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Abstract

We explore the role of global value chains (GVCs) in the design of preferential trade agreements (PTAs). We propose a theory that focuses on firms involved in backward and forward GVC activities 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 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 deepwater 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 that include provisions regulating both trade-related and non-trade-related policies. We find also evidence that GVC activities affect the flexibility of PTAs. Our results indicate that trade intermediation by producers is the main driver of the design of trade agreements.

Keywords

Trade agreements; international trade; global value chains; depth; flexibility

JEL Classification

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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 for such agreements to include provisions that are not directly related to merchandise trade policies. Examples include commitments to liberalize and protect foreign direct investment (FDI) and improve access to markets for services. As a result, many PTAs have become deeper, going beyond the reduction and removal of tariffs on imports of goods to regulate other trade-related policies more extensively and more stringently than the World Trade Organization (WTO). Thus, PTAs have replaced the WTO as the main instrument that countries use to deepen trade policy cooperation.

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 it then requires 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 contributions in economics (Bernard et al., 2019; Erbahar and Rebeyrol, 2023), we focus on backward and forward 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 both backward and forward 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 and forward GVC activities push for PTAs that include these cost-reducing 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. This 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 value-added trade on a synthetic indicator of PTA depth and on many dimensions of PTA design, including services liberalization, investment and competition policy disciplines and regulation of the process of production, reflected inter alia in provisions on protection of workers and the environment. To build a broad and comprehensive portfolio of outcome variables, we use the Design of Trade Agreements (DESTA) database (Dür et al., 2014), which contains synthetic indicators of PTA depth as well as more specific indicators that capture different dimensions of trade agreement depth.

We find that trade through GVCs increases PTA depth. This effect is driven by both domestic and foreign value-added component of exports. Our results also reveal that trade through GVCs has heterogeneous effects on the probability of including broadly defined dimensions of depth across multiple policy areas. In particular, we find that trade associated with backward and forward GVC activities systematically increases the probability of including provisions on investment, services and competition as well as chapters related to environmental standards and labor rights. Moreover, we find evidence that both backward and forward GVC activities are associated with the inclusion of disciplines on the temporary (re-)imposition of tariffs. This is consistent with insights of previous studies claiming that extensive (preferential) liberalization of tariffs calls for accompanying mechanisms providing governments with the possibility to respond selectively to demands by import-competing firms for protection (Rosendorff and Milner, 2001) but suggests that GVC trade is associated with greater disciplines on the use of flexibility mechanisms in deep PTAs (Baccini et al., 2015).

The size of our estimated causal effect is remarkable. When we take our most conservative estimate, moving either the domestic value-added (DVA) or 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 about 30% 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 of our knowledge, this study is the first to show that GVC trade has a *causal* effect on the depth of PTAs and the inclusion of policy areas 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, e.g., 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., 2014; 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, we contribute to the literature that identifies firms involved in global activities as the main political actors pushing for trade and investment liberalization in the last three decades (Kim, 2017; Osgood, 2018; Kim et al., 2019; Osgood, 2021; Lee and Stuckatz, 2023). More specifically, 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 influence not only *whether* we observe cooperation between countries, but also 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 GVC activities.

Argument

Multinational corporations and deep trade integration

Our argument starts with a key distinction made in the literature on trade agreements between shallow and deep trade integration. The standard approach in this literature is to identify deep integration as cooperation that goes beyond reciprocal reduction of import tariffs and quantitative trade restrictions (Dür et al., 2014; Hoekman and Nelson, 2018). Until the 1980s, shallow integration lays at the core of most trade agreements because border barriers were the main policy affecting trade. Before the rise of global value chain production models, trade was mostly of a "ship-and-forget" nature (Cooper, 1988), i.e. once produced and goods were paid for, they were put on a ship to the foreign buyer and producers could forget about the transaction. In a GVC world this is not feasible.

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 significant drivers of the formation of deep PTAs (Mattli, 1999; Baldwin, 2011; Antràs and Staiger, 2012; Rodrik, 2018). Deep PTAs generally include many investment provisions, which protect multinationals' assets in host markets. Moreover, deep 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 such provisions with important host (South) economies to gain an edge over their direct competitors.

Another important feature of deep PTAs is the inclusion of binding dispute settlement mechanisms through which treaty commitments can be enforced. Maggi and Rodriguez-Clare (1998) have shown that PTAs can help governments credibly commit to liberalization and investment protection by including binding provisions, that if not implemented will give rise to authorized retaliatory measures by trading partners, thus helping to sustain 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 in PTAs.

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.

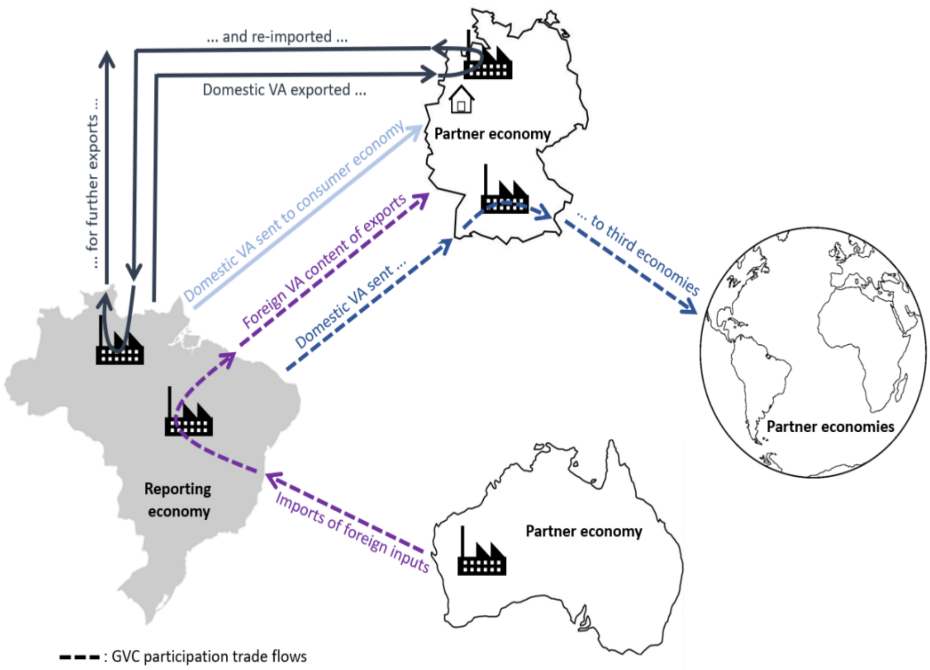
The role of backward and forward GVC activities

We begin by making what we believe are two innocuous assumptions. First, absent lobbying for reciprocal trade liberalization, governments have few incentives to pursue it, given the prevailing political economy equilibrium that reflects protectionist preferences of import-competing industries and disinterest of domestic (non-exporting) producers. This assumption is largely in line with the Grossman and Helpman (1994) model of protection for sale, a workhorse of political economy theory. Second, interest groups that anticipate gains from trade have incentives to promote further trade liberalization. This assumption is also a staple of the political economy of trade literature. It implies that the winners from trade liberalization favor further economic integration, whereas those expecting to lose (import-competing firms; workers in plants that undertake tasks that may be offshored) will oppose it.

