Deep trade integration and North-South participation in global value chains*

Zarlasht M. Razeq[a]

Abstract

Do comprehensive trade agreements increase the participation of States in global value chains (GVCs) and contribute to their development? Although there is extensive evidence in the trade literature that deep preferential trade agreements (PTAs) can increase States' bilateral export of final goods and, by implication, contribute to local development, much less is known about the characteristics of this effect on GVC relations. This paper answers the question in the framework of a gravity model and uses a comprehensive dyadic data set on trade in GVCs, PTAs, export and other characteristics for 188 countries and economies between 1990 and 2018. Results provide robust evidence that deep PTAs increase members' bilateral trade in GVCs over the long term, especially when these agreements involve at least one developing country or economy and include provisions that support investment. These results underscore that GVC-facilitating deep PTAs are a powerful policy tool that can mobilize the potential of production and trade in GVCs for development.

Keywords: development, global value chains (GVCs), integration, investment, trade agreements

JEL classification codes: F14, F15, F55, F63

* Received: 29 July 2022 – Revised: 15 November 2022 – Accepted: 16 November 2022

I am grateful to Leonardo Baccini for his suggestions and guidance. I also thank two anonymous reviewers and the editors for their helpful comments, and Krzysztof Pelc, Vincent Arel-Bundock and Christina Davis for very helpful discussions of the earlier drafts of this paper. All the remaining errors are my own. This work was supported by a Joseph Armand Bombardier Fellowship from the Social Sciences and Humanities Research Council (SSHRC) Canada. An earlier version of this paper won the UNCTAD–Academy of International Business (AIB) Award for Best Research on Investment and Development.

[a] Department of Political Science, McGill University, Montreal, Canada (zarlasht.muhammadrazeq@mail.mcgill.ca).

1. Introduction and background

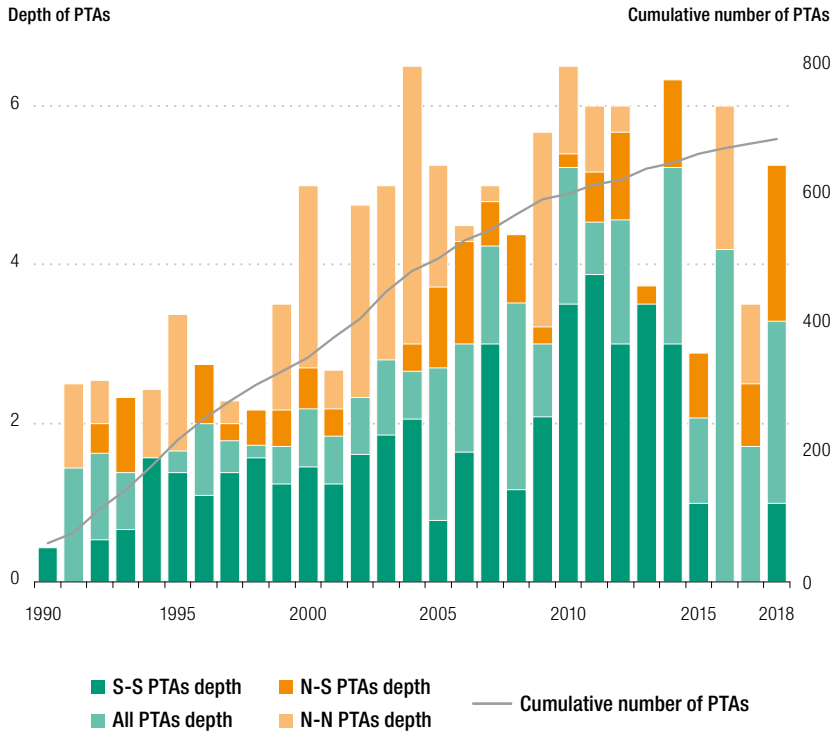
Over the past three decades, there have been two important changes in the organization and institutions of international trade and production: the proliferation and deepening of preferential trade agreements (PTAs) and the globalization of production and the consequent rise of global value chains (GVCs). In terms of PTAs, the gridlock in progress towards multilateral trade liberalization after the Doha Round has made preferential trade liberalization a de facto (and often more preferable) instrument for States to organize their bilateral trade relations (Hartman, 2013). Just between the end of the 1990s and 2018, the cumulative number of PTAs signed globally – especially with and among developing economies – tripled, reaching over 600 (Dür et al., 2014). Over the same period, the share of more comprehensive (deep) PTAs, which cover tariffs but also beyond-tariff areas such as investment, market access, services, competition, procurement policies and others, also increased (figure 1).

