Global Value Chains and Deep Integration*

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Abstract

We explore how trade affects the design of preferential trade agreements (PTAs) and the role of global value chains (GVCs) in this process. We propose a theory that focuses on firms involved in backward GVC activities that export goods that are *sourced* rather than produced to identify the main actors pushing for deep trade integration. To address the critical issue of endogeneity of trade flows for trade policy, our identification strategy exploits a recent transportation shock: the sharp increase in the maximum size of container ships, which more than quadrupled between 1995 and 2017. The key variation in our instrument hinges on the fact that only deep-water ports can accommodate these new larger ships. Our strategy is flexible enough to generate excludable instruments for different value-added components of exports, which allows us to disaggregate the causal effect of GVC participation into backward and forward GVC activities. We find that trade through GVCs increases the probability of forming deep PTAs, and that this effect is mainly driven by backward GVC activities. Our results indicate that trade intermediation by producers is the main driver of deep preferential liberalization.

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1 Introduction

Both developed and developing countries are deeply involved in preferential trade liberalization. Approximately 700 preferential trade agreements (PTAs) are currently in force – up from roughly 100 in 1990. While tariff reductions on a preferential basis are a central feature of all bilateral and regional trade agreements, it has become increasingly common to include provisions that are not directly related to merchandise trade policies, such as those that liberalize and protect foreign direct investment (FDI) and open access to services markets. As a result, many PTAs have become deeper. They now regulate trade-related issues more extensively and more stringently than the World Trade Organization (WTO). Thus, PTAs have replaced the WTO has the main instrument that countries use to deepen trade policy cooperation. A consequence is that deeper integration of markets has occurred on a piecemeal basis, within subsets of countries that have made reciprocal commitments to open their markets to two-way flows of trade and investment on a preferential basis.

In parallel to the expansion of the number and depth of PTAs, growing firm-level specialization has fragmented the structure of global trade. The production of goods and services increasingly occurs through global value chains (GVCs) and international production networks managed by lead firms. Such production involves organizing activities that are dispersed across several countries. A range of idiosyncratic country-specific regulatory regimes affects how the associated cross-border flows of investment, technology, and production tasks and distribution activities are managed. These regimes in turn influence the feasibility and profitability of organizing cross-border production to capture economies of scale and reduce overall production costs (World Bank, 2020).

Assessing the causes of (deep) PTAs is important for understanding globalization and trade governance. Is there a causal link between the growth of GVC production and the proliferation of deep(er) PTAs? Some have argued that deep PTAs are needed to support GVCs, i.e., that deep integration drives value chain investment and production. Others point out that GVCs have expanded during periods and in regions where the main countries involved did not have deep PTAs with each other, which they argue demonstrates that unilateral trade opening, technological changes and export-oriented development strategies drove the rise of GVCs. These two views are not inconsistent: autonomous market opening may boost trade up to a point but then require international cooperation to reduce policy uncertainty and the costs of regulatory heterogeneity.

In this paper we explore how trade affects the design of PTAs and the role of GVCs. A well-established literature claims that deep PTAs reflect the needs and interests of multinational enterprises (MNEs) (Mattli, 1999; Chase, 2003; Manger, 2009; Blanchard and Matschke, 2015; Rodrik, 2018; Blanga-Gubbay et al., 2020). Building on recent contri-

butions in economics (Bernard et al., 2019; Erbahar and Rebeyrol, 2023), we focus on backward GVC activities – particularly trade intermediation by producers (TIP), which are implemented by firms that export goods that are sourced rather than produced domestically. We argue that backward GVC activities are particularly vulnerable to high trade costs, and that the provisions included in deep PTAs – such as services liberalization and protection of investment – help lower some of these costs. Anticipating the benefits from deep trade integration, we expect that firms involved in backward GVC activities push for PTAs that include these cost-reduction provisions.

To address the critical issue of endogeneity of trade flows for trade policy, we apply a novel instrument for trade based on Altomonte et al. (2018). Our identification strategy exploits a recent transportation shock: the sharp increase in the maximum size of container ships, which more than quadrupled between 1995 and 2017. The key variation in our instrument hinges on the fact that only deep-water ports (DWPs) can accommodate these new larger ships. Our strategy is flexible enough to generate excludable instruments for different value-added components of exports, which allows us to disaggregate the causal effect of backward vs. forward GVC activities.

We use this identification strategy to estimate the causal effects of gross and value-added trade on a synthetic indicator of PTA depth and on many dimensions of PTA design, including services liberalization, investment provisions, and competition as well as non-trade issues. To build a broad and comprehensive portfolio of outcome variables, we use the Design of Trade Agreements (DESTA) database (Dür et al., 2014a), which contains synthetic indicators of PTAs' depth as well as more specific indicators that capture the presence of trade-related provisions.

We find that trade through GVCs increases PTAs' depth. This effect is mainly driven by the foreign (rather than domestic) value-added component of exports. Our results also reveal that trade through GVCs has heterogeneous effects on the probability of including broadly identified depth dimensions across multiple issue areas. However, we find that trade associated with backward GVC activities systematically increases the probability of including a number of depth dimensions (namely investment, services and competition) as well as chapters and provisions related to environmental standards. Finally, we show that when looking at specific issue areas, trade through backward GVC activities tends to have a larger effect than forward GVC activities, which do not include TIP.

The size of our estimated causal effect is remarkable. When we take our most conservative estimate, moving the foreign value-added (FVA) component of bilateral exports in any sector by two standard deviations increases the depth of the bilateral trade policy relationship by 35% of the average depth in our sample. This effect roughly corresponds to a shift from the depth of the EC-Jordan Euro-Med Association Agreement (at the

67^{th} percentile in the unconditional distribution of depth based on all agreements coded in DESTA) to that of the EC Europe Agreements with Estonia, Latvia and Lithuania (78^{th} to 81^{st} percentile). These agreements were all signed during the second half of the 1990s, but the Europe Agreements are much deeper and more comprehensive as they were seen as paving the way for accession to the European Union. The EC-Jordan Association Agreement does not cover regulatory areas, and does not address important issues such as government procurement or introduce any significant level of commitment in services and investment liberalization.

Our paper advances three streams of research. First, we contribute to the literature claiming that preferential liberalization moves hand in hand with and responds to the growing importance of FDI, offshoring and GVCs (Mattli, 1999; Chase, 2003; Blanchard, 2007; Manger, 2009; Blanchard, 2010; Baldwin, 2011; Antràs and Staiger, 2012; Blanchard and Matschke, 2015; Baccini et al., 2017; Blanchard et al., 2017; Bown et al., 2020). To the best our knowledge, our study is the first to show that trade through GVCs has a causal effect on the depth of PTAs and the inclusion of specific issue areas, chapters or provisions that facilitate global production activities.

Second, our paper is related to a large body of research that assesses how PTAs affect trade and FDI. With few exceptions (Rose, 2004), this literature has found that PTAs have a large effect on trade flows between partner countries (Baier and Bergstrand, 2007; Büthe and Milner, 2008; Mansfield and Reinhardt, 2008; Baier et al., 2014; Büthe and Milner, 2014; Dür et al., 2014b; Egger and Nigai, 2015; Osnago et al., 2017; Miroudot and Rigo, 2019; Laget et al., 2020; Kox and Rojas-Romagosa, 2020). Our results highlight that reverse causality is at play, which could lead to *overestimating* the impact of preferential liberalization on trade activities.

Third, and more generally, this paper contributes to the literature on the legalization and rational design of international institutions (Abbott et al., 2000; Koremenos et al., 2001). We find empirical support for the hypothesis that trade agreements are designed in response to the preferences and interests of domestic economic actors involved in shaping the structure of GVC trade. Our results suggest that interest groups with stakes in GVC trade have a large influence not only over *whether* we observe cooperation between countries, but also over the *type* of cooperation we observe, e.g. deep or shallow integration. In this regard, our findings also indicate that in an era of uncertainty and economic disruptions (Goldberg and Reed, 2023), a retrenchment of GVCs would inevitably lead to a slowdown of deep trade integration, since this would change the incentives of the actors involved in backward GVC activities.

2 Argument

Multinational corporations and deep trade integration

Why do countries engage in preferential liberalization? In the international trade and political economy literature, there is growing consensus that the activities of multinational corporations involved in GVCs such as offshoring and vertical FDI and the resulting splintering of production and value-added trade are the main driver of the formation of deep PTAs (Mattli, 1999; Baldwin, 2011; Antràs and Staiger, 2012; Rodrik, 2018). PTAs are appealing to economic actors involved in GVCs for at least three reasons.

First, preferential liberalization cuts tariffs on intermediate goods, which constitute the core of vertical FDI, i.e. intra-firm trade. In doing so, PTAs reduce the production costs for multinationals, which move parts and components between countries to exploit locational advantages. There is convincing empirical evidence to support this mechanism (Chase, 2003; Blanchard and Matschke, 2015). Second, the new generation of PTAs includes a large number of investment provisions, which protect multinationals' assets in host markets. Similarly, PTAs include provisions that liberalize the service sector, allowing large productive companies operating in the banking, insurance, and pharmaceutical sectors to enter foreign markets and further increase their profits. Manger (2009) documents qualitatively how multinationals from major (North) countries compete with each other to negotiate PTAs including these trade-related provisions with important host (South) economies to gain an edge over their direct competitors.

