	✓	✓	✓
Subsidiary-country-industry-year FE	✓	✓	✓	✓
Domestic-year FE	✓	✓	✓	✓
Obs.	990,033	990,033	990,033	990,033
R^2	0.565	0.565	0.565	0.565

Source: Authors' calculations using the World Bank's Deep Trade Agreement, the WIOD, the UNCTAD IIA mapping and the ORBIS dataset.
Note:The table shows OLS regressions with high-dimensional fixed effects. In all columns, the dependent variable is the log of the number of firm-to-firm connections. The explanatory variables are Backward and Forward, PTA measures, Input specificity of the affiliate/parent, their interaction terms and BIT. PTA measures change by column: in column (1) PTA is a dummy variable, in column (2) we use PTAs' total depth, in column (3) we employ PTAs' core depth and in column (4) we use PTAs' WTO-X depth. Standard errors are clustered at country-industry-pair level and reported in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

4. Robustness Checks

In this section, we address two concerns. First, relative to other PTAs around the world, the European Union (EU) constitutes a trade agreement which is special in several regards, and this warrants an assessment to which extent the results on PTA effects on ownership are driven by the EU. Second, it might be that some of the effects of PTAs are staggered in the sense that they are partially anticipated or that they have lagged effects. We address these issues in two separate subsections. We suppress the tables underlying the subsequent discussion to a supplementary online appendix for the sake of brevity and defer the interested reader to it.

Table 7. Ownership Propensity: Vertical Integration in GVCs and Input Specificity

1(number of firm-to-firm connections ($CF^{rs}_{ij,t}$))	PTA	Total depth	Core depth	WTO-X depth
$Backward^{rs}_{j}$	0.022***	0.025***	0.023***	0.026***
	(0.006)	(0.006)	(0.006)	(0.006)
$Forward^{rs}_{j}$	−0.006	−0.003	−0.003	−0.005
	(0.007)	(0.007)	(0.007)	(0.007)
Input specificity $affiliate^{r}$ × $Backward^{rs}_{j}$	−0.058***	−0.086***	−0.078***	−0.081***
	(0.011)	(0.011)	(0.011)	(0.011)
Input specificity $parent^{s}$ × $Forward^{rs}_{j}$	0.079***	0.064***	0.066***	0.073***
	(0.013)	(0.013)	(0.013)	(0.013)
$PTA\text{-}measures_{ij,t}$	−0.018***	−0.043***	−0.027***	−0.052***
	(0.000)	(0.001)	(0.000)	(0.001)
$PTA\text{-}measures_{ij,t}$ × $Backward^{rs}_{j}$	−0.002	0.026	0.010	0.035*
	(0.008)	(0.016)	(0.011)	(0.020)
$PTA\text{-}measures_{ij,t}$ × $Forward^{rs}_{j}$	−0.022**	−0.084***	−0.058***	−0.091***
	(0.009)	(0.018)	(0.012)	(0.022)
$PTA\text{-}measures_{ij,t}$ × Input specificity $affiliate^{r}$	0.008***	0.021***	0.012***	0.027***
	(0.000)	(0.001)	(0.000)	(0.001)
$PTA\text{-}measures_{ij,t}$ × Input specificity $parent^{s}$	0.017***	0.040***	0.026***	0.048***
	(0.000)	(0.001)	(0.001)	(0.001)
$PTA\text{-}measures_{ij,t}$ × Input specificity $affiliate^{r}$ × $Backward^{rs}_{j}$	0.232***	0.489***	0.338***	0.574***
	(0.016)	(0.033)	(0.022)	(0.040)
$PTA\text{-}measures_{ij,t}$ × Input specificity $parent^{s}$ × $Forward^{rs}_{j}$	0.205***	0.556***	0.369***	0.651***
	(0.018)	(0.037)	(0.024)	(0.045)
$BIT_{ij,t}$	−0.001***	−0.001***	−0.001***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Country-pair FE	✓	✓	✓	✓
Industry-pair FE	✓	✓	✓	✓
Shareholder-country-industry-year FE	✓	✓	✓	✓
Subsidiary-country-industry-year FE	✓	✓	✓	✓
Domestic-year FE	✓	✓	✓	✓
Obs.	111,505,680	111,505,680	111,505,680	111,505,680
R^2	0.194	0.195	0.195	0.195

Source: Authors' calculations using the World Bank's Deep Trade Agreement, the WIOD, the UNCTAD IIA mapping and the ORBIS dataset.
Note: The table shows OLS regressions with high-dimensional fixed effects. In all columns, the dependent variable is binary, indicating the existence or not of any ownership link. The explanatory variables are Backward and Forward, PTA measures, Input specificity of the affiliate/parent, their interaction terms and BIT. PTA measures change by column: in column (1) PTA is a dummy variable, in column (2) we use PTAs' total depth, in column (3) we employ PTAs' core depth and in column (4) we use PTAs' WTO-X depth. Standard errors are clustered at country-industry-pair level and reported in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

4.1. Results for EU versus Non-EU Integration

Among the PTAs, one stands out for the large number of countries involved in what is the deepest PTA among all of them, and this is the EU. With a new member state joining, there is not only symmetric, free market access in all goods and services, but access is granted to all of the four *freedoms* in the EU's Single Market. These freedoms are about goods and services trade, capital mobility, labor mobility, and residence choice by households. In order for the Single Market to work, the national legal and institutional context needs to be adjusted, typically to a significant extent. This goes far beyond the consequences of a membership in the average PTA.