While previous research has focused on the role of trade in intermediates in general, which represent a large share of GVC trade, to explain preferential liberalization (Manger, 2009; Blanchard and Matschke, 2015; Baccini et al., 2018; Osgood, 2018, 2021), our argument hinges on two specific types of trade conducted by firms involved in GVCs: 1) *backward* GVC trade activities; and 2) *forward* GVC trade activities. Backward GVC trade refers to the ratio of the 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 trade corresponds to the ratio of the DVA *sent to third economies* to the economy's total gross exports. This concept captures the domestic value added contained in intermediate inputs sent to third economies for further processing and subsequently exported through supply chains.[2] Figure 1 describes these two activities graphically.

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

Figure 1: Trade in Value-Added



Source: WTO Trade in Value-Added Explanatory Note

Backward GVC trade activities can be further decoupled into two categories. First, the import of foreign intermediate inputs for export (FIE), that is, products that are used to produce domestic goods, a share of which are exported and therefore constitute *forward* GVC activities. Second, recent contributions in economics (Bernard et al., 2019; Erbahar and Rebeyrol, 2023) highlight that many firms export goods that are sourced from other firms rather than produced by the firm. 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 solely an intermediary role, those involved in CAT export both sourced products and own 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, cups, and spoons (which it sources from external suppliers), it is selling a bundle of goods for the consumption of its coffee and ancillary products 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 FIE, PI and CAT also tend to export a significantly larger number of products compared to firms that only export goods they produce themselves. For instance, the average firm involved in PI and CAT exports 4–5 times more products than 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 greater.

Previous studies have argued that CAT reflects demand–scope complementarities: bundling together own produced goods with complementary products sourced from other firms increases the consumption of the good(s) a firm produces. FIE, PI and CAT are also explained by supply-side advantages. The most productive firms are better equipped to overcome the many hurdles associated with serving foreign markets and, in turn, better access to FIE is associated with a productivity boost (Halpern et al., 2015).

We argue that firms involved in backward and forward GVC activities are the main actors pushing for deep preferential trade liberalization. The first part of our argument is about trade costs. Firms involved in backward and forward GVC activities depend heavily on trade, because they import *and* export goods. High trade costs increase the production costs of firms involved in backward and forward GVCs, reducing the demand for both their sourced and produced goods. Because both types of products are bundled together, high trade costs have a multiplier effect for firms involved in these activities. Moreover, high trade costs also affect the supply side, reducing the efficiency of the distribution and production networks on which firms involved in backward and forward GVCs rely. At the extreme, if trade costs are too high, final buyers have incentives to buy goods from the original suppliers, bypassing firms involved in FIE, PI and CAT, or to purchase from competitors.

Deep PTAs lower the trade costs of firms involved in backward and forward GVC activities. Building on a large literature in both economics and political science (Mattli, 1999; Antrás, 2003; Helpman et al., 2008), we contend that deep PTAs reduce the hold-up problem created by contractual incompleteness between countries. Contractual frictions are common in international transactions because of differences in domestic institutions and of limited enforcement ability in foreign markets. Deep trade agreements reduce contractual uncertainty, because they set common provisions, which in turn lower transaction costs and negative externalities (Osnago et al., 2019). Moreover, deep PTAs provide a commitment device for countries to enforce rules through the *pacta sunt servanda* mechanism embedded in international agreements (Mattli, 1999). By doing so, deep agreements interact with the make-or-buy decisions of firms, consolidating the activities of those firms that trade internationally and engage in global production (Kim et al., 2019).

Which provisions do firms involved in GVC trade activities demand in PTAs? And how do these provisions facilitate the activities of firms involved in GVCs? In addition to the traditional lobbying by exporters for lower foreign tariffs (shallow integration), which reduces the prices of goods and in turn boosts demand for them, firms involved in backward and forward GVCs demand the inclusion of deep integration provisions that protect investment, liberalize services, and foster competition (Kim et al., 2019). These provisions lower the costs of GVC trade, which include uncertainty-induced transaction costs, helping these firms strengthen their supply-side advantage. Take investment protection. Many of the firms involved in backward and forward GVC activities are MNEs, whose trade happens between home country plants and subsidiaries or among subsidiaries, i.e. intra-firm trade. Including provisions that protect foreign investment in *country A* reduces negative externalities for MNEs that export goods produced domestically or sourced from abroad to *country A*. In turn, reductions in policy uncertainty and operating costs strengthen the production and distribution networks of firms participating in backward and forward GVCs activities. Liberalizing transportation and distribution services further increases the efficiency of the production and logistics networks on which firms involved in backward and forward GVC activities rely. Furthermore, mutual action to facilitate trade by reducing administrative and compliance costs through adoption of common procedures or mutual recognition of standards (including for environmental protection, promotion of labor and human rights, and, more generally, for responsible business conduct) reduces the transaction costs of firms involved in complex global production networks.

Unlike shallow integration involving the (preferential) removal of specific tariff lines, provisions included in deep PTAs regulate whole sectors or a broad range of economic activity. Recall that especially firms involved in backward GVC activities export a significantly larger variety of goods than exporters that only sell what they produce. Better access to foreign inputs may be associated with the introduction of new output varieties (Goldberg et al., 2010; Colantone and Crinó', 2014) and product switching, which may make firms less concerned about a specific tariff line (Amiti and Konings, 2007). Without questioning the salience of shallow integration, we argue that firms involved in backward and forward GVC activities are particularly likely to benefit from a reduction in trade and operating costs that cuts across different industries, which is exactly what deep integration provisions deliver through investment liberalization, investor protection, regulatory cooperation, trade facilitation or service sector opening. Anticipating these benefits from deep trade integration, we expect that firms involved in backward and forward GVC activities push for PTAs that include such provisions.

In sum, our argument's main testable implication is that *as backward and forward GVC activities increase, countries are more likely to form deep PTAs.* We also explore three corollaries of our main hypothesis. First, we expect that both backward and forward GVC trade activities increase the probability of including specific chapters on investment protection and service liberalization, which are of paramount importance for FIE, PI, and CAT. Second, we expect that both backward and forward GVC trade activities increase the probability of including specific chapters on non-trade issues, i.e. environment and labor standard, since it is in the interest of FIE, PI, and CAT to set homogeneous standards to lower transaction costs. Third, we expect backward and forward GVC trade activities to be associated positively with flexibility provisions specifying conditions under which governments may temporarily reimpose trade measures if needed to assist domestic industries detrimentally affected by removal of tariffs. Because deep PTAs entail the removal of tariffs on substantially all merchandise trade between partner countries, they require flexibility to be able to manage the costs faced by the losers from tariff liberalization (Rosendorff and Milner, 2001; Baccini et al., 2015).

Illustrative cases

Examples abound of firms involved in backward GVC activities pushing for deep PTAs. In the US, Chrysler, Ford, and General Motors are among the companies that lobby the most in favor of PTAs (Osgood 2021). All these companies import a large number of parts and components. For instance, Ford imports engines from China, transmissions from Turkey, tooling and fixtures from Germany, among other countries. While these automobile companies serve the US domestic market, they also export many vehicles to other countries, mainly through their subsidiaries. These embody a large share of foreign value added. Nor surprisingly, Chrysler, Ford, and General Motors pushed for forming deep PTAs with those countries that are the final destinations of their exports, to protect their foreign investments, reduce transaction costs, and gain an edge over competing car-producers. Both Chrysler and Ford have subsidiaries serving the South Korean market with cars assembled in the US and lobbied heavily for the US-South Korea trade agreement (signed on June 30, 2007).[3]

The US is not the only example when it comes to the automobile industry. Thailand is among the world's largest vehicle producers and exporters. The Thai automotive industry is export-oriented and driven by foreign investment, mainly from Japanese firms. For instance, Honda and Toyota (and to a lesser extent Nissan and Mazda) export a large share of (Japan-made) automotive parts to Thailand through their subsidiaries. These are assembled in final goods (i.e. automobiles) and exported to other countries, using Toyota and Honda subsidiaries. These vehicles embody large shares of FVA. Honda and

[3] Lobbying documents available on `https://www.opensecrets.org/` [accessed on July 13, 2023]).