Third, the new generation of PTAs includes strict dispute settlement mechanisms that facilitate the enforcement of the treaty commitments. (Maggi and Rodriguez-Clare, 1998) builds on a seminal piece in economics Mattli (1999) to explain that PTAs help governments credibly commit to liberalization and investment protection through the *pacta sunt servanda* mechanism provided by trade cooperation. The presence of credible commitments is in line with the preferences of multinationals involved in GVC activities, since they face the highest risk of direct and indirect expropriation. Indeed, Kim (2012) shows that the presence of GVCs is correlated with the inclusion of strong dispute settlement mechanisms.

We build on this literature to propose an argument that breaks down firms'participation in GVCs into different economic activities. We then make the case that a specific set of GVC activities creates strong incentives to advocate deep trade integration. Our argument allows us to identify which GVC activities are particularly likely to trigger a push for deep PTAs, and to explain why firms involved in these activities have incentives to demand deep trade integration.

The role of backward GVC activities

We begin by making what we believe are two innocuous assumptions. First, if interest groups are not lobbying for further trade liberalization, governments have few incentives to pursue it, given the strong protectionist preferences of import-competing industries and domestic (non-exporting) producers. This assumption is largely in line with Grossman and Helpman's (1994) protection for sale, which is the workhorse of political economy theory. Second, interest groups that anticipate gains from trade have incentives to promote further trade liberalization. This assumption is common in the political economy literature of trade, and it implies that the winners from trade liberalization favor further economic integration, whereas losers oppose it.

Our argument hinges on a specific set of firms involved in GVCs: those involved in *backward* GVC activities, which refers to the ratio of the *foreign value-added* (FVA) *content of exports* to the economy's total gross exports. The FVA content of exports corresponds to the value added of inputs that were imported to produce intermediate or final goods (including services) to be exported.[1] Forward GVC activities correspond to the ratio of the *domestic value added sent to third economies* to the economy 's total gross exports. This concept captures the domestic value added contained in inputs sent to third economies for further processing and export through supply chains.[2]

Previous research has mainly focused on a specific type of backward GVC activity: foreign intermediate inputs for exported good (FIE). These foreign intermediate inputs are used to produce domestic goods, a share of which are exported and therefore constitute *forward* GVC activities. Building on recent contributions in economics (Bernard et al., 2019; Erbahar and Rebeyrol, 2023), we note that many firms export goods that are sourced rather than produced domestically. The sourced portion of exports is considered trade intermediation by producers (TIP). Erbahar and Rebeyrol (2023) decompose TIP into two components: 1) purely intermediated (PI) and 2) carry-along trade (CAT). PI refers to firms exporting products that they have not produced; therefore they serve as intermediaries. Using firm-product-level data from Turkey, Erbahar and Rebeyrol (2023: 1) find that "88% of products were purely intermediated by at least one manufacturing exporter" and that "this trade represented 36%–43% of aggregate exports by manufacturers."

CAT refers to exports of goods where the firm exports *more* than it produces domestically. The key difference between PI and CAT is that while firms involved in PI have a purely intermediary role, those involved in CAT export both sourced products and produced goods to foreign markets. For instance, if company A exports coffee (which it produces) as well as related goods such as coffee vending machines, plastic cups, and spoons (which

[1] It is also referred to as *vertical specialization* when expressed as a percentage of gross exports.
[2] It is also referred as the *seller* perspective or supply side in GVC participation.

it sources from external suppliers), it is selling a bundle of goods for the coffee room that all feature its brand name and are carry-along products. Using Belgian firm-level data, Bernard et al. (2019: 526) find that CAT "is widespread and important, occurring at more than 90 percent of exporters, appearing in more than 95 percent of exported products and accounting for more than 30 percent of export value." Importantly, they document that firms engaged in CAT are the most productive.

Firms involved in PI and CAT also tend to export a significantly larger number of goods compared to firms that only export goods they produce themselves. The average firm involved in PI and CAT exports 4–5 times more goods that the average firm that is not involved in PI and CAT (Bernard et al., 2019; Erbahar and Rebeyrol, 2023). For 'superstar' exporters, these differences are even more striking.

Previous studies have explained that CAT occurs due to demand–scope complementarities: bundling goods that are produced and sourced together increases their consumption. Both PI and CAT are also explained by supply-side advantages. The most productive firms (those involved in CAT and PI) are better equipped to overcome the many hurdles associated with serving foreign markets.[3]

We argue that firms involved in backward GVC activities are the main actors pushing for deep preferential trade liberalization. The first part of our argument is about trade costs that we maintain are more relevant for firms participating in backward GVCs than for other firms. We make this first part of the argument in the following steps:

1. To begin with, firms involved in backward GVC activities depend heavily on trade, because they import *and* export goods. A large share of their exports comes from imported goods, unlike firms engaged in forward GVC activities, which produce goods locally. This strong trade dependence holds for firms involved in FIE, PI, and CAT.

2. Because of their role as intermediaries, firms involved in PI and CAT are particularly affected by trade costs. High trade costs increase the production costs of firms involved in PI and CAT, reducing the demand for their sourced and produced goods. Because both types of goods are bundled together, high trade costs have a multiplier effect for firms involved in PI and CAT. This multiplier effect does not apply to firms engaging exclusively in FIE and forward GVC activities, which do not source goods.

3. High trade costs also affect the supply side, reducing the efficiency of the distribution and production networks on which firms involved in PI and CAT rely. At the extreme, if trade costs are too high, final buyers have incentives to purchase goods from the original suppliers, bypassing firms involved in PI and CAT. The risk of

[3]We acknowledge that better access to FIE is also associated with productivity boosts (Halpern et al., 2015).

bypassing is more limited for FIE and domestic value added, for which there may be no other suppliers.

We then argue that deep PTAs lower the trade costs of firms involved in backward activities in general, and in PI and CAT in particular. In addition to lower traditional tariffs, which reduce the prices of goods and in turn boost demand for them, firms involved in PI and CAT also demand the inclusion of provisions that protect investment, liberalize services, and foster competition. These provisions lower the costs of trade, helping firms involved in PI and CAT strengthen their supply-side advantage. Take services liberalization, for instance. Liberalizing transportation and retail trade increases the efficiency of the production and distribution networks on which firms involved in PI and CAT rely. Moreover, protection of investment lowers the costs for subsidiaries operating in the foreign markets in which firms involved in PI and CAT sell their sourced products, which further strengthens the production and distribution networks of firms participating in backward GVCs activities. Furthermore, agreeing on uniform environmental and labor standards reduces the transaction costs of these firms, which source goods and inputs abroad.

Unlike traditional tariffs, which apply to a specific tariff line, provisions included in deep PTAs regulate the whole economy. Recall that firms involved in PI and CAT export a significantly larger variety of goods than exporters that only sell what they produce.[4] Thus, without undermining the importance of traditional tariffs, we argue that firms involved in backward GVC activities are particularly likely to benefit from a reduction of trade costs that cut across different industries, which is exactly what provisions (such as investment protections or service liberalization) included in deep PTA deliver. Anticipating these benefits from deep trade integration, we expect that firms involved in GVC activities in general, and in PI and CAT in particular, push for PTAs that include these provisions.

In sum, our argument's main testable implication is that *as backward GVC activities increase, countries are more likely to form deep PTAs.* We also expect that, in explaining deep preferential trade integration, backward GVC activities carry a significantly larger weight than forward GVC activities. We also expect that both backward and forward GVC activities increase the probability of forming deep PTAs more than gross exports.

3 Data and Empirical Strategy

Our empirical exercise uses three trade indicators as independent variables. Trade data are sourced from the 2021 release of the Organisation for Economic Co-operation and

[4]This can also apply to FIE. Better access to foreign inputs may be associated with the introduction of new output varieties (Goldberg et al., 2010) as well as product switching, which may make firms less concerned about a specific tariff line (Amiti and Konings, 2007).

Development (OECD) Trade in Value-Added (TiVA) database, which provides bilateral gross and value-added trade flows for 66 countries and 45 sectors during the period 1995–2018. Appendix Tables A-1 and A-2 list the countries and sectors included in the dataset, which comprises the country and sector coverage of our estimation sample. The first independent variable is a measure of sector-specific gross exports from an origin country i to a destination j in sector z at time t (*Gross Exports*). We also use two standard measures of forward and backward GVC activity. Domestic value added (*DVA*) represents the domestic value added of gross exports generated in the domestic economy of i and is embedded in the gross exports from i to j.[5] This variable captures forward GVC activity. The *FVA* indicator represents the value added embedded in an industry-specific trade transaction between an exporter i and an importer j coming from anywhere in the world except i and j.[6] The FVA measure captures backward GVC activity.

Taken together, the three predictors capture the key trade-based incentives that could motivate two countries to choose higher degrees of depth in a trade agreement. Exporter i and importer j might care about depth in their trade policy relationship due to: i) the gross value of the trade flows from i to j (Gross Exports); ii) the value added generated by i and embedded in the exports from i to j (DVA); and iii) the value added generated from anywhere else in the world that can be accessed through the gross imports by j from i (FVA).