As said, the EU is special in terms of the number of its members. However, it is also special in terms of association agreements—PTAs with non-member countries. During our sample period, 2007–2015, one country joined the EU, namely Croatia, which became the 28th member of the EU in 2013. With this

event, the PTA indicator changed from zero to unity for 27 country pairs between 2012 to 2013 in the data (Croatia with the 27 incumbent members). But the EU also extended preferential goods-market access to outsiders such as South Korea in 2015.[11] The EU is also special in terms of its depth: its PTA-depth score is 0.60, while that score amounts to 0.44 for the average non-EU PTA in the data.

In this subsection, we address to what extent the results are driven by the EU's PTA activities. We do so by controlling for PTAs of the EU (i.e., those where at least one member of a new PTA is an EU country) separately from all PTAs. With this design, a significant parameter on the PTA measures with at least one EU partner would indicate that the EU induces a PTA-related stimulus on firm-to-firm ownership, which is significantly different from the average PTA.

Two tables in the supplementary online appendix pertain to this robustness check, one for log positive firm-to-firm ownership country and one to the propensity of any ownership. The corresponding results suggest that the findings presented above are not driven by the EU's PTAs alone. Furthermore, they suggest that those PTAs with at least one EU member also increase vertical ownership. Not surprisingly and consistent with the earlier findings, the effect is larger for deeper PTAs.

4.2. Timing of Effects

Regarding the main effects, two further issues may be important, and both relate to the timing of effects. Burstein and Melitz (2013) demonstrate that adjustment dynamics can be important for the extensive and intensive margins of firm-level and aggregate trade. Fahn et al. (2014) and Garetto, Oldenski, and Ramondo (2019) demonstrate that dynamic adjustment is an important feature of the network of affiliates of multinational firms.

Specifically, one might argue that companies plan their integration strategies with foresight, whereby announced PTA enforcement might trigger anticipation effects on firm-to-firm ownership (see Burstein and Melitz 2013 for a theoretical underpinning regarding exporters and Kogut and Kulatilaka 1994 for one regarding multinational firms). On the other hand, adjusting the affiliate network structure of a company's organization is costly (see Griffith and Gareth 2014; Lambrinoudakis 2016), which might trigger lagged responses to actual PTA enforcement.

In what follows, we attempt to address both arguments by running models which employ terms capturing lagged responses (sluggish adjustment) as well as forward-looking ones (anticipation effects). Specifically, we address sluggish adjustment by employing up to three lags of PTA enforcement in the regressions beyond the contemporaneous effects in the main analysis. Regarding anticipation, we include up to three forward leads of the PTA measures akin to the lags. In the interest of a condensed presentation, we present lead and lag results together in single tables.

Again, two tables in the supplementary online appendix pertain to this robustness check, one for log positive firm-to-firm ownership country and one to the propensity of any ownership. The corresponding results suggest that the effects of the main variables of interest—i.e., PTA-measures$_{ij,t}$ and the associated interaction terms—turn out robust when controlling for up to three lags and leads of PTA enforcement. The contemporaneous BITs effect turns out positive and statistically significant in this specification. The latter finds accord in the literature on BITs and FDI (see Egger, Erhardt, and Masllorens 2023).

5. Conclusion

In this paper, we investigate the effects of PTAs (and their depth) on firm ownership. Thanks to a unique and novel and very large data set that measures counts of ownership links at a country-and-sector-pair level, we can uncover interesting heterogeneities arising when a PTA comes into force. In particular, given

11 The EU also signed a free trade agreement with the prospective member Moldova in 2014, which came provisionally into force the same year.

the structure of our data, we can consider interactions of PTAs with sector-specific characteristics regarding value chains in determining firm-to-firm ownership.

Overall, we find a positive effect of PTAs (and their depth) on foreign firm ownership both for the frequency as well as the propensity of any ownership.

A second set of results is related to the direction of integration within GVCs. More concretely, after combining the ownership data with input-output coefficients from input-output tables, we are able to differentiate between horizontal and vertical and, for the latter, between forward and backward investment. Regarding log ownership counts, we only find a mildly positive effect of PTAs on horizontal and vertical forward integration. The strongest effects materialize for the propensity of any ownership. At this margin, we find a clear negative impact of PTAs on horizontal integration and a positive effect on vertical integration in both the forward and backward directions.

Finally, we shed light on the role of the specificity of inputs in conjunction with PTA membership for vertical integration. We find that a higher input specificity induces a larger positive effect of PTAs on the frequency of forward integration, while the opposite is true for backward integration. A higher input specificity raises the propensity of any integration in both the forward and the backward directions.

These results appear robust to a special treatment of European Union versus average PTAs and to the timing of effects allowing for anticipation of sluggish adjustment.

Data Availability Statement

The authors do not have permission to share data from Bureau van Dijk.

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