Toyota were key actors pushing for the Thailand-Australia FTA (signed on July 4, 2004), a deep PTA that has facilitated exports of Japanese cars to Australia, accounting for more than half of all Thai exports utilizing the FTA. Other non-Japanese car producers such as Ford and General Motors with plants in Thailand have also benefited from this deep PTA for similar reasons.

The automobile industry is no exception. Major US retail companies such as Walmart have been among the main political donors to push for deep PTAs. Walmart is a good example of TIP, since it exports many products that are not made in the US, but are sourced from other countries. Key Walmart suppliers are located in the United Kingdom, Canada, China, Mexico, Taiwan, Hong Kong, France, among others. Deep PTAs reduce uncertainty and trade costs, allowing Walmart to lock-in final buyers and avoid being bypassed by original suppliers. Many lobbying documents pertaining to Walmart include "discussion regarding supply chain security issues" in relation to trade agreements, especially with Colombia and Panama.[4] Similarly, Procter and Gamble has lobbied intensively in favor of deep trade agreements in the US (Osgood, 2021).

Such examples illustrate the importance of GVC activities in the formation of deep PTAs. The examples make clear that MNEs involved in backward GVC activities are key actors supporting deep trade integration because of their extensive networks of global production and reliance on intra-firm trade between home country plants and foreign subsidiaries. In their constant effort of cutting production costs and gaining an edge over competitors, these internationalized firms support not just deep preferential tariff removal, but also investment liberalization and protection and measures to open services markets to foreign competition.[5]

Data and Empirical Strategy

Our empirical analysis uses trade data sourced from the 2021 release of the Organisation for Economic Co-operation and Development (OECD) Trade in Value-Added (TiVA) database, which provides bilateral value-added trade flows for 66 countries and 45 sectors for 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. We employ two standard measures of forward and backward GVC activity as independent variables. The first is the domestic value added (DVA) of industry-specific gross exports generated in domestic economy i that is embedded in the gross exports from

[4]Lobbying documents available on `https://www.opensecrets.org/`.

[5]Specifically on investment protection, a Chilean negotiator interviewed by the authors confirmed that, during the TPP negotiations, MNEs were very vocal in demanding the inclusion of a dispute settlement mechanism in the investment chapter to protect their foreign assets. The Chilean negotiator requested anonymity. The interview was conducted on July 14, 2023.

i to j in industry z.[6] This variable captures forward GVC activity. The second indicator represents the foreign value added (FVA) embedded in an industry z trade transaction between an exporter i and an importer j originating in other countries (i.e., not i or j).[7] The FVA measure captures backward GVC activity.

Taken together, the two 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 value added generated by i and embedded in the exports from i to j (DVA); and (ii) 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 comprise indicators capturing pertinent dimensions of the trade policy regime of i and j as potential signatories of one or more PTAs that are active at time t. We begin our analysis using a synthetic measure of the depth of PTAs sourced from the DESTA database. This is a continuous variable constructed by Dür et al. (2014) through latent trait analysis of 49 specific variables that are theoretically related to the depth of an agreement.[8] We rescale the indicator to set its minimum value over the distribution of all agreements recorded in DESTA to 0. Due to the country and time coverage of our econometric application (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 continuous DESTA 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 is given by:

$$\text{Depth}_{ij,t} = \beta X_{ijz,t-1} + \gamma_{izt} + \gamma_{jzt} + \gamma_{ijz} + \varepsilon_{ijz,t} \qquad (1)$$

where $X_{ijz,t-1} \in \{\text{Domestic Value}_{ijz,t-1}\ ;\ \text{Foreign Value}_{ijz,t-1}\}$, γ_{izt}, γ_{jzt} and γ_{ijz} denote exporter-time-sector, importer-time-sector and exporter-importer-sector fixed effects, respectively, and $\varepsilon_{ijz,t}$ is the error term.

As a second step, 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., 2014). The first variable captures whether the agreement foresees the reduction of all tariffs. The remaining six variables indicate whether the agreement

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

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

[8] See the description of *depth_ rasch* in the DESTA Indices Explanatory Notes

goes beyond reducing tariffs to span cooperation in the realms of: (i) product standards (technical barriers to trade and sanitary and phytosanitary measures), (ii) investment, (iii) services, (iv) public procurement, (v) competition policy, and (vi) intellectual property rights. Together, these measures are used to construct an additive index of PTA depth and are referred to as "indices." Four additional outcome variables capture dimensions of depth associated with the inclusion of language on labor and the environment. These binary indicators are also sourced from the DESTA dataset. Two capture whether an agreement mentions environmental and labor standards. Two others indicate whether an agreement contains separate chapters on labor and environmental standards.

Each of the binary outcome 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.[9] When more than one agreement is active at time t, we use the maximum value of the depth indicator. For each of these outcome variables Y, we fit a set of linear probability models given by:

$$\mathrm{Y}_{ij,t} = \beta X_{ijz,t-1} + \gamma_{izt} + \gamma_{jzt} + \gamma_{ijz} + \varepsilon_{ijz,t} \tag{2}$$

where variables are defined as in Equation 1 above.

To provide additional evidence on the design of PTAs, we also use a PTA variable that captures disciplines on the use of standard flexibility instruments that can be used by parties to protect against unforeseen shocks without breaching the agreement. Such flexibility instruments include suspension of tariff cuts in case of balance of payments problems; general safeguard provisions; and allowing for the imposition of anti-dumping duties and measures to countervail subsidized imports. In the absence of these provisions, a country that suspends its tariff cuts or imposes antidumping and countervailing duties on goods covered by the agreement is in breach of the agreement.

Of relevance to testing the hypothesis motivating our analysis is the inclusion of additional disciplines on the use of contingent protection instruments by PTA signatories. While governments will want to continue to have access to flexibility to be able to manage trade adjustment pressures and unexpected shocks, GVC trade will be negatively affected by the use of such measures and MNEs will therefore have incentives to ensure that PTAs include stronger disciplines on the their use than apply in the GATT/WTO. The measure used, *flexrigid*, is composed as an additive index that ranges from 0 to 8, depending on how many provisions are included that go beyond GATT/WTO provisions. They include disciplines on the duration (and possible extension) of safeguard actions that go beyond GATT/WTO

[9] A detailed description of the outcome variables used is provided in 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).

requirements, permitting safeguard measures only during a transition period, limiting the magnitude of a safeguard action to the MFN duty or the temporal suspension of a duty reduction, agreement on *de minimis* dumping margins or dumped trade volumes that are more constraining than GATT/WTO-specified levels, and provisions to develop a common policy on subsidies.[10] As with the other dependent variables discussed above, when more than one PTA is in force for a given year, we take the maximum value assumed by the variable for that dyad in that year.