Our outcome variables consist of indicators that capture relevant dimensions of the trade policy regime involving i and j as potential signatories of one or more PTAs active at time t. We begin our analysis using a synthetic measure of the depth of PTAs sourced from the DESTA database. This corresponds to the continuous indicator constructed by Dür et al. (2014b) through latent trait analysis of 49 specific variables that are theoretically related to the depth of an agreement.[7] We rescaled the original indicator so that its minimum value over the distribution of all agreements recorded in DESTA equals 0. Due to the country and time coverage of our econometric exercise (see below), the shallowest agreement considered in our estimation sample has a value of the rescaled DESTA indicator that is strictly larger than 0. For each country pair ij at each point in time t, we define Depth_{ijt} as the maximum value between 0 and the value of the rescaled DESTA continuous indicator of the most recent PTAs signed by countries i and j that are active at time t.

The resulting set of specifications used to study how trade and GVCs affect PTA depth

[5]For more details on the construction of the variable, see the description of EXGR_DVA in the Guide to OECD TiVA Indicators.

[6]The FVA variable was constructed starting from the IMGR_BSCI variable, presented in the Guide to OECD TiVA Indicators.

[7]For more details on the construction of the variable, see the description of *depth_rasch* in the DESTA Indices Explanatory Notes

is given by:

$$\text{Depth}_{ijt} = \beta X_{ijtz} + \gamma_{itz} + \gamma_{jtz} + \gamma_{ijz} + \varepsilon_{ijtz} \quad (1)$$

for each variable X_{ijtz} among Gross Exports$_{ijtz}$, Domestic Value$_{ijtz}$, *and* Foreign Value$_{ijtz}$. The terms γ_{itz}, γ_{jtz} and γ_{ijz} denote exporter-time-sector, importer-time-sector and exporter-importer-sector fixed effects, respectively; ε_{ijtz} is the error term.

As a second step in our empirical exercise, we unpack the synthetic indicator of depth and study the effect of trade and GVCs on seven dimensions of depth. These seven dichotomous variables are taken from the DESTA dataset, and represent key provisions that can be included in a given PTA (Dür et al., 2014b). The first provision captures whether the agreement foresees a reduction of all tariffs. The remaining six indicate whether the agreement goes beyond reducing tariffs to introduce cooperation in the realms of: i) standards (Technical Barriers to Trade and Sanitary and Phytosanitary measures), ii) investment, iii) services, iv) public procurement, v) competition, and vi) intellectual property rights. Together, these are used to construct an additive index of depth, found in DESTA. They are thus referred to as "indices." Four additional outcome variables capture depth dimensions related to non-trade issues. These binary indicators are also sourced from the DESTA dataset. Two of them indicate whether an agreement refers to environmental and labor standards. The remaining two indicate whether the agreement contains separate chapters on labor and environmental standards.

The analytical focus on the seven dimensions of depth provided by the DESTA indices reflect the conceptual framework discussed in Section 2, where the design of PTAs is seen as a function of the needs and interests of economic actors involved in GVCs, notably MNEs. We can thus expect indices on trade in services, investment policies and competition, and procurement and intellectual property rights to be particularly relevant for MNEs. Our analysis also takes into account many other features of PTA design that might also be very pertinent to MNEs, such as non-trade issues including labor rights or environmental protection.

Each of the outcome binary indicators Y takes a value of 1 for a country pair ij at time t if there is at least a PTA signed by both i and j that is active at t and includes the relevant chapter or provision. [8] When more than one agreement is active at the same time, we use the maximum value of the depth indicator.

For each outcome variable Y, we fit a set of linear probability models given by the following

[8] For a detailed description of the outcome variables used, please refer to the DESTA Indices Explanatory Notes and DESTA Codebook. The relevant variables are: *full_fta*, *standards*, *investments*, *services*, *procurement*, *competition* and *iprs* (for the DESTA indices); *nti_labor* and *nti_labor_chapter* (for labor standards); *nti_env* and *nti_env_chapter* (for environmental standards).

equations:

$$\mathrm{Y}_{ijt} = \beta X_{ijtz} + \gamma_{itz} + \gamma_{jtz} + \gamma_{ijz} + \varepsilon_{ijtz} \tag{2}$$

for each $X_{ijtz} \in \{\text{Gross Exports}_{ijtz}\ \text{Domestic Value}_{ijtz}\ \text{Foreign Value}_{ijtz}\}$, where γ_{itz}, γ_{jtz}, γ_{ijz} and ε_{ijtz} are defined as in Equation 1 above.

3.1 Instrumental variable identification strategy

Specifications 1 and 2 are both affected by endogeneity of the trade and GVC performance variables. We address this problem by instrumenting gross exports and its value-added components with the respective flows predicted by a gravity model augmented with three triple interactions. The first two elements of each interaction term are always the same and consist of 1) the maximum size of container ships operating in a given year and 2) the number of ports in the destination country that can accommodate the largest ship from the sample period (normalized by the number of kilometers of coastline). The third factor in the interactions is one of three dyadic controls normally included in the gravity specification: logarithm of the bilateral distance, a dummy for contiguity, and a dummy for land-lockedness. This approach seeks to generate – for each endogenous trade variable – a corresponding instrument whose variation, adequately cleansed of all sources of confounding heterogeneity, only reflects drivers of trade performance that are completely exogenous to the design of trade agreements.

Formally, for each $X_{ijtz} \in \{\text{Gross Exports}_{ijtz}\ \text{Domestic Value}_{ijtz}\ \text{Foreign Value}_{ijtz}\}$ we construct the respective instrument as the predicted values $\hat{X}_{ijtz}$ from a gravity specification estimated with Poisson pseudo maximum likelihood where X_{ijtz} is the dependent variable and the right-hand side features exporter-time-sector (itz), importer-time-sector (jtz), and exporter-importer-sector (ijz) fixed effects and the column vector $\mathbf{Z}_{ijt}$ defined as follows:

$$\mathbf{Z}_{ijt} = DWP_j \times \log MaxSize_t \begin{bmatrix} Distance_{ij} \\ Contiguity_{ij} \\ Landlocked_{ij} \end{bmatrix} \tag{3}$$

We gathered the data used to construct these instruments from different sources. The standard gravity bilateral variables (Distance, Contiguity and Landlocked) are sourced from the CEPII database (Head et al., 2010). The variables $MaxSize_t$ and DWP_j are from Altomonte et al. (2018).[9] $MaxSize_t$ is the maximum size of container ships expressed in TEU.[10] The sharp increase in this variable from 5,000 to 20,500 TEU from 1995 to 2017

[9] Table B-1 reports the estimation results from the gravity exercise.

[10] TEU stands for twenty-foot equivalent unit, which is a unit of cargo capacity generally used to describe the capacity of container ships and container terminals; 1 TEU corresponds to the capacity to accommodate one standard intermodal container which is 6.1 meters (20 ft) long and 2.44 meters (8 ft) wide. There is no precise standard for height, although the most common measure is 2.59 meters (8.6

is the key exogenous variation for our identification strategy. Altomonte et al. (2018) show that market operators widely adopted the new larger ships during the same period, which allowed this technological innovation to immediately affect trade flows. Larger ships have deeper maximum drafts (i.e. the distance between the waterline and the lowest point of the keel) and therefore can only access ports where the water is deep enough (i.e., deep water ports).

The variable DWP_j equals the number of ports in partner country j that have had a water depth of at least 16 meters[11] since 1995 as well as a container terminal, divided by the length of the country j's coastline (in kilometers), both of which are required to accommodate, load and unload the new container ships introduced between 1995 and 2017. Altomonte et al. (2018) collected the raw data on 3,528 ports in the 40 countries covered in World Input–Output Database using multiple sources and techniques, including text analysis of the website `worldportsource.com` and email and phone interviews. They identified 47 DWPs that meet our two identification criteria – i.e., depth of at least 16 meters and presence of a container terminal – for the sample period.[12]

The term $DWP_j \times \log MaxSize_t$ in equation 3 reflects the main intuition informing our identification strategy: using larger ships decreases transportation costs, and increases exports to countries that have more DWPs. Our identification thus relies on the exogenous shock to transportation costs embedded in the composition of two factors: the presence of DWPs in partner countries and the increase in the size of container ships over time. The vector of dyadic variables used to construct $\mathbf{Z}_{ijt}$ allows this shock in transportation technology to shape bilateral gross and value-added trade flows differently depending on the bilateral distance, contiguity, and land-lockedness of each pair of trading partners. The main effect of these variables on PTA design is subsumed in the fixed effects and therefore poses no threat to the exclusion restriction. We ultimately use the variation given by these triple interactions for identification. The excludability of the resulting instrumental variables rests on the assumption that, conditional on controls (including fixed effects subsuming observable and unobservable heterogeneity at the it, jt and ij levels), the composition of the three factors in each element of $\mathbf{Z}_{ijt}$ only affects the design of PTAs through their impact on gross and value-added trade flows.

We are confident that this is the case. Assume, for instance, that the investment required to construct a DWP in country j came largely from country i. Given that we only focus on DWPs that operated throughout our sample period, this would create an ij-specific tension such that the pre-sample investment of i in j's DWP could shape the incentives

ft), to fit into railway tunnels.

[11]The depth has to be at least 16 meters both at the quays where ships get loaded/unloaded and at the canal that must be used to access the quays. We chose this depth because Tthe largest series of ships introduced during our sample period have a maximum draft of 16 meters.