In terms of production, globalization has made the fragmentation and outsourcing of production processes less costly, giving rise to GVCs, which are product-specific sets of interconnected production stages such as design, making of parts, assembly and sales, "with each stage adding value, and with at least two stages being produced in different countries" (Antras, 2020, p. 553). In the first decade of the 2000s alone, nearly half of global trade was already in inputs exported for further processing or assembly (World Bank et al., 2017; World Bank, 2020), and between 1990 and 2019, the value added production of foreign affiliates of large firms increased fivefold (UNCTAD, 2020). An increase in participation by developing and emerging economies is notable if we compare States' participation in GVC trade across the globe between 1990 and 2018, using the data set built for this paper (figure 2).

The interplay of these two changes has already been subject to extensive discussions and reassessments of trade and development strategies, especially for the developing world (UNCTAD, 2013 and 2020; Van Assche and Brandl, 2021; World Bank et al., 2017; World Bank, 2020). Despite the surge in policy interest, in the literature a systematic analysis of the causal relation of these global dynamics has been limited, and although there is extensive evidence that deeper PTAs increase trade in final goods (Baccini et al., 2015; Baier and Bergstrand, 2007; Rose, 2004; Spilker et al., 2018), there is still much less known about whether PTAs that are designed primarily to address trade in final goods (Antras and Staiger, 2012) have similar policy and theoretical implications for the growing trade in GVCs.

One reason for this gap has been the limitation of statistics for rigorous cross-country analysis, which emerges from both empirical and conceptual complexities associated with GVC relations. In the context of trade in GVCs, the organization

Figure 1. Annual cumulative number and the average depth of PTAs, 1990–2018

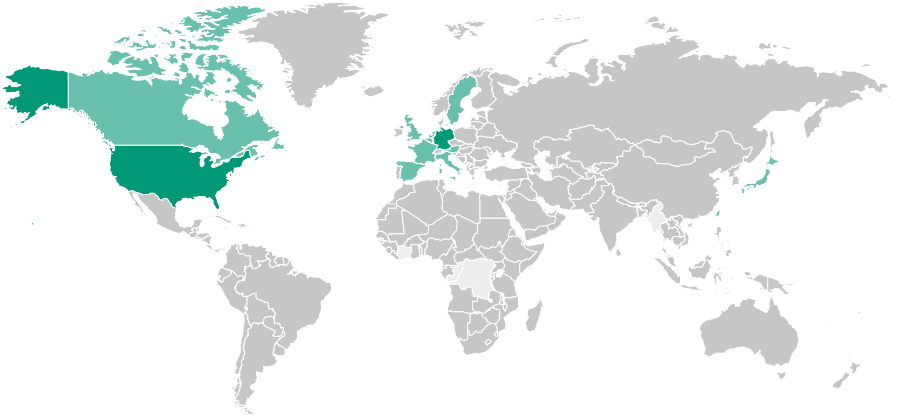


Source: Author's calculation, based on the Design of Trade Agreements (DESTA).
Note: N-N = North-North dyads, N-S = North-South dyads, S-S = South-South dyads.