Identification strategy

Specifications 1 and 2 are both affected by endogeneity of the trade and GVC performance variables. We address this problem by instrumenting value-added trade 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 (i) the maximum size of container ships operating in a given year and (ii) 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: the logarithm of 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 $X_{ijz,t-1} \in \{\text{Domestic Value}_{ijz,t-1}\,;\,\text{Foreign Value}_{ijz,t-1}\}$ we construct the respective instrument as the predicted values $\hat{X}_{ijz,t-1}$ from a gravity specification estimated with Poisson pseudo maximum likelihood where $X_{ijz,t-1}$ is the dependent variable and the right-hand side features exporter-time-sector (izt), importer-time-sector (jzt), and exporter-importer-sector (ijz) fixed effects and the column vector $\mathbf{Z}_{ijt}$ is defined as follows:

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

The data used to construct these instruments come from different sources. The standard gravity bilateral variables (Distance, Contiguity and Landlocked) are obtained from the CEPII database (Head et al., 2010). $MaxSize_t$ is the maximum size of container ships expressed in twenty-foot equivalent TEU containers.[11] The sharp increase in this variable

[10] See notes on *flexrigid* in DESTA Indices Explanatory Notes.

[11] TEU is a standard unit of cargo capacity used to describe the capacity of container ships and container terminals. One TEU corresponds to the capacity to accommodate one standard intermodal

from 5,000 to 20,500 TEU between 1995 and 2017 is the key exogenous variation for our identification strategy. The variables $MaxSize_t$ and DWP_j are from Altomonte et al. (2018), who document widespread adoption by market operators of new, larger ships during this period, allowing this technological innovation to immediately affect trade flows.[12] 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 captures the number of ports in partner country j that have had a water depth of at least 16 meters since 1995 as well as a container terminal, divided by the length of the country j's coastline (in kilometers). The 16 meter water depth is the minimum needed to accommodate, load and unload the new container ships introduced between 1995 and 2017.[13] Altomonte et al. (2018) collected 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.[14]

The term $DWP_j \times \log MaxSize_t$ in equation 3 reflects the main intuition informing our identification strategy: using larger ships decreases unit 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 value-added trade flows.

We are confident that this is the case. Assume, for instance, that the investment required

container 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 ft), the maximum height permitting containers to pass through railway tunnels.

[12] Tables B-1 and B-2 report the estimation results from the gravity exercise.

[13] This applies to both at the quays where ships get loaded/unloaded and the canal used to access the quays. We chose 16 meters because the largest ships introduced during our sample period have a maximum draft of 16 meters.

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

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 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 potential concern arises from possible 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 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.

Our core analysis centers on the 1995-2007 period. After the enlargement of the Panama Canal in 2007, so-called post-Panamax vessels that are significantly larger than previous vessels take over the container business. This transportation shock creates incentives to dredge ports in order to accommodate the post-Panamax vessels and their larger cargo. For instance, the project for deepening the New York and New Jersey Harbor began in 2008.[15] As such, our instruments are not suitable to identify GVC activities in the post-Panamax period. We treat the 2008-2017 period as a placebo in our analysis.

Estimation sample

We perform our analysis on two samples. The first includes EU member states as individual countries. 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 through 2017 in which at least two signatories belong to the sample of 66 OECD TiVA countries. This spans 419 of the more than 600 agreements in the DESTA dataset. Appendix Tables A-3 and A-4 report summary statistics for the main variables used in the regression analysis.

We then estimate our baseline results using a second sample, in which we aggregate EU member states into a single unit, reflecting the fact that the EU has a common commercial policy and thus EU PTAs apply identically to all EU member states. This aggregation requires creating an unique identifier for the EU, with the coverage of European nations

[15] See `https://www.nan.usace.army.mil/Missions/Navigation/Dredged-Material-Management-Plan/` [consulted on September 5, 2023].

depending on the number of countries that are a member of the EU in the first half of a given year t. Overall, 27 countries had become a member of the EU as of 2007. Croatia, the last country to become a member, joined in July 2013, and becomes part of the EU single identifier as of 2014. This brings the number of observations to 1,376,730.

We then proceed to aggregate the relevant variables. For the independent variables, we sum dyadic value-added trade flows at the sectoral level across EU members in a given year. In other words, EU member states are aggregated in a single EU identifier. For the dependent variable, we simply assign the maximum value of depth between a partner country and the EU in a given year and keep only one observation. We also aggregate the CEPII geographical variables, creating artificial measures of distance, contiguity and landlocked. The distance variable assumes a value equal to the distance between a partner country and Belgium. We thus artificially consider Brussels as the "capital" of the EU. The landlocked variable is constructed based on whether the origin and the destination country in a dyad is landlocked. We consider the value of landlocked for the EU to be equal to 0, and proceed to compute the variable in the same fashion.[16] The contiguity dummy variable takes value 1 for the dyad if the partner country is contiguous to any of the EU member states. Finally, we aggregate the count of Deep Water Ports at the EU level, by summing the number of deep water ports exceeding the relevant threshold.

Results

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.

Baseline findings

Table 1 reports the two-stage least-squares (2SLS) estimated coefficients of equation 1 specified for each of the two independent variables of interest – DVA and FVA – instrumented with their augmented gravity predicted values discussed previously. The results reveal that both variables have a positive and statistically significant causal effect on PTA depth (columns 1–2). The magnitude of the effect is similar for the two components of GVCs. This holds both in the disaggregated sample (Table 1) as well as the sample aggregated at the EU level (Table 2).

To illustrate the economic meaningfulness of these point estimates, consider the example of increasing either the DVA component or the FVA component of bilateral exports in any sector by two standard deviations. This corresponds to a change of roughly USD 500

[16] *Landlocked* takes value 1 if one of the two countries in the dyad is landlocked.

Table 1: Trade, GVCs and Depth - Baseline estimates

Outcome variable	Depth	
	(1)	(2)
Domestic Value (DVA)	0.9103***	
	(0.2571)	
Foreign Value (FVA)		2.8899***
		(0.7024)
Observations	2,509,650	2,509,650
ITZ FEs	YES	YES
JTZ FEs	YES	YES
IJZ FEs	YES	YES
KL F-stat	29.74	65.55
KP LM underidentification	29.62	65.55
Effect of $\hat{X}$ on Y	0.572	0.458

Notes: The results refer to the period 1995-2007. The independent variables include two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value (FVA) captures backward GVC activity, whereas Domestic Value (DVA) measures forward GVC activity. The two 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 describes each variable included in the model. Standard errors are clustered by dyads and sector (ijz) 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-3.
*** p<0.01, ** p<0.05, * p<0.1

million – the difference between the average DVA and 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 about 30% of the sample average (baseline estimates). 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).

The results suggest that both DVA and FVA embedded in gross exports are key dimensions

Table 2: Trade, GVCs and Depth - EU as a Single Actor

Outcome variable	Depth	
	(1)	(2)
Domestic Value (DVA)	10.2456***	
	(3.3505)	
Foreign Value (FVA)		46.3358***
		(13.1487)
Observations	1,376,730	1,376,730
ITZ FEs	YES	YES
JTZ FEs	YES	YES
IJZ FEs	YES	YES
KL F-stat	10.11	13.56
KP LM underidentification	9.909	12.81
Effect of $\hat{X}$ on Y	10.67	9.665

Notes: The results refer to the period 1995-2007. The independent variables include two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value (FVA) captures backward GVC activity, whereas Domestic Value (DVA) measures forward GVC activity. The two 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 describes each variable included in the model. Standard errors are clustered by dyads and sector (ijz) 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-4.
*** p<0.01, ** p<0.05, * p<0.1

of GVCs that shape the depth of PTAs. This finding is consistent with the idea that both DVA and FVA embedded in gross exports from i to j directly reflect 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 capture additional pressures for deeper integration. Moreover, from the perspective of economic actors in importing country j, high DVA and FVA embedded in i's exports to j reveal i's role as a hub, which creates economic incentives for deep integration between the two countries.[17].