[12]See Altomonte et al. (2018) for further details and descriptives on the construction of the instrument.

to deepen the investment dimension in ij's bilateral policy relationship through trade agreements, thus making the number of DWPs in j endogenous to the depth of PTAs between i and j. However, this is not an issue for our identification because the dyadic fixed effects control for the ij-specific tension. Another concern arises from potential linkages among PTAs. For instance, the depth of a PTA signed during the sample period may be a function of the design of previous PTAs that legally constrained the negotiating space of one or more signatories to the new agreement. Therefore, the fact that new PTAs are deep(er) than the average agreement may be rooted in a period prior to the shock, thus conferring exogenous variation on our instrument. We address this endogeneity potential concern by including a demanding battery of fixed effects: our identification strategy allows us to control for any i or j or even ij idiosyncratic constraints in negotiating new agreements from the pre-sample period.

3.2 Estimation sample

Combining all data sources to fit our regression equations generated a panel of 4,440,150 observations featuring 66 reporting and partner countries, and up to 45 sectors for the period 1995–2017. Given this sample, the information on trade policy used to construct our dependent variables comes from agreements signed until 2017 in which at least two signatories belong to the sample of 66 OECD TiVA countries (n = 419 of the more than 600 agreements in the DESTA dataset). Appendix Table A-3 reports summary statistics for the main variables used in the regression analysis.

4 Trade, GVCs and Depth

We start by presenting our estimation results from the exercise that investigates the causal effect of trade and GVC intensity on the broad and comprehensive indicator of depth from the DESTA database.

4.1 Baseline results

Table 1 reports the two-stage least-squares (2SLS) estimated coefficients of equation 1 specified for each of the three independent variables of interest – Gross Exports, Domestic Value and Foreign Value – instrumented with their augmented gravity predicted values as illustrated in Section 3.1. The results reveal that all independent variables have a positive and statistically significant causal effect on depth (columns 1–3).[13] In terms of magnitude, the results suggest the importance of FVA, which proxies backward GVC activity, as compared to domestic value-added and gross exports in driving the increased depths of PTAs.

[13]The Cragg-Donald test on the baseline estimates does not suggest concerns for underidentification.

To illustrate the economic meaning of these point estimates, consider the example of increasing the FVA component of bilateral exports in any sector by two standard deviations. This corresponds to a change of roughly USD 500 million – the difference between the average FVA content of French sector-level exports to Germany over our sample period and that of Lithuanian exports to South Korea. According to our estimate, the effect of this rise in GVC activity would be an increase in the level of PTA depth equivalent to 35% of the sample average. This effect roughly corresponds to moving from the depth of the EC-Jordan Euro-Med Association Agreement (at the 67^{th} percentile in the unconditional distribution of depth out of all agreements coded in DESTA) to that of the EC Europe Agreements with Estonia, Latvia and Lithuania (78^{th} to 81^{st} percentile). As noted above, this increase in depth is significant: the EC-Jordan Association Agreement does not incorporate commitments on services trade and investment liberalization of the type found in the Europe Agreements, which were a stepping stone for accession to the European Union and thus engage more deeply and comprehensively with many trade-related issue areas (Hoekman and Djankov, 1997).

Table 1: Trade, GVCs and Depth – Baseline estimates

Outcome variable	Depth		
	(1)	(2)	(3)
Gross Exports	0.9005***		
	(0.2796)		
Domestic Value		0.9662***	
		(0.3528)	
Foreign Value			9.3466***
			(2.3361)
Observations	4,440,150	4,440,150	4,440,150
ITZ FEs	YES	YES	YES
JTZ FEs	YES	YES	YES
IJZ FEs	YES	YES	YES
KL F-stat	45.19	39.44	81.11
KP LM underid.	12.45	11.45	15.01
Effect of $\hat{X}$ on Y	1.046	0.884	2.408

Notes: The independent variables include a measure of gross exports and two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value captures backward GVC activity, whereas Domestic Value measures forward GVC activity. The three variables are sourced from the OECD TiVA dataset. The dependent variable provides a synthetic measure of the maximum level of depth for PTAs including countries i and j as signatories and active in time t. The variable is sourced from the DESTA database. Section 3 describes each variable included in the model. Standard errors are clustered by dyads (i-j) and are reported in parentheses. *Effect of $\hat{X}$ on Y* is computed by multiplying each coefficient by two times the standard deviation of the relevant independent variable. First stage results are reported in Appendix Table B-2.
*** p<0.01, ** p<0.05, * p<0.1

The results suggest that FVA embedded in gross exports is the key dimension of GVC performance shaping the broad and comprehensive value of PTAs' depth. This is consistent with the idea that the FVA embedded in gross exports from i to j directly reflects the incentives of economic actors that are active in GVCs beyond the bilateral trade relationship at stake (such as foreign suppliers to, or vertically integrated multinationals active in, the exporting country) and therefore captures additional pressures for deeper integration. Moreover, from the perspective of economic actors in importing country j, high FVA embedded in i's exports to j reveals i's role as a hub for FVA ultimately reaching j's market and therefore potentially incentivizing stronger incentives for deep integration

with i. Gross exports seem to have a smaller effect on the broad and comprehensive Depth indicator, which reinforces the notion that GVC activities such as offshoring and vertical FDI are the main trade dimensions influencing the incentives to negotiate deeper PTAs.

4.2 Robustness tests

We now test the baseline results presented above with seven robustness checks. We start by manipulating our sample. First, we replicate the baseline specification after removing all country pairs that include China from the estimation sample. The results reported in Table 2 strongly confirm the baseline patterns, which increases our confidence that our findings are not driven by the rapid rise of Chinese trade during our sample period.

Table 2: Trade, GVCs and Depth – Removing China

Outcome variable	Depth		
	(1)	(2)	(3)
Gross Exports	0.8788***		
	(0.2767)		
Domestic Value		0.9743***	
		(0.3532)	
Foreign Value			7.1726***
			(1.7920)
Observations	4,305,600	4,305,600	4,305,600
ITZ FEs	YES	YES	YES
JTZ FEs	YES	YES	YES
IJZ FEs	YES	YES	YES
KL F-stat	42.90	37.11	71.28
KP LM underidentification	12.25	11.27	14.16
Effect of $\hat{X}$ on Y	0.823	0.731	1.425

Notes: The independent variables include a measure of gross exports and two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value captures backward GVC activity, whereas Domestic Value measures forward GVC activity. The three variables are sourced from the OECD TiVA dataset. The dependent variables provide a synthetic measure of the maximum level of depth for PTAs including countries i and j as signatories and active at time t. The variable is sourced from the DESTA database. Section 3 describes each variable included in the model. Observations including China as importer or exporter are dropped. Standard errors are clustered by dyads (i-j) and are reported in parentheses. *Effect of $\hat{X}$ on Y* is computed by multiplying each coefficient by two times the standard deviation of the relevant independent variable.
*** p<0.01, ** p<0.05, * p<0.1

In a second exercise, we re-estimate the results excluding dyadic observations that include two member states of the European Union (EU) (Table 3). To do so, we re-code EU member states and assign them to the same ID starting from the year of accession. This allows us to test whether our findings are driven by the presence of agreements between EU member states. The results confirm our baseline estimates, suggesting a strong effect of Foreign Value on the level of depth. [14]

Additionally, we test that our baseline results are consistent with the causal effects estimated preserving variation across the ijz dimension for identification. Those estimates, reported in Appendix Table C-1, reveal a strong, positive and statistically significant effect

[14] We conduct additional tests to further account for the presence of multiple EU member states in our sample. We re-estimate the results by keeping only one EU member state at a time. We also cluster the standard errors for the whole EU, which increases the standard errors of about three times but still returns significant results.

Table 3: Removing EU Dyads

Outcome variable	Depth		
	(1)	(2)	(3)
Gross Exports	4.0222***		
	(1.3918)		
Domestic Value		5.0103***	
		(1.7361)	
Foreign Value			30.6084***
			(9.9942)
Observations	3,914,460	3,914,460	3,914,460
ITZ FEs	YES	YES	YES
JTZ FEs	YES	YES	YES
IJZ FEs	YES	YES	YES
KL F-stat	5.734	5.611	7.722
KP LM underidentification	11.61	11.66	15.30
Effect of $\hat{X}$ on Y	4.757	4.690	7.766