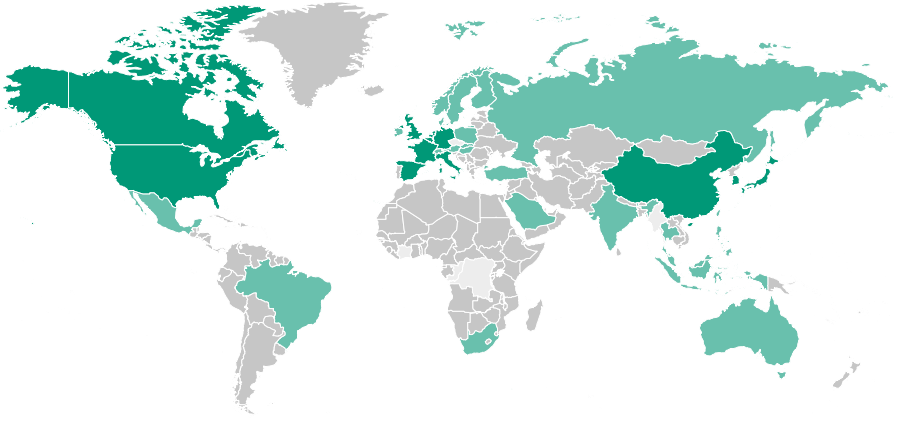
of production and trade is "structurally different from its predecessors" wherein "trade was largely in finished goods" (Gereffi, 2018, p. 431). Within GVCs, the value of items that move from a source to a destination country for further processing or assembly increases only by the value of the modification and changes that the destination country can add domestically to the imported items. The gain from bilateral trade in GVCs is not simply the total value of export but the value of domestic value added (DVA), which is the difference between the total value of export and foreign value added (FVA) to export (UNCTAD, 2013; appendix table A.1). Countries involved in simple and low value added stages, such as assembly of ready-to-use parts, contribute little domestically towards their exported items, whereas those involved in more complex stages of production, such as the design of prototypes, produce most of the value of their exported items (Gereffi, 2018).

Figure 2. GVC trade in 1990 and 2018

GVC trade, 1990
(Thousands of dollars, 2010 = 100)



GVC trade, 2018
(Thousands of dollars, 2010 = 100)



Source: Author's calculations, based on Eora-UNCTAD data set.
Note: GVC trade is the sum of foreign value added (FVA) and indirect value added (DVX) to exports.

Electronics are an oft-given example: Although the iPhone X label shows *Made in China*, only 10 per cent of its pre-sale commercial value is produced and added by firms in China. The rest is added by 10 upstream and downstream countries and economies[1] involved in various bilateral agreements.[2] Therefore, in bilateral terms, economies that trade more in final goods with one another, e.g. China and the United States or Japan and Taiwan Province of China, may not be those that trade more in GVCs with one another.

For these reasons, trade in GVCs and conventional trade qualitatively and quantitively draw different pictures of bilateral trade (Casella et al., 2019; Johnson and Noguera, 2012; Koopman et al., 2014; European Commission et al., 2008; United Nations, 2013), and hence, analysing trade in terms of GVCs offers more direct policy implications for development. In this context, conducting a detailed cross-country analysis of the effect of trade integration on GVCs will improve our understanding of whether and how deep integration can help countries upgrade and expand their production capacity and, by implication, contribute to their development.

The goal and empirical contribution of this paper are in this area. By contributing to the literature on bilateral trade integration (Baccini et al., 2015; Dür et al., 2014) and GVCs (Antras et al., 2012; Koopman et al., 2008; Lenzen et al., 2013) and building a comprehensive dyadic data set with data on PTAs (from DESTA),[3] trade in GVCs (from the Eora-UNCTAD data set)[4] and other country-level dyadic variables, the paper empirically examines the effect of deep integration on bilateral trade in GVCs. Of particular interest are the variations across time, PTAs' design features and countries' income levels. To further qualify that trade in GVCs and conventional trade are indeed qualitatively and quantitively different, I also estimate the effect of deep PTAs on bilateral export flows. Methodologically, the paper follows best practices in the gravity model of trade analysis and applies panel-data techniques with a full set of fixed effects (FE), accounting for the endogeneity of trade policy to the extent possible (Yotov et al., 2016).

In doing so, it improves upon and adds to the coverage and mechanisms of a scant and recent number of empirical works on the subject (Boffa et al., 2019; Laget et al., 2020). Using both Eora and DESTA covers the entire universe of PTAs and bilateral GVC relations from 1990 to 2018 for 188 countries or economies,

[1] The data set used in this paper includes Hong Kong, China and Taiwan Province of China. In line with the approach in the Eora-UNCTAD data set, the term "countries" in this paper covers both countries and economies.

[2] See appendix table A.2 for a tear-down of the iPhone X's major parts, as well as firms, economies and PTAs involved.