[17] Gross exports (not reported) 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 (Osgood, 2018; Kim et al., 2019)

Additional evidence

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 above.

Table 3 reports the 2SLS estimates for specification 2, in which the dependent variables take the value of 1 when two countries have at least one active PTA that reduces tariffs (columns 1–2), provides for cooperation on standards (columns 3–4), has investment provisions (5–6), liberalizes services (7–8), includes public procurement disciplines (9–10), or has disciplines on competition policy (11–12) or intellectual property rights (13–14). The results confirm that value-added trade has a significant effect on most of these dimensions of PTA design. Value-added trade has a statistically significant positive effect on the probability of having a PTA featuring cooperation on all these indicators of PTA depth. The two exceptions are the coefficient estimates for public procurement and intellectual property rights. The latter finding may reflect the fact that most PTAs do not include binding public procurement provisions, or, for parties to the WTO Government Procurement Agreement, do not go beyond the commitments made in that agreement (Hoekman, 2018; Shingal and Ereshchenko, 2020). Although many PTAs embody disciplines on IPRs, research has shown that this tends to be concentrated in US and EU agreements, and that inclusion of IPRs that are deeper than applicable WTO disciplines is a function of the innovative capacity of non-OECD countries that participate in a PTA (Mödlhamer, 2020; Dür and Mödlhamer, 2022).

GVC trade also positively influences the probability of a PTA featuring provisions or a specific chapter related to non-trade issues such as labor and environmental standards (Table 4). Trade indicators have a positive effect on the inclusion of provisions (columns 1–2) and chapters (columns 3–4) related to both environmental and labor standards. Regarding labour standards, the effect of GVC activities on labour provisions is much larger than the effect of GVC activities on labour chapters. This finding seems to suggest that firms involved in backward and forward GVC activities prefer to push for less stringent provisions of labour standards, something that future studies should investigate futher.

Finally, we evaluate the effect of value-added trade on provisions governing the use of flexibility mechanisms as an additional element of PTA design. Both value-added trade variables yield positive and strongly significant coefficient estimates on the probability of greater discipline (cooperation) on the use of standard safeguard and instruments of contingent protection in PTAs (Table 5). The results suggest that value chain trade affects not only the prospects for deep liberalization of tariffs and inclusion of provisions

Table 3: Trade, GVCs and DESTA Depth Indices

Outcome variable	Tariff Reduction		Standards		Investment		Services	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Domestic Value (DVA)	1.8934***		1.9833***		1.6783***		1.5239***	
	(0.3511)		(0.3674)		(0.3117)		(0.2825)	
Foreign Value (FVA)		4.2435***		4.4402***		3.8784***		3.3187***
		(0.5552)		(0.5784)		(0.5047)		(0.4433)
Observations	2,509,650	2,509,650	2,509,650	2,509,650	2,509,650	2,509,650	2,509,650	2,509,650
ITZ FEs	YES	YES	YES	YES	YES	YES	YES	YES
JTZ FEs	YES	YES	YES	YES	YES	YES	YES	YES
IJZ FEs	YES	YES	YES	YES	YES	YES	YES	YES
KL F-stat	29.74	65.55	29.74	65.55	29.74	65.55	29.74	65.55
KP LM underid.	29.62	65.55	29.62	65.55	29.62	65.55	29.62	65.55
Effect of $\hat{X}$ on Y	1.191	0.673	1.247	0.704	1.055	0.615	0.958	0.526

Outcome variable	Procurement		Competition		Intellectual Property	
	(9)	(10)	(11)	(12)	(13)	
Domestic Value (DVA)	0.0245		1.6844***		0.0256	
	(0.0228)		(0.3128		(0.0236)	
Foreign Value (FVA)		−0.1926**		3.5767***		−0.2706***
		(0.0879)		(0.4790)		(0.0946)
Observations	2,509,650	2,509,650	2,509,650	2,509,650	2,509,650	2,509,650
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	29.74	65.55	29.74	65.55	29.74	65.55
KP LM underid.	29.62	65.55	29.62	65.55	29.62	65.55
Effect of $\hat{X}$ on Y	0.0154	−0.0305	1.059	0.567	0.0161	-0.0429

Notes: The results cover the period 1995-2007. The independent variables include two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value (FVA) captures backward GVC activity, whereas Domestic Value (DVA) measures forward GVC activity. The 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 describes each variable included in the model. Standard errors are clustered by dyads and sector (ijz) 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 4: Trade, GVCs and Non-Trade Issues

	Labour Standards			
Outcome variable	Provision		Chapter	
	(1)	(2)	(3)	(4)
Domestic Value (DVA)	1.5896***		0.0193***	
	(0.2946)		(0.0037)	
Foreign Value (FVA)		3.7812***		0.0448***
		(0.4925)		(0.0065)
Observations	2,509,650	2,509,650	2,509,650	2,509,650
ITZ FEs	YES	YES	YES	YES
JTZ FEs	YES	YES	YES	YES
IJZ FEs	YES	YES	YES	YES
KL F-stat	29.74	65.55	29.74	65.55
KP LM underid.	29.62	65.55	29.62	65.55
Effect of $\hat{X}$ on Y	0.999	0.600	0.0121	0.00710

	Environmental Standards			
Outcome variable	Provision		Chapter	
	(1)	(2)	(3)	(4)
Domestic Value (DVA)	1.5865***		1.5412***	
	(0.2938)		(0.2866)	
Foreign Value (FVA)		3.4871***		3.9729***
		(0.4628)		(0.5125)
Observations	2,509,650	2,509,650	2,509,650	2,509,650
ITZ FEs	YES	YES	YES	YES
JTZ FEs	YES	YES	YES	YES
IJZ FEs	YES	YES	YES	YES
KL F-stat	29.74	65.55	29.74	65.55
KP LM underid.	29.62	65.55	29.62	65.55
Effect of $\hat{X}$ on Y	0.998	0.553	0.969	0.630

Notes: Results refer to the period 1995-2007. The independent variables include two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value (FVA) captures backward GVC activity, whereas Domestic Value (DVA) measures forward GVC activity. The 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 describes each variable included in the model. Standard errors are clustered by dyads and sector (ijz) 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

addressing regulation of economic activity (investment, services, competition, product standards) but also disciplines on the use of contingent protection.[18]

Table 5: Trade, GVCs and Disciplines on Flexibility

Outcome variable	Flexibility	
	(1)	(2)
Domestic Value (DVA)	2.8250***	
	(0.5262)	
Foreign Value (FVA)		5.4198***
		(0.7598)
Observations	2,509,650	2,509,650
ITZ FEs	YES	YES
JTZ FEs	YES	YES
IJZ FEs	YES	YES
KL F-stat	29.74	65.55
KP LM underidentification	29.62	65.55
Effect of $\hat{X}$ on Y	1.776	0.860