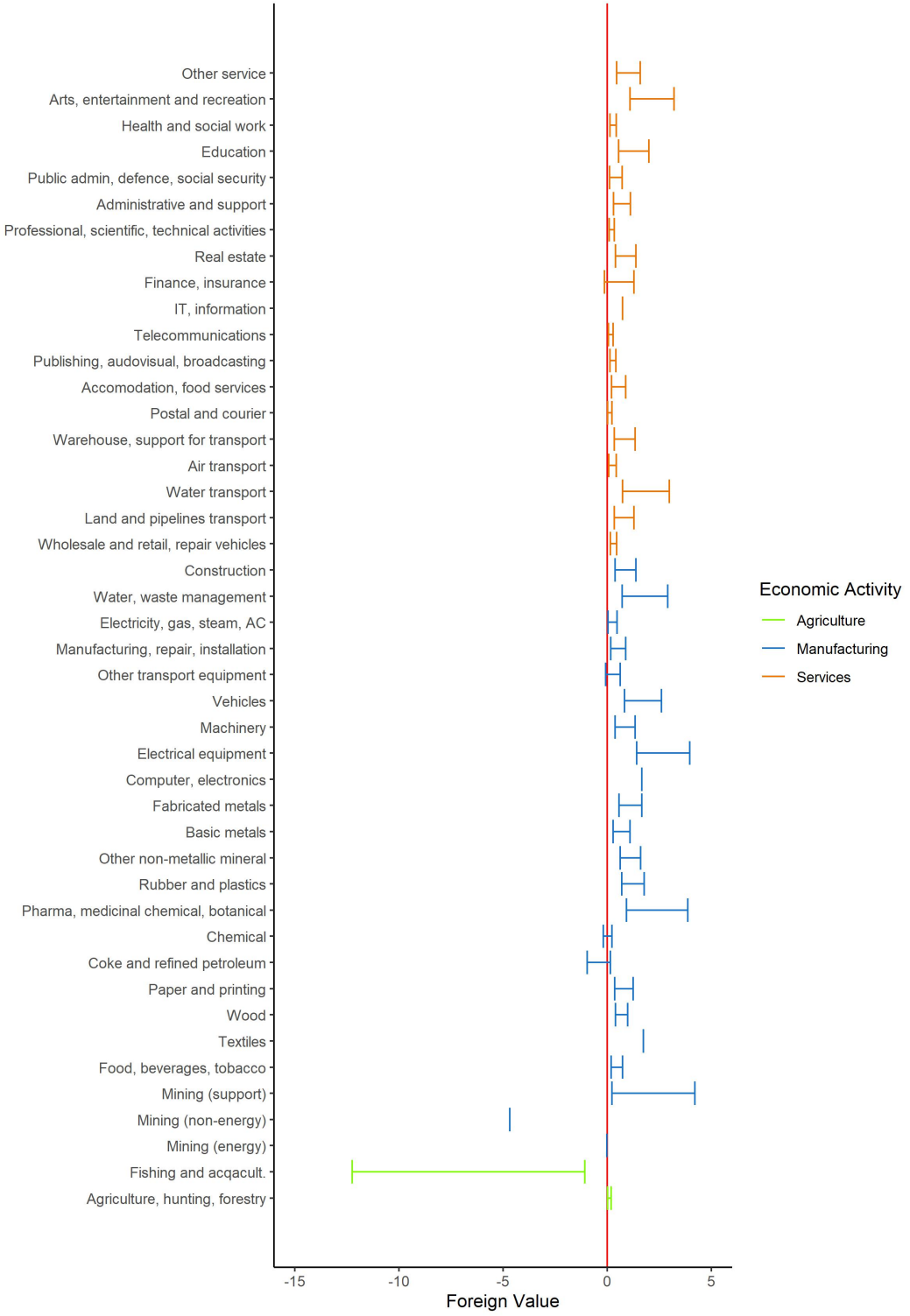
Notes: The independent variables include a measure of gross exports and two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value captures backward GVC activity, whereas Domestic Value measures forward GVC activity. The three variables are sourced from the OECD TiVA dataset. The dependent variables provide a synthetic measure of the maximum level of depth for PTAs including countries i and j as signatories and active at time t. The variable is sourced from the DESTA database. Section 3 describes each variable included in the model. Observations including EU member states as importers and exporters are dropped. Standard errors are clustered by dyads (i-j) and are reported in parentheses. *Effect of $\hat{X}$ on Y* is computed by multiplying each coefficient by two times the standard deviation of the relevant independent variable.
*** p<0.01, ** p<0.05, * p<0.1

for all three trade and GVC regressors. While these results support the baseline findings in Table 1, the specifications without ijz fixed effects are prone to potential endogeneity issues, as discussed in Section 3.1, and thus may overestimate the extent to which trade and GVCs affect depth. The results presented in Table 1 are thus our preferred set of estimates.

We further explore the effects of GVC activity across different sectors. We notice two things. First, the effect of backward GVC activity is generally larger across sectors. This can be seen by applying our baseline model to each sector and comparing the coefficients estimated for Foreign Value (Figure 1) and Domestic Value (Figure 2). This is in line with our baseline results. Second, we observe that effect is particularly larger for services (Figure1).

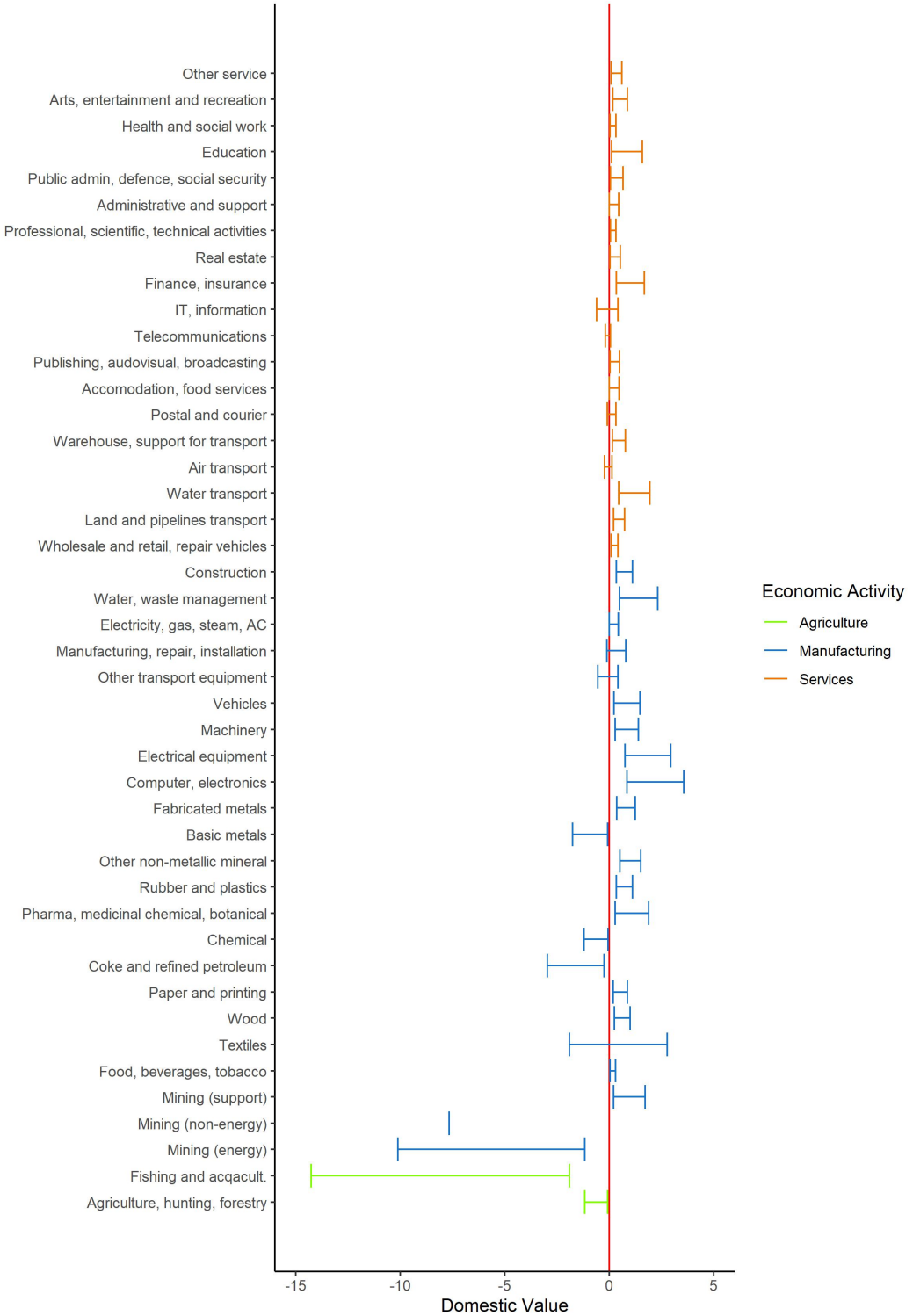
We conduct three additional tests to check the robustness of our findings. First, our baseline findings do not change when the inference on the point estimates is conducted using standard errors clustered at the ijz level (Appendix Table C-2). Second, we estimate the results on two subsets of the dataset (pre-2007 and post-2007), and the results are consistent with those estimated for the whole sample (Appendix Tables C-3 and C-4). Third, we test the robustness of the results by estimating local effects. The depth variable takes value 0 if there is no agreement between countries i and j. We re-estimate the results on a subset of country pairs that signed a trade agreement as coded in DESTA. The results are consistent with our baseline estimates (Appendix Table C-5)

Figure 1: Sectoral Breakdown – Foreign Value and Depth



Notes: The Figure shows 2SLS estimates and 95% confidence intervals for models regressing Depth on Foreign Value in each OECD TiVA sector. The sectors are colored based on aggregation in three areas of economic activity. The aggregation was performed following the International Standard Industrial Classification of All Economic Activities (ISIC).

Figure 2: Sectoral Breakdown – Domestic Value and Depth



Notes: The Figure shows 2SLS estimates and 95% confidence intervals for models regressing Depth on Domestic Value in each OECD TiVA sector. The sectors are colored based on aggregation in three areas of economic activity. The aggregation was performed following the International Standard Industrial Classification of All Economic Activities (ISIC).