[3] The Design of Trade Agreements (DESTA) data set can be accessed at www.designoftradeagreements.org.

[4] The Eora-UNCTAD data set is periodically updated and can be accessed at https://worldmrio.com. This paper uses the 2019 version. For a simplified view of relations between GVC indicators, see appendix table A.1.

including many developing ones. Laget et al. (2020), in contrast, use a selected sample of 260 PTAs compiled by the World Bank and the estimations of Wang et al. (2013) of GVC trade for 40 major economies, which covers the period 1995–2011, leaving the 2010s trade recover and many PTAs and developing countries out of the analysis. Boffa et al. (2019) use Eora-UNCTAD but the same data for PTAs and compare their effect on GVC trade with the effect of bilateral investment treaties (BITs).

Key findings in this paper show that deep trade integration increases States' participation in GVCs. Furthermore, the size of this effect varies significantly across time, the content of PTAs and States' level of development. More specifically, the study shows that the effect of deep PTAs on bilateral trade in GVCs is more pronounced over the long term, showing that deep PTAs are conducive to an effective institutional framework needed for bilateral trade in GVCs to develop. In addition, GVC-facilitating deep PTAs also support investment-related activities, especially when they include developing economies. Finally, the reformative long-term effect of deep PTAs on GVC relations persists when we compare it with those of (BITs and the World Trade Organization (WTO). These results emphasize that deep trade integration is a powerful and long-lasting policy tool that can be effective in facilitating trade in GVCs and contribute to development.

The rest of the paper is organized as follows. In the next section, I derive from the literature several hypotheses related to the expected effect of PTAs on trade in GVCs. The following three sections explain the data set, the empirical strategy and the results. Concluding remarks highlight the policy implications of this paper.

2. The expected effect of deep trade integration on GVCs

What is the expected effect of PTAs on trade in value added? As argued by others, trade in GVCs is more responsive to preferential than to multilateral trade agreements. This is because PTAs are "more individualized" by design and, therefore, "can better reflect member-specific idiosyncratic needs" (Antras and Staiger, 2012, p. 3144). Furthermore, in comparison with shallow PTAs, i.e. PTAs with few provisions, deep PTAs are more effective in facilitating GVC trade because they go beyond "broadly applied" tariff cuts and foster deeper market integration (Antras and Staiger, 2012, p. 3144).

Stylized facts arising from the empirical assessments of the effect of deep PTAs on final exports suggest that their effect is stronger than the effect of shallow PTAs for several reasons. First, deep PTAs help to reduce the uncertainty associated not only with tariffs but also with non-tariff barriers (Antras and Staiger, 2012; Limao, 2016).

This encourages buyers and suppliers to source or sell their products in those markets where the risk is predicted to be low because of higher commitments of local governments bound by a comprehensive PTA. In addition, because entering deeper agreements goes beyond tariffs, their ratification and then implementation by members entail extensive reforms and harmonization in all member States. For example, if under a deep PTA the tax or customs codes have to be revised or new national agencies need to be created, it will take more time for these changes to be implemented and take effect.

In contrast to shallow PTAs, the effect of deep PTAs is, therefore, expected to materialize over the long rather than short term and lead to deeper, here-to-stay institutional and structural changes in member states, propelling more certainty in bilateral relations. Second, because deep PTAs go beyond tariff and customs issues, they have a more extensive spillover effect on the economy overall, fostering stronger production linkages among firms in member States. When compared with shallow agreements, for example, deep PTAs have been more effective in increasing the flows of foreign direct investment (FDI) as well as stimulating firms' specialization upstream or downstream along the GVC, especially over the long run (Büthe and Milner, 2014; Hofmann et al., 2017; Johnson and Noguera, 2012; Orefice and Rocha, 2014; World Bank et al., 2017).