Notes: The results refer to the period 1995-2007. The independent variables include two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value (FVA) captures backward GVC activity, whereas Domestic Value (DVA) measures forward GVC activity. The two variables are sourced from the OECD TiVA dataset. The dependent variable provides a measure of flexibility for PTAs including countries i and j as signatories and active in time t. The variable is sourced from the DESTA database. Section describes each variable included in the model. Standard errors are clustered by dyads and sector (ijz) 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-3.
*** p<0.01, ** p<0.05, * p<0.1

Robustness Checks

To explore the robustness of the baseline results we undertake several robustness checks. First, and most importantly, we re-estimate the baseline results for the subset of observations spanning the post-2007 period, i.e. after the enlargement of the Panama canal and consequent expansion in the maximum size of ships that can use the canal. Ta-

[18] The literature has found mixed results on the relationship between flexibility and trade liberalization, with some scholars arguing that flexibility supports deeper liberalization of trade (Finger and Nogues, 2006; Kucik and Reinhardt, 2008) and others finding that instruments such as antidumping act more as an instrument to reverse liberalization, e.g., Bown and Tovar (2011) and Moore and Zanardi (2009). Prusa et al. (2022), focusing on antidumping, the most frequently observed flexibility instrument, conclude such instruments are used significantly less among countries that have concluded PTAs than against non-members.

bles 6 shows that results are not robust over the disaggregated sample over the period 2008-2017.[19] The coefficients of both measures of value-added trade are negative and statistically insignificant, with a F-statistic below 10. This confirms our instruments are no longer good predictors of GVC activities after the enlargement of the Panama Canal and the related increase in use of larger vessels, which creates economic incentives to dredge ports.

Table 6: Trade, GVCs and Depth - Baseline estimates (post-2007)

Outcome variable	Depth	
	(1)	(2)
Domestic Value (DVA)	-5.5003	
	(13.5157)	
Foreign Value (FVA)		-15.3872
		(10.4984)
Observations	1,930,500	1,930,500
ITZ FEs	YES	YES
JTZ FEs	YES	YES
IJZ FEs	YES	YES
KL F-stat	0.168	2.179
KP LM underidentification	0.173	2.249
Effect of $\hat{X}$ on Y	-6.532	-5.323

Notes: The results refer to the period 2008-2017. The independent variables include two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value (FVA) captures backward GVC activity, whereas Domestic Value (DVA) measures forward GVC activity. The two 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 describes each variable included in the model. Standard errors are clustered by dyads and sector (ijz) 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-3.
*** p<0.01, ** p<0.05, * p<0.1

This is also observed when we unpack the broad measure of PTA depth. TablesC-2 and C-3 show that value-added trade does not explain the inclusion of different types of provisions associated with deeper PTAs. The coefficient estimates for the various DESTA depth indices, as well as variables capturing inclusion of provisions on environmental or labor standards are not statistically significant and exhibit different signs. Similar results are observed for the variable measuring PTAs disciplines on the use of flexibility instruments (Table C-4).

[19] The same results hold for the EU-aggregated sample over the period 2008-2017 (C-1).

We then perform other tests, which we report in Appendix C. In particular, we test the robustness of our results to the exclusion of EU member states from the sample, re-estimating the baseline results by keeping one EU member state at a time. The results, which are showed in Figures C-1 and C-2, are robust for every EU member state, with value-added trade flows yielding positive and significant effects on the depth indicators.

We also replicate the baseline specification after removing all country pairs that include China from the disaggregated estimation sample. The results reported in Appendix Table C-5 confirm the pattern of baseline results, increasing confidence that our findings are not driven by the rapid growth in trade realized by China during our sample period.

Finally, we investigate if our disaggregated baseline results are consistent with the causal effects estimated preserving variation across the ijz dimension for identification. Those results, reported in Table C-6, reveal a strong, positive and statistically significant effect for the two GVC trade regressors. While these results support the baseline findings in Table 1, the specifications without ijz fixed effects are prone to potential endogeneity issues discussed previously and thus may overestimate the extent to which trade and GVCs affect depth. The results presented in Table 1 are therefore our preferred set of estimates.

Conclusion

This paper explores the causal effect of GVCs on the design of trade agreements. We find that GVC-based trade, specifically the DVA and FVA component of exports, increases the depth of PTAs. Our results also illustrate that GVC intensity has consistently positive effects on the probability of including several dimensions of PTA depth– including tariff reduction and disciplines on product standards and on investment, services, and competition policies. Further, we find that value-added trade is positively associated with inclusion of provisions and chapters on environmental and labor protection, as well as inclusion of disciplines on the use of standard flexibility mechanisms included in trade agreements.

Our analysis can be extended along at least three dimensions. First, while our paper provides a macro analysis on the effect of GVCs on deep trade integration, which we consider a necessary starting point, future studies could address the politics behind our results. In particular, using lobbying activities at the firm- or business association-level may help unveil preferences of key economic actors in favor or against preferential trade liberalization. Second, while the choice of specific elements of PTA design used in our empirical analysis reflects a deliberately 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, provides 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 rising geoeconomic competition and geopolitical tensions are likely to drive re-organization and de-risking of GVCs, with consequent changes in sourcing patterns and GVC-related incentives to pursue deep PTAs.

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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 act

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

Table A-3: Summary statistics for variables in estimation sample

Variable	mean	p50	sd	min	max
Trade policy data from DESTA					
Depth	0.769	0	1.147	0	3.513
Tariffs Reduction	0.027	0	0.163	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)	0.020	0	0.141	0	1
Labour Standards (chapter)	0.005	0	0.073	0	1
Environmental Standards (provision)	0.023	0	0.149	0	1
Environmental Standards (chapter)	0.017	0	0.129	0	1
Flexibility	0.072	0	0.527	0	7
Gross and VA trade from OECD TiVA					
Domestic Value (DVA)	0.044	0.0005	0.458	0	97.421
Foreign Value (FVA)	0.011	0.0001	0.129	0	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. (2014).

Table A-4: Summary statistics for variables in estimation sample (EU aggregate)

Variable	mean	p50	sd	min	max
Trade policy data from DESTA					
Depth	0.402	0	0.897	0	3.513
Tariffs Reduction	0.019	0	0.136	0	1
Standards	0.019	0	0.138	0	1
Investment	0.011	0	0.106	0	1
Services	0.011	0	0.105	0	1
Procurement	0.007	0	0.084	0	1
Competition	0.009	0	0.095	0	1
Intellectual Property Rights	0.010	0	0.102	0	1
Labour Standards (provision)	0.008	0	0.089	0	1
Labour Standards (chapter)	0.005	0	0.068	0	1
Environmental Standards (provision)	0.013	0	0.114	0	1
Environmental Standards (chapter)	0.005	0	0.071	0	1
Flexibility	0.076	0	0.586	0	7
Gross and VA trade from OECD TiVA					
Domestic Value (DVA)	0.073	0	0.829	0	97.421
Foreign Value (FVA)	0.015	0	0.186	0	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. (2014).