5 Unpacking Depth: Trade versus Non-trade Issues

GVCs have a positive causal effect on PTAs' depth as measured by the synthetic and comprehensive indicator available in DESTA. We now unpack the notion of depth and investigate the effect of trade and GVC intensity on the set of measures that comprise the DESTA index and four chapter- and provision-specific indicators regarding integration on non-trade issues, as discussed in Section 3.

Table 4 reports the 2SLS estimates for specification 2, in which the dependent variables take a value of 1 when there is at least one PTA active between two countries that provides for a reduction in tariffs (columns 1–3), cooperation on standards (columns 4–6), investment (7–9), services (10–12), procurement (13–15), competition (16–18) or intellectual property rights (19–21). The results confirm that gross and value-added trade have a significant effect on defined dimensions of PTA design. However, we identify some heterogeneity. The trade indicators have a positive and statistically significant effect on the probability of having a PTA featuring cooperation on tariff reduction, standards, investment, services and competition. When it comes to procurement and intellectual property, the effect is negative. Only Foreign Value presents significant coefficients, although at the 0.1 and 0.05 levels.

Table 4: Trade, GVCs and DESTA Indices

Outcome variable	Tariff Reduction			Standards			Investment			Services		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Gross Exports	0.1216***			0.1232***			0.1206***			0.1172***		
	(0.0252)			(0.0254)			(0.0252)			(0.0247)		
Domestic Value		0.1551***			0.1573***			0.1540***			0.1489***	
		(0.0355)			(0.0357)			(0.0355)			(0.0347)	
Foreign Value			0.6808***			0.6831***			0.6707***			0.6766***
			(0.1042)			(0.1044)			(0.1038)			(0.1032)
Observations	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150
ITZ FEs	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
JTZ FEs	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
IJZ FEs	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
KL F-stat	45.19	39.44	81.11	45.19	39.44	81.11	45.19	39.44	81.11	45.19	39.44	81.11
KP LM underid.	12.45	11.45	15.01	12.45	11.45	15.01	12.45	11.45	15.01	12.45	11.45	15.01
Effect of $\dot{X}$ on Y	0.141	0.142	0.175	0.143	0.144	0.176	0.140	0.141	0.173	0.136	0.136	0.174

Outcome variable	Procurement			Competition			Intellectual Property		
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Gross Exports	−0.0150			0.1208***			−0.0162		
	(0.0109)			(0.0252)			(0.0110)		
Domestic Value		−0.0194			0.1542***			−0.0205	
		(0.0147)			(0.0354)			(0.0148)	
Foreign Value			−0.0871*			0.6800***			−0.0963**
			(0.0468)			(0.1038)			(0.0468)
Observations	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150
ITZ FEs	YES	YES	YES	YES	YES	YES	YES	YES	YES
JTZ FEs	YES	YES	YES	YES	YES	YES	YES	YES	YES
IJZ FEs	YES	YES	YES	YES	YES	YES	YES	YES	YES
KL F-stat	45.19	39.44	81.11	45.19	39.44	81.11	45.19	39.44	81.11
KP LM underid.	12.45	11.45	15.01	12.45	11.45	15.01	12.45	11.45	15.01
Effect of $\dot{X}$ on Y	−0.0174	−0.0177	−0.0224	0.140	0.141	0.175	−0.0189	−0.0188	−0.0248

Notes: The independent variables include a measure of gross exports and two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value captures backward GVC activity, whereas Domestic Value measures forward GVC activity. The three variables are sourced from the OECD TiVA dataset. Each dichotomous dependent variable indicates whether an agreement between countries i and j includes a specific set of provisions/issues contributing to the depth of the agreement. When countries are part of multiple agreements, the maximum value of this variable is considered. The variables are sourced from the Desta database. Section 3 describes each variable included in the model. Standard errors are clustered by dyads (i-j) and are reported in parentheses. *Effect of $\dot{X}$ on Y* is computed by multiplying each coefficient by two times the standard deviation of the relevant independent variable.
*** p<0.01, ** p<0.05, * p<0.1

We identify further heterogeneity when we estimate how trade and GVC performance influence the probability of having a PTA featuring a specific chapter or provision related to non-trade issues such as labor and environmental standards (Table 5). Trade indicators have a positive effect on the inclusion of provisions related to both environmental and labor standards. Looking chapter-level variables, we find a difference between the positive effect on the inclusion of environmental chapters and the negative effect on the inclusion of labour-related chapters.

Table 5: Trade, GVCs and Non-Trade Issues

Labour Standards						
Outcome variable	Provision			Chapter		
	(1)	(2)	(3)	(4)	(5)	(6)
Gross Exports	0.1153***			−0.0027***		
	(0.0245)			(0.0010)		
Domestic Value		0.1467***			−0.0025**	
		(0.0345)			(0.0010)	
Foreign Value			0.6367***			−0.0573***
			(0.0993)			(0.0201)
Observations	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150
ITZ FEs	YES	YES	YES	YES	YES	YES
JTZ FEs	YES	YES	YES	YES	YES	YES
IJZ FEs	YES	YES	YES	YES	YES	YES
KL F-stat	45.19	39.44	81.11	45.19	39.44	81.11
KP LM underid.	12.45	11.45	15.01	12.45	11.45	15.01
Effect of $\hat{X}$ on Y	0.134	0.134	0.164	−0.00318	−0.00229	−0.0148
Environmental Standards						
Outcome variable	Provision			Chapter		
	(1)	(2)	(3)	(4)	(5)	(6)
Gross Exports	0.1172***			0.1295***		
	(0.0246)			(0.0335)		
Domestic Value		0.1490***			0.1656***	
		(0.0346)			(0.0468)	
Foreign Value			0.6592***			0.6982***
			(0.1012)			(0.1287)
Observations	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150	4,440,150
ITZ FEs	YES	YES	YES	YES	YES	YES
JTZ FEs	YES	YES	YES	YES	YES	YES
IJZ FEs	YES	YES	YES	YES	YES	YES
KL F-stat	45.19	39.44	81.11	45.19	39.44	81.11
KP LM underid.	12.45	11.45	15.01	12.45	11.45	15.01
Effect of $\hat{X}$ on Y	0.136	0.136	0.170	0.150	0.152	0.180

Notes: The independent variables include a measure of gross exports and two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value captures backward GVC activity, whereas Domestic Value measures forward GVC activity. The three variables are sourced from the OECD TiVA dataset. Each dichotomous dependent variable indicates whether an agreement between country i and j includes a specific provision or chapter related to non-trade issues and contributes to the depth of the agreement. When countries are part of multiple agreements, the maximum value of this variable is considered. The variables are sourced from the DESTA database. Section 3 describes each variable included in the model. Standard errors are clustered by dyads (i-j) and are reported in parentheses. *Effect of $\hat{X}$ on Y* is computed by multiplying each coefficient by two times the standard deviation of the relevant independent variable.
*** p<0.01, ** p<0.05, * p<0.1

6 Conclusion

This paper explores the causal effect of GVCs on the design of trade agreements. We find that GVC-based trade, and particularly the FVA component of exports, increases the depth of PTAs. Our results also illustrate that trade and GVC intensity have hetero-

geneous effects on the probability of including broadly identified chapters on various issue areas. However, we find that trade through GVCs systematically increases the probability of including a number of depth dimensions – namely investment, services, and competition as well as chapters and provisions related to environmental standards. Finally, we show that in specific issue areas, GVC trade intensity tends to have a greater effect than gross exports, which also include activities unrelated to global production. This effect is stronger for backward GVC activities than for forward GVC activities.

Our analysis can be extended along at least three dimensions. First, widening the country and time coverage of our empirical framework, or complementing it with a focus on a different set of countries or time period, would test the external validity of our exercise. Second, while the choice of specific elements of PTA design used in our empirical analysis reflects a deliberate parsimonious approach, investigating the effect of GVC-based trade on a broader set of design features represents a promising avenue for future research. In particular, further examining the impact on non-trade issues such as labor rights and environmental sustainability could shed new light on GVC actors' incentives to use trade agreements to achieve non-trade objectives. Finally, the GVC literature, at both the sectoral and firm level, offers a broad set of potential measures to characterize the activities of economic actors in GVCs. Employing different empirical tools to investigate our research question can offer complementary perspectives and potentially a more granular understanding of the drivers of deeper trade agreements.

The implications of our findings are important and timely. PTAs have become deeper over time, a trend that appears impossible to reverse or even stop. However, our findings show that the expansion of GVCs affected this trend during the study period. Protectionist policies implemented by populist parties and the COVID-19 pandemic are likely to contract GVCs at least for the near future. If this is the case, the GVC-related incentives to pursue deep PTAs might be reduced in the future.

References

Abbott, K. W., R. O. Keohane, A. Moravcsik, A. M. Slaughter, and D. Snidal, "The concept of legalization," *International Organization*, 2000, *54* (3), 401–19.

Altomonte, Carlo, Laura Bonacorsi, and Italo Colantone, "Trade and Growth in the Age of Global Value Chains," *BAFFI CAREFIN Working Paper N.97*, 2018.

Amiti, Mary and Jozef Konings, "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia," *American Economic Review*, 2007, *97* (5), 1611–1638.

Antràs, Pol and Robert W. Staiger, "Offshoring and the Role of Trade Agreements," *The American Economic Review*, 2012, *102* (7), 3140–3183. Publisher: American Economic Association.