B Construction of the instrument

Table B-1: Gravity estimates - Baseline

Outcome variable	Domestic Value		Foreign Value	
	(1)	(2)	(3)	(4)
Distance (ln)	-0.7070***		-0.7184***	
	(0.0028)		(0.0035)	
Distance* Part. DWPs * ln(MaxSize)	0.5516***	1.8832**	0.5622***	-0.7488
	(0.0808)	(0.7320)	(0.0903)	(0.9963)
Contiguity	0.5809***		0.4169***	
	(0.0079)		(0.0095)	
Contiguity * Part. DWPs * ln(MaxSize)	-1.2730***	-6.5148**	-0.6042*	-12.8159***
	(0.3341)	(2.6060)	(0.3156)	(2.7890)
Landlocked	-0.2056***		-0.2543***	
	(0.0187)		(0.0210)	
Landlocked * Part. DWPs * ln(MaxSize)	2.0183***	-12.5146***	2.7692***	-17.6156***
	(0.3094)	(3.2839)	(0.2725)	(3.1409)
Observations	2,352,677	1,969,426	2,370,783	2,181,538
ITZ FEs	YES	YES	YES	YES
JTZ FEs YES	YES	YES	YES	YES
IJZ FEs	NO	YES	NO	YES

Notes: The results refer to the period 2008-2017. Robust standard errors are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table B-2: Gravity estimates - EU Aggregate

Outcome variable	Domestic Value		Foreign Value	
	(1)	(2)	(3)	(4)
Distance (ln)	-0.6129***		-0.6392***	
	(0.0053)		(0.0067)	
Distance* Part. DWPs * ln(MaxSize)	2.7086***	-48.2924***	5.5094***	-36.9769***
	(0.7209)	(7.3782)	(0.9139)	(10.2891)
Contiguity	0.7705***		0.3904***	
	(0.0133)		(0.0172)	
Contiguity * Part. DWPs * ln(MaxSize)	8.4589***	-0.5999	1.1978	4.9995***
	(2.1620)	(0.8496)	(3.2737)	(1.1636)
Landlocked	-1.0286***		-0.9545***	
	(0.0342)		(0.0364)	
Landlocked * Part. DWPs * ln(MaxSize)	-8.0245	47.9327	2.1500	16.8597
	(6.0029)	(32.5269)	(3.5202)	(29.2726)
Observations	1,277,790	981,428	1,290,047	1,132,207
ITZ FEs	YES	YES	YES	YES
JTZ FEs YES	YES	YES	YES	YES
IJZ FEs	NO	YES	NO	YES

Notes: The results refer to the period 2008-2017. Robust standard errors are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table B-3: First Stage Results – Baseline

Linear Prediction	Domestic Value (DVA) (1)	Foreign Value (FVA) (2)
	-2.8272***	
	(0.5185)	
		-0.7956***
		(0.0983)
Observations	2,509,650	2,509,650
ITZ FEs	YES	YES
JTZ FEs	YES	YES
IJZ FEs	YES	YES

Notes: The results refer to the period 2008-2017. Standard errors are clustered by dyad and sectors and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

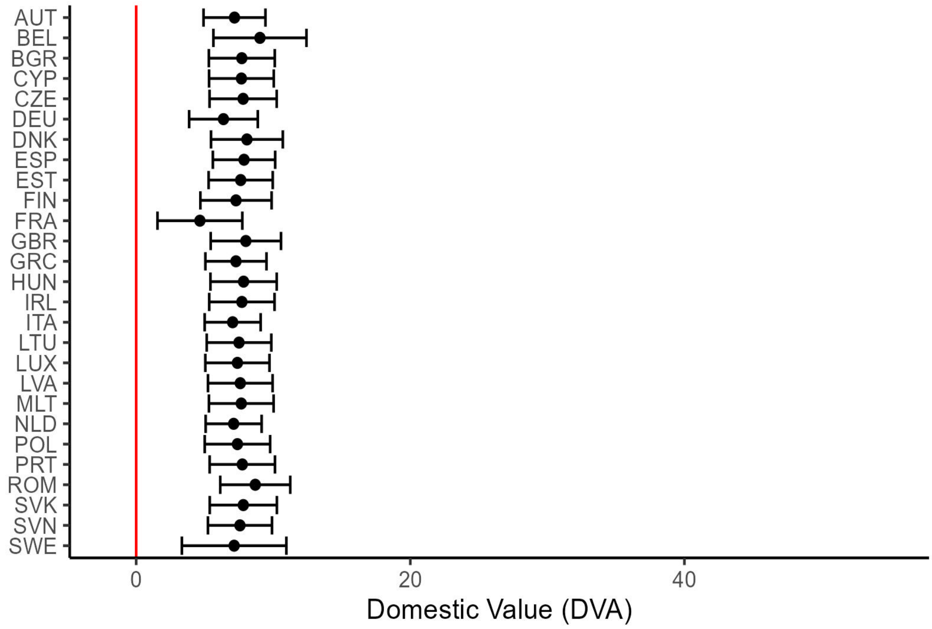
Table B-4: First Stage Results – EU aggregate

Linear Prediction	Domestic Value (DVA) (1)	Foreign Value (FVA) (2)
	-0.1303***	
	(0.0410)	
		-0.0560***
		(0.0152)
Observations	1,376,730	1,376,730
ITZ FEs	YES	YES
JTZ FEs	YES	YES
IJZ FEs	YES	YES

Notes: The results refer to the period 2008-2017. Standard errors are clustered by dyad and sectors and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

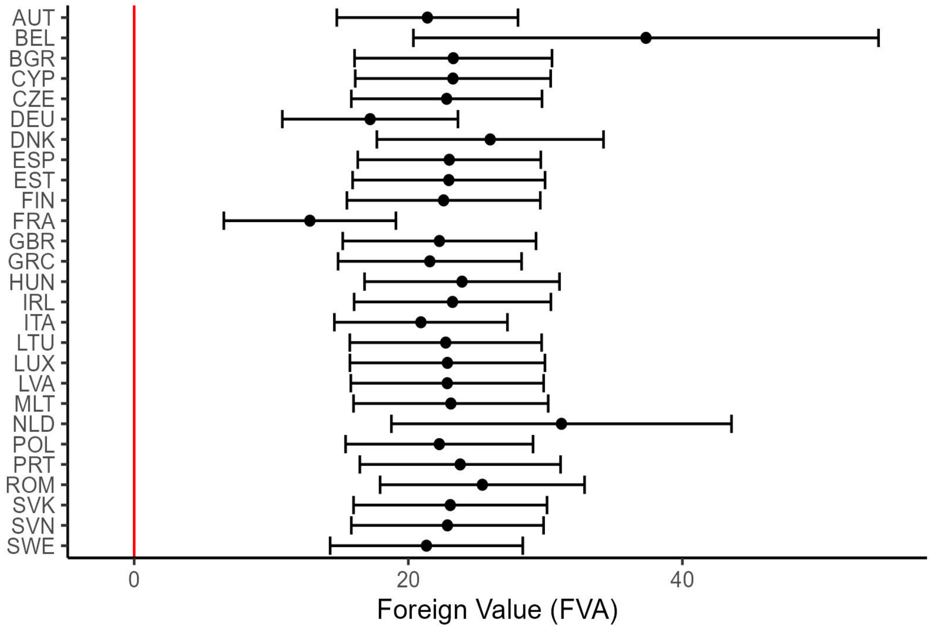
C Other Robustness Tests

Figure C-1: Sub-sets with individual EU countries (DVA)



Notes: This figure reports the estimated coefficients of Domestic Value (DVA) in 27 sub-sets.Each subset keeps one EU member states at the time. The estimates refer to the period 1995-2007.

Figure C-2: Sub-sets with individual EU countries (FVA)



Notes: This figure reports the estimated coefficients of Foreign Value (FVA) in 27 sub-sets. Each subset keeps one EU member states at the time. The estimates refer to the period 1995-2007.

Table C-1: Trade, GVCs and Depth - EU as a Single Actor (post-2007)

Outcome variable	Depth	
	(1)	(2)
Domestic Value (DVA)	-2.9930	
	(1.8876)	
Foreign Value (FVA)		-49.6399
		(63.3524)
Observations	687,960	687,960
ITZ FEs	YES	YES
JTZ FEs	YES	YES
IJZ FEs	YES	YES
KL F-stat	2.532	0.612
KP LM underidentification	2.687	0.649
Effect of $\hat{X}$ on Y	-7.370	-28.34

Notes: The results refer to the period 2008-2017. The independent variables include two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value (FVA) captures backward GVC activity, whereas Domestic Value (DVA) measures forward GVC activity. The two 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 describes each variable included in the model. Standard errors are clustered by dyads and sector (ijz) 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-3.
*** p<0.01, ** p<0.05, * p<0.1

Table C-2: Trade, GVCs and DESTA Indices (post-2007)

Outcome variable	Tariff Reduction		Standards		Investment		Services	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Domestic Value (DVA)	0.5424		0.5424		0.2345		0.2866	
	(1.3270)		(1.3270)		(0.5750)		(0.7014)	
Foreign Value (FVA)		−2.1100		−2.1100		−0.2873		0.2587
		(1.4381)		(1.4381)		(0.2100)		(0.1873)
Observations	1,930,500	1,930,500	1,930,500	1,930,500	1,930,500	1,930,500	1,930,500	1,930,500
ITZ FEs	YES	YES	YES	YES	YES	YES	YES	YES
JTZ FEs	YES	YES	YES	YES	YES	YES	YES	YES
IJZ FEs	YES	YES	YES	YES	YES	YES	YES	YES
KL F-stat	0.168	2.179	0.168	2.179	0.168	2.179	0.168	2.179
KP LM underid.	0.173	2.249	0.173	2.249	0.173	2.249	0.173	2.249
Effect of $\hat{X}$ on Y	0.644	-0.730	0.644	-0.730	0.279	-0.0994	0.340	0.0895

Outcome variable	Procurement		Competition		Intellectual Property	
	(9)	(10)	(11)	(12)	(13)	
Domestic Value (DVA)	0.4299		0.5019		0.2964	
	(1.0511)		(1.2258)		(0.7249)	
Foreign Value (FVA)		0.8843		0.1458		−0.0668
		(0.6015)		(0.1265)		(0.0854)
Observations	1,930,500	1,930,500	1,930,500	1,930,500	1,930,500	1,930,500
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	0.168	2.179	0.168	2.179	0.168	2.179
KP LM underid.	0.173	2.249	0.173	2.249	0.173	2.249
Effect of $\hat{X}$ on Y	0.511	0.306	0.596	0.0504	0.352	-0.0231

Notes: The results cover the period 2008-2017. The independent variables include two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value (FVA) captures backward GVC activity, whereas Domestic Value (DVA) measures forward GVC activity. The 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 describes each variable included in the model. Standard errors are clustered by dyads and sector (ijz) 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-3: Trade, GVCs and Non-Trade Issues (post-2007)

	Labour Standards			
Outcome variable	Provision		Chapter	
	(1)	(2)	(3)	(4)
Domestic Value (DVA)	0.4434		0.1788	
	(1.0829)		(0.4409)	
Foreign Value (FVA)		−0.0672		1.0176
		(0.0925)		(0.6906)
Observations	1,930,500	1,930,500	1,930,500	1,930,500
ITZ FEs	YES	YES	YES	YES
JTZ FEs	YES	YES	YES	YES
IJZ FEs	YES	YES	YES	YES
KL F-stat	0.168	2.179	0.168	2.179
KP LM underid.	0.173	2.249	0.173	2.249
Effect of $\hat{X}$ on Y	0.527	−0.0232	0.212	0.352

	Environmental Standards			
Outcome variable	Provision		Chapter	
	(1)	(2)	(3)	(4)
Domestic Value (DVA)	0.3191		0.2514	
	(0.7808)		(0.6165)	
Foreign Value (FVA)		−0.0558		0.9474
		(0.0915)		(0.6434)
Observations	1,930,500	1,930,500	1,930,500	1,930,500
ITZ FEs	YES	YES	YES	YES
JTZ FEs	YES	YES	YES	YES
IJZ FEs	YES	YES	YES	YES
KL F-stat	0.168	2.179	0.168	2.179
KP LM underid.	0.173	2.249	0.173	2.249
Effect of $\hat{X}$ on Y	0.379	−0.0193	0.299	0.328

Notes: Results refer to the period 2008-2017. The independent variables include two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value (FVA) captures backward GVC activity, whereas Domestic Value (DVA) measures forward GVC activity. The 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 describes each variable included in the model. Standard errors are clustered by dyads and sector (ijz) 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: Trade, GVCs and Disciplines on Flexibility (post-2007)

Outcome variable	Flexibility	
	(1)	(2)
Domestic Value (DVA)	2.9583	
	(7.2236)	
Foreign Value (FVA)		-4.9836
		(3.4342)
Observations	1,930,500	1,930,500
ITZ FEs	YES	YES
JTZ FEs	YES	YES
IJZ FEs	YES	YES
KL F-stat	0.168	2.179
KP LM underidentification	0.173	2.249
Effect of $\hat{X}$ on Y	3.513	-1.724

Notes: The results refer to the period 2008-2017. The independent variables include two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value (FVA) captures backward GVC activity, whereas Domestic Value (DVA) measures forward GVC activity. The two variables are sourced from the OECD TiVA dataset. The dependent variable provides a measure of flexibility for PTAs including countries i and j as signatories and active in time t. The variable is sourced from the DESTA database. Section describes each variable included in the model. Standard errors are clustered by dyads and sector (ijz) 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-3.
*** p<0.01, ** p<0.05, * p<0.1

Table C-5: Trade, GVCs and Depth – Removing China

Outcome variable	Depth	
	(1)	(2)
Domestic Value (DVA)	0.4433*	
	(0.2295)	
Foreign Value (FVA)		1.7459**
		(0.6959)
Observations	2,433,600	2,433,600
ITZ FEs	YES	YES
JTZ FEs	YES	YES
IJZ FEs	YES	YES
KL F-stat	26.30	60.40
KP LM underidentification	26.18	59.73
Effect of $\hat{X}$ on Y	0.261	0.230

Notes: The results refer to the period 1995-2007. The independent variables include two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value (FVA) captures backward GVC activity, whereas Domestic Value (DVA) measures forward GVC activity. The 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 describes each variable included in the model. Observations including China as importer or exporter are dropped. Standard errors are clustered by dyads and sector (ijz) 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-6: Removing ijz fixed effects

Outcome variable	Depth	
	(1)	(2)
Domestic Value (DVA)	12.5165***	
	(0.6862)	
Foreign Value (FVA)		55.4098***
		(2.7003)
Observations	2,509,650	2,509,650
ITZ FEs	YES	YES
JTZ FEs	YES	YES
IJZ FEs	YES	YES
KL F-stat	326.9	417.8
KP LM underidentification	328.9	420.9
Effect of $\hat{X}$ on Y	7.870	8.790

Notes: The results refer to the period 1995-2007. The independent variables include two measures of value-added trade between exporter i and importer j at time t in sector z. Foreign Value (FVA) captures backward GVC activity, whereas Domestic Value (FVA) measures forward GVC activity. The two 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 describes each variable included in the model. Standard errors are clustered by dyads and sector (ijz) 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

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