Baccini, Leonardo, Pablo Pinto, and Stephen Weymouth, "The Distributional Consequences of Preferential Trade Liberalization: Firm-Level Evidence," *International Organization*, 2017, *71* (2), 373–95.

Baier, Scott L. and Jeffrey H. Bergstrand, "Do Free Trade Agreements Actually Increase Members' International Trade?," *Journal of International Economics*, 2007, *71* (1), 72–95.

_ , _ , and Michael Feng, "Economic Integration Agreements and the Margins of International Trade," *Journal of International Economics*, 2014, *93* (2), 339–50.

Baldwin, E. Richard, "21st Century Regionalism: Filling the gap between 21st century trade and 20th century trade rules," *Available at SSRN 1869845*, 2011.

Bernard, Andrew B, Emily J Blanchard, Ilke Van Beveren, and Hylke Vandenbussche, "Carry-Along Trade," *The Review of Economic Studies*, March 2019, *86* (2), 526–563.

Blanchard, Emily, "Foreign Direct Investment, Endogenous Tariffs, and Preferential Trade Agreements," *The B.E. Journal of Economic Analysis & Policy*, 2007, *7* (1).

_ , "Reevaluating the role of trade agreements: Does investment globalization make the WTO obsolete?," *Journal of International Economics*, September 2010, *82* (1), 63–72.

_ **and Xenia Matschke**, "US multinationals and preferential market access," *Review of Economics and Statistics*, 2015, *97* (4), 839–54.

_ , Chad Bown, and Robert Johnson, "Global Value Chains and Trade Policy," *Dartmouth, mimeo*, 2017.

Blanga-Gubbay, Michael, Paola Conconi, and Mathieu Parenti, "Lobbying for Glbalization," *ULB, mimeo*, 2020.

Bown, Chad, Aksel Erbahar, and Maurizio Zanardi, "Global Value Chains and the Removal of Trade Protection," *Peterson Institute for International Economics Working Paper*, 2020.

Büthe, Tim and Helen V. Milner, "The Politics of Foreign Direct Investment into Developing Countries: Increasing FDI Through International Trade Agreements?," *American Journal of Political Science*, 2008, *52* (4), 741–62.

_ **and** _ , "Foreign Direct Investment and Institutional Diversity in Trade Agreements: Credibility, Commitment, and Economic Flows in the Developing World, 1971–2007," *World Politics*, 2014, *66* (1), 88–122.

Chase, Kerry A., "Economic interests and regional trading arrangements: The case of NAFTA," *International Organization*, 2003, *57* (1), 137–74.

Dür, Andreas, Leonardo Baccini, and Manfred Elsig, "The Design of International Trade Agreements: Introducing a New Dataset," *Review of International Organizations*, 2014, *9* (3), 353–75.

Dür, Andreas, Leonardo Baccini, and Manfred Elsig, "The design of international trade agreements: Introducing a new dataset," *The Review of International Organizations*, 2014, *9* (3), 353–375.

Egger, Peter and Sergey Nigai, "Effects of deep versus shallow trade agreements in general equilibrium," in Andreas Dür and Manfred Elsig, eds., *Trade Cooperation. The Purpose, Design and Effects of Preferential Trade Agreements*, Cambridge University Press, 2015, chapter 15.

Erbahar, Aksel and Vincent Rebeyrol, "Trade intermediation by producers," *Journal of International Economics*, January 2023, *140*, 103693.

Goldberg, P. K., A. K. Khandelwal, N. Pavcnik, and P. Topalova, "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India," *The Quarterly Journal of Economics*, November 2010, *125* (4), 1727–1767.

Goldberg, Pinelopi and Tristan Reed, "Is the Global Economy Deglobalizing? And if so, why? And what is next?," Technical Report w31115, National Bureau of Economic Research, Cambridge, MA April 2023.

Grossman, Gene M. and Elhanan Helpman, "Protection for Sale," *American Economic Review*, 1994, *86* (2), 526–563.

Halpern, L., M. Koren, and A. Szeidl, "Imported Inputs and Productivity," *American Economic Review*, December 2015, *105* (12), 3660–3703.

Head, Keith, Thierry Mayer, and John Ries, "The erosion of colonial trade linkages after independence," *Journal of International Economics*, 2010, *81* (1), 1–14.

Hoekman, Bernard and Simeon Djankov, "Effective protection and investment incentives in Egypt and Jordan during the transition to free trade With Europe," *World Development*, 1997, *25* (2), 281–291.

Kim, Soo Yeon, "Negotiating the Nexus: Production Networks and Behind-the-Border Commitments in Regional Trade Agreements," *Mimeo*, 2012.

Koremenos, B., C. Lipson, and Snidal D., "The rational design of international institutions," *International organization*, 2001, *55* (4), 761–99.

Kox, Henk L. M. and Hugo Rojas-Romagosa, "How trade and investment agreements affect bilateral foreign direct investment: Results from a structural gravity model," *The World Economy*, 2020, *n/a* (n/a).

Laget, E., A. Osnago, N. Rocha, and M. Ruta, "Deep Trade Agreements and Global Value Chains," *Review of Industrial Organization*, 2020, *57* (2), 379–410.

Maggi, Giovanni and Andres Rodriguez-Clare, "The value of trade agreements in the presence of political pressures," *Journal of Political Economy*, 1998, *106* (3), 574–601.

Manger, Mark S., *Investing in protection: The politics of preferential trade agreements between north and south*, Cambridge University Press, 2009.

Mansfield, Edward D. and Eric Reinhardt, "International institutions and the volatility of international trade," *International Organization*, 2008, *62* (4), 621–52.

Mattli, Walter, *The logic of regional integration: Europe and beyond*, Cambridge University Press, 1999.

Miroudot, Sébastien and Davide Rigo, "Preferential Trade Agreements and Multinational Production," *RSCAS Working Papers*, 2019, *2019/14*.

Osnago, Alberto, Nadia Rocha, and Michele Ruta, "Do deep trade agreements boost vertical FDI?," *The World Bank Economic Review*, 2017, *30* (1), 119–25.

Rodrik, Dani, "What do trade agreements really do?," *Journal of economic perspectives*, 2018, *32* (2), 73–90.

Rose, Andrew K., "Do We Really Know that the WTO Increases Trade?," *American Economic Review*, 2004, *94* (1), 98–114.

World Bank, *World Development Report 2020: Trading for Development in a World of Global Value Chains*, Washington DC: World Bank, 2020.

Appendix

A Data and summary statistics

Table A-1: List of countries

Argentina	Colombia	Hong Kong	Laos	Peru	Spain
Australia	Costa Rica	Honduras	Latvia	Philippines	Sweden
Austria	Croatia	India	Lithuania	Poland	Switzerland
Belgium	Cyprus	Indonesia	Luxembourg	Portugal	Taiwan
Brazil	Czech Republic	Ireland	Malaysia	Romania	Thailand
Brunei	Denmark	Island	Malta	Russia	The Netherlands
Bulgaria	Estonia	Israel	Mexico	Saudi Arabia	Tunisia
Cambodia	Finland	Italy	Morocco	Singapore	Turkey
Canada	France	Japan	Myanmar	Slovakia	United Kingdom
Chile	Germany	Kazakhstan	New Zealand	Slovenia	United States
China	Greece	Korea	Norway	South Africa	Viet Nam

Notes: The table reports the list of countries included in the OECD TiVA sample.

Table A-2: List of sectors

OECD TiVA code	Description
D01T02	Agriculture, hunting, forestry
D03	Fishing and aquaculture
D05T06	Mining and quarrying, energy producing products
D07T08	Mining and quarrying, non-energy producing products
D09	Mining support service activities
D10T12	Food products, beverages and tobacco
D13T15	Textiles, textile products, leather and footwear
D16	Wood and products of wood and cork
D17T18	Paper products and printing
D19	Coke and refined petroleum products
D20	Chemical and chemical products
D21	Pharmaceuticals, medicinal chemical and botanical products
D22	Rubber and plastics products
D23	Other non-metallic mineral products
D24	Basic metals
D25	Fabricated metal products
D26	Computer, electronic and optical equipment
D27	Electrical equipment
D28	Machinery and equipment, nec
D29	Motor vehicles, trailers and semi-trailers
D30	Other transport equipment
D31T33	Manufacturing nec; repair and installation of machinery and equipment
D35	Electricity, gas, steam and air conditioning supply
D36T39	Water supply; sewerage, waste management and remediation activities
D41T43	Construction
D45T47	Wholesale and retail trade; repair of motor vehicles
D49	Land transport and transport via pipelines
D50	Water transport
D51	Air transport
D52	Warehousing and support activities for transportation
D53	Postal and courier activities
D55T56	Accommodation and food service activities
D58T60	Publishing, audiovisual and broadcasting activities
D61	Telecommunications
D62T63	IT and other information services
D64T66	Financial and insurance activities
D68	Real estate activities
D69T75	Professional, scientific and technical activities
D77T82	Administrative and support services
D84	Public administration and defence; compulsory social security
D85	Education
D86T88	Human health and social work activities
D90T93	Arts, entertainment and recreation
D94T96	Other service activities
D97T98	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use

Notes: The table reports the list of industries included in the OECD TiVA sample.

Table A-3: Variables' sources and summary statistics on estimation sample

Variable	mean	p50	sd	min	max
Trade policy data from DESTA					
Depth	0.754	0	1.127	0.000	3.513
Tariffs Reduction	0.027	0	0.161	0	1
Standards	0.028	0	0.164	0	1
Investment	0.022	0	0.147	0	1
Services	0.021	0	0.143	0	1
Procurement	0.008	0	0.089	0	1
Competition	0.022	0	0.146	0	1
Intellectual Property Rights	0.010	0	0.100	0	1
Labour Standards (provision)	0.005	0	0.072	0	1
Labour Standards (chapter)	0.005	0	0.073	0	1
Environmental Standards (provision)	0.015	0	0.122	0	1
Environmental Standards (chapter)	0.017	0	0.129	0	1
Gross and VA trade from OECD TiVA					
Gross exports	0.057	0.001	0.581	0.000	134.586
Domestic value	0.044	0.001	0.458	0.000	97.421
Foreign value	0.011	0.000	0.129	0.000	33.634

Notes: Trade variables are reported in this table in USD billion. Longer descriptions of the depth variables are included in the table as reported by the in the Codebook of the DESTA dataset, version 2.1 Dür et al. (2014b).

B Construction of the instrument

Table B-1: Gravity estimates

Outcome variable	Gross Exports		Domestic Value		Foreign Value	
	(1)	(2)	(3)	(4)	(5)	(6)
Distance* Part. DWPs * ln(MaxSize)	-4.3506***	-2.3231***	-3.6084***	-1.5093***	-8.0779***	-10.9391***
	(0.1280)	(0.1515)	(0.1204)	(0.1207)	(0.2120)	(0.9361)
Contiguity * Part. DWPs * ln(MaxSize)	11.0209***	130.2561***	12.1036***	125.1982***	3.9546***	100.9138***
	(0.2622)	(4.2152)	(0.2674)	(4.0563)	(0.3176)	(5.1105)
Landlocked * Part. DWPs * ln(MaxSize)	-1.8201***	-5.6274***	-3.8570***	-6.4795***	0.7585***	-14.0758***
	(0.3644)	(0.5145)	(0.4637)	(0.5100)	(0.2295)	(1.7171)
Observations	4,305,310	4,109,670	4,302,337	4,079,570	4,312,928	4,230,333
ITZ FEs	YES	YES	YES	YES	YES	YES
JTZ FEs	YES	YES	YES	YES	YES	YES
IJZ FEs	NO	YES	NO	YES	NO	YES

Notes: Standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table B-2: First Stage Results – Baseline

Linear Prediction	Gross Exports (1)	Domestic Value (2)	Foreign Value (3)
	0.0362***		
	(0.0054)		
		0.0288***	
		(0.0046)	
			0.0086***
			(0.0010)
Observations	4,440,150	4,440,150	4,440,150
ITZ FEs	YES	YES	YES
JTZ FEs	YES	YES	YES
IJZ FEs	YES	YES	YES

Notes: Standard errors are clustered by dyad and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

C Other Robustness Tests

Table C-1: Removing ijz fixed effects

Outcome variable	Depth		
	(1)	(2)	(3)
Gross Exports	5.3434***		
	(1.5010)		
Domestic Value		6.1569***	
		(1.8168)	
Foreign Value			32.7001***
			(8.1827)
Observations	4,440,150	4,440,150	4,440,150
ITZ FEs	YES	YES	YES
JTZ FEs	YES	YES	YES
IJZ FEs	NO	NO	NO
KL F-stat	42.82	41.89	41.33
KP LM underidentification	9.433	8.293	13.01
Effect of $\hat{X}$ on Y	6.159	5.592	8.360

Notes: The independent variables include a measure of gross exports and two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value captures backward GVC activity, whereas Domestic Value measures forward GVC activity. The three variables are sourced from the OECD TiVA dataset. The dependent variable provides a synthetic measure of the maximum level of depth for PTAs including countries i and j as signatories and active in time t. The variable is sourced from the DESTA database. Section 3 describes each variable included in the model. Standard errors are clustered by dyads (i-j) and are reported in parentheses. *Effect of $\hat{X}$ on Y* is computed by multiplying each coefficient by two times the standard deviation of the relevant independent variable.
*** p<0.01, ** p<0.05, * p<0.1

Table C-2: Clustering standard errors at the ijz level

Outcome variable	Depth		
	(1)	(2)	(3)
Gross Exports	0.9932***		
	(0.1103)		
Domestic Value		0.9205***	
		(0.1197)	
Foreign Value			13.9896***
			(1.5947)
Observations	4,440,150	4,440,150	4,440,150
ITZ FEs	YES	YES	YES
JTZ FEs	YES	YES	YES
IJZ FEs	YES	YES	YES
KL F-stat	109.4	90.26	93.18
KP LM underidentification	86.72	73.19	79.02
Effect of $\hat{X}$ on Y	1.145	0.836	3.576

Notes: The independent variables include a measure of gross exports and two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value captures backward GVC activity, whereas Domestic Value measures forward GVC activity. The three variables are sourced from the OECD TiVA dataset. The dependent variable provides a synthetic measure of the maximum level of depth for PTAs including countries i and j as signatories and active in time t. The variable is sourced from the DESTA database. Section 3 describes each variable included in the model. Standard errors in parentheses are clustered at the ijz level. *Effect of $\hat{X}$ on Y* is computed by multiplying each coefficient by two times the standard deviation of the relevant independent variable.
*** p<0.01, ** p<0.05, * p<0.1

Table C-3: Pre-2007 subset

Outcome variable	Depth		
	(1)	(2)	(3)
Gross Exports	1.5595***		
	(0.5242)		
Domestic Value		1.8279***	
		(0.6932)	
Foreign Value			12.8020***
			(2.9069)
Observations	2,509,650	2,509,650	2,509,650
ITZ FEs	YES	YES	YES
JTZ FEs	YES	YES	YES
IJZ FEs	YES	YES	YES
KL F-stat	45.02	39.03	79.95
KP LM underidentification	12.47	11.56	14.33
Effect of $\hat{X}$ on Y	1.237	1.149	2.031

Notes: The independent variables include a measure of gross exports and two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value captures backward GVC activity, whereas Domestic Value measures forward GVC activity. The three variables are sourced from the OECD TiVA dataset. The dependent variables provide a synthetic measure of the maximum level of depth for PTAs including countries i and j as signatories and active at time t. The variable is sourced from the DESTA database. Section 3 describes each variable included in the model. Observations for years from 2008 to 2017 are dropped. Standard errors are clustered by dyads (i-j) and are reported in parentheses. *Effect of $\hat{X}$ on Y* is computed by multiplying each coefficient by two times the standard deviation of the relevant independent variable.
*** p<0.01, ** p<0.05, * p<0.1

Table C-4: Post-2007 subset

Outcome variable	Depth		
	(1)	(2)	(3)
Gross Exports	0.3659		
	(0.2462)		
Domestic Value		0.2927	
		(0.3022)	
Foreign Value			6.0390***
			(2.1339)
Observations	1,930,500	1,930,500	1,930,500
ITZ FEs	YES	YES	YES
JTZ FEs	YES	YES	YES
IJZ FEs	YES	YES	YES
KL F-stat	43.10	37.47	80.08
KP LM underidentification	12.36	11.30	15.25
Effect of $\hat{X}$ on Y	0.553	0.348	2.089

Notes: The independent variables include a measure of gross exports and two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value captures backward GVC activity, whereas Domestic Value measures forward GVC activity. The three variables are sourced from the OECD TiVA dataset. The dependent variables provide a synthetic measure of the maximum level of depth for PTAs including countries i and j as signatories and active at time t. The variable is sourced from the DESTA database. Section 3 describes each variable included in the model. Observations for years from 1995 to 2007 are dropped. Standard errors are clustered by dyads (i-j) and are reported in parentheses. *Effect of $\hat{X}$ on Y* is computed by multiplying each coefficient by two times the standard deviation of the relevant independent variable.
*** p<0.01, ** p<0.05, * p<0.1

Table C-5: Local Effects – Removing Country Pairs without PTA

Outcome variable	Depth		
	(1)	(2)	(3)
Gross exports	0.6801***		
	(0.2456)		
Domestic value		0.6660**	
		(0.3057)	
Foreign Value			6.1121***
			(1.6771)
Observations	2,672,370	2,672,370	2,672,370
ITZ FEs	YES	YES	YES
JTZ FEs	YES	YES	YES
IJZ FEs	YES	YES	YES
KL F-stat	41.68	35.88	74.38
KP LM underidentification	11.16	10.33	12.76
Effect of $\hat{X}$ on Y	0.765	0.578	1.555

Notes: The independent variables include a measure of gross exports and two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value captures backward GVC activity, whereas Domestic Value measures forward GVC activity. The three variables are sourced from the OECD TiVA dataset. The dependent variables provide a synthetic measure of the maximum level of depth for PTAs including countries i and j as signatories and active at time t. The variable is sourced from the DESTA database. Section 3 describes each variable included in the model. Observations for country pairs that do not sign a PTA, as reported by DESTA, are dropped. Standard errors are clustered by dyads (i-j) and are reported in parentheses. *Effect of $\hat{X}$ on Y* is computed by multiplying each coefficient by two times the standard deviation of the relevant independent variable.
*** p<0.01, ** p<0.05, * p<0.1