Finally, previous research comparing the effects of deep and shallow PTAs also shows that there are more variations in the effect of deep PTAs on trade across the design features of agreements, e.g. the number and the characteristics of provisions that they cover, as well as countries' characteristics. When stratified by countries' income levels, for example, deep North-South PTAs indicate a stronger effect on trade and investment flows between members than North-North and South-South PTAs (Baccini et al., 2015; Egger and Nigai, 2015). Compared with other dyads, deep North-South PTAs exhibit a stronger effect because the North-South comparative advantages in terms of factors of production and resources are complementary rather than substituting for one another. This complementarity encourages resource-seeking producers from developed countries to establish more backward linkages with suppliers from developing countries after deeper integration and to buy more inputs from them (Harding and Javorcik, 2011; Markusen and Maskus, 2001). Suppliers in the South, similarly, get better access to producers from the North, and through customizing their production and improving their technology improve their competitiveness against firms in other developing countries that are not in a deep PTA with the North (Amendolagine et al., 2013; Baldwin et al., 2014; Fernandez and Portes, 1998). Therefore, deep PTAs are also expected to increase the flow of trade in GVCs, especially over the long term or when the trade is between a developed (North) and a developing (South) economy. This discussion suggests these hypotheses:

H1a: Deep PTAs increase bilateral value added trade more than shallow PTAs.

H1b: Deep PTAs increase bilateral value added trade over the long term more than shallow PTAs.

H1c: Deep PTAs increase bilateral value added trade more between North-South dyads than between other dyads.

The effect of deep PTAs may also depend on another design feature of PTAs: the number and characteristics of provisions that make the depth of an agreement. According to DESTA's classification, these provisions include standards and certification rules, government procurement rules, competition policies, intellectual property rights (IPRs), services (e.g. liberalization and national treatment) and investment (e.g. commitments to no restriction on transfers and payments, compensation in case of expropriation, investor–state dispute settlement mechanisms and national treatment (Dür et al., 2014, p. 360).

While relying on the quantity (number) of these provisions included in a PTA is important to understanding and comparing the depth and coverage of agreements, all seven provisions constituting the depth of PTAs may not have an equal qualitative effect on production and the flow of bilateral value added trade, and as stated by others, only "the role of specific provisions in shaping GVCs may be relevant" (World Bank et al., 2017, p. 179). For example, while the flow of trade in final goods and services may be more directly influenced by the elimination of tariffs and market access rules, the flow of cross-border production may respond more directly to factors such as the promotion of investment, regulation and liberalization of services, and ease of technology transfers, i.e. factors that have a direct impact on the productive capacities of domestic firms and their abilities to add more value to the national exports.

Based on this characterization, I further identify and examine the effect of PTAs that contain specific provisions: PTAs containing investment-related (i.e. either investment, services or IPR) provisions, PTAs containing competition-related (i.e. either procurement or competition) provisions and PTAs with other (i.e. either scope or standards) provisions. As previous research indicates, the primary mechanisms through which agreement may facilitate greater participation in GVCs are investment-related provisions because they have a more direct effect on domestic production capacity through FDI and production specialization. More specifically, the inclusion of investment-related provisions in PTAs augments the effect of preferential liberalization on trade indirectly through multinationals' investment and resource-seeking strategies (Allee and Peinhardt, 2014; Boffa et al., 2019; Büthe and Milner, 2014; Dixon and Haslam, 2016). Likewise, service liberalization and service-related provisions have a greater impact on domestic production than liberalization of trade in goods because the services sector (e.g. finance or communications) is normally an upstream (closer

to suppliers) sector that supports the development and operation of production relations. Service liberalization can further accelerate technological development and help in upgrading the overall productivity of the economy (Carmody, 2020; Konan and Maskus, 2006). IPR provisions also facilitate technology diffusion and knowledge transfer and support efforts to increase production and advance development through FDI and licensing (Maskus and Fink, 2005; Maskus and Penubarti, 1995).

Competition-related provisions aim to liberalize national procurement markets and remove discrimination against foreign suppliers, changing the way firms sell their products in local markets. Although including these provisions directly affects the demand for more downstream imports into the economy, their impact on the production linkages of local firms and their value added activities is effectuated indirectly over time and through FDI because preliminary reforms may be required in the first place to establish an open procurement market (Anderson et al., 2012; Anderson and Muller, 2008). Similarly, although other provisions on standards and tariffs can potentially enable local suppliers to meet the regulatory requirements in foreign markets, their impact materializes only in the long run and after implementing extensive reforms (Brusick et al., 2005; Piermartini and Budetta, 2009; Vijil, 2014). This discussion leads to the following hypothesis:

> *H2: The inclusion of investment-related provisions in PTAs increases trade in GVCs more than PTAs that do not include these provisions.*

To further qualify deep PTAs as an effective institutional framework, I compare their effect with the effect of BITs and joint membership in the WTO for each dyad.[5] Standing alone, BITs improve the terms and environment of trade in goods between the two member States because they offer investment protection mechanisms, most-favoured nation treatment, national treatment and fair compensation mechanisms – among others (Bergstrand and Egger, 2013). When compared with deep PTAs, however, the effect of stand-alone BITs on bilateral exports is often much smaller. Recent research shows that this is, indeed, the case with trade in GVCs as well (Boffa et al., 2019).

There are several reasons for this difference. First, the mitigating effect of PTAs on the uncertainty associated with trade relations is higher than that of BITs. Whereas BITs are always bilateral and time-limited, PTAs can be multilateral, and once in force, they remain in force until members (old and new) decide to ratify or revise them. Second, the effect of PTAs is much greater than that of BITs. Whereas BITs focus more on protection than liberalization of investment, a feature already weakening in recent years (Kerner and Pelc, 2022), PTAs with investment provisions focus on both.

[5] Although there has been little change in the WTO membership in the 2000s and afterward, there were still variations among developed and developing countries in the 1990s. The coefficient of the WTO is not absorbed by FE, which means there are still variations in this variable that can be exploited.

For example, PTAs with investment provisions may also stipulate national treatment rules for pre-establishment or entry phases of investment, specify performance requirements (e.g. local content, export, technology transfer), touch upon corporate governance rules (e.g., the nationality of senior management) or extend the most-favoured-nation clause to investors outside the PTA area (World Bank, 2020). PTAs with a certain level of depth, therefore, are considered more comprehensive in their effect than stand-alone BITs.

Compared with both PTAs and BITs, the WTO is viewed as a low-impact institution in the context of trade in GVCs for two reasons. First, with the growing fragmentation of production, States find it increasingly difficult "to utilize traditional GATT/WTO concepts and rules" to discipline their trade relations under GVCs (Antras and Staiger, 2012, pp. 3144–3177). This is because tariff cuts and trade liberalization through the WTO are small in those sectors that use highly customized inputs, i.e. sectors that rely on few but highly specialized suppliers across the world. Therefore, rules negotiated through the WTO may not interest those countries that seek more specific and customized integration and liberalization. In contrast, under preferential agreements, tariff cuts and trade liberalization can be not only more customized but also implemented faster, especially "for intermediate goods than for finished products" as shown in recent studies on the effect of tariff cuts on intermediate trade (Baccini et al., 2018, p. 1).

Second, liberalization of policies that have a direct impact on production at the plant- and factory-level activities, i.e. investment, services and technology transfer, are outside of the WTO mandate. As the evidence indicates, the WTO has made little progress in areas other than the liberalization of trade in goods (Francois and Hoekman, 2010). Therefore, the effect of PTAs on trade in value added may be more salient than the effect of WTO membership too. In other words:

> *H3: The long-term effect of deep PTAs is higher on value added trade than the stand-alone effect of BITs or joint WTO membership.*

3. Data and variables

For this paper I put together and use a dyadic data set.[6] Each observation is a unique ij pair of economies ($country1$ and $country2$) producing and receiving value added to export at year t. The measure of GVC trade is the estimation of bilateral value added trade flows from Eora-UNCTAD. The measure of the deepness of trade agreements also differs from the mentioned studies on the subject and is an absolute index of PTAs' depth from DESTA. The depth index is based on direct coding and

[6] The data set created and used in this paper is available from the author through Harvard Dataverse.

aggregation of over 100 issue areas mentioned directly in the texts of PTAs into seven major provisions: scope of coverage, investment, services, procurement, intellectual property, competition and standards. It ranges, therefore, between zero (when a PTA is shallow and does not include any issue area) and seven (when a PTA is deep and includes all seven issue areas). The World Bank's measure of PTA depth is relative and defined in relation to the WTO's legal texts: A PTA is deep if it includes provisions that complement or go beyond the WTO mandate, i.e. provisions that are WTO-plus or WTO-extra. Preference in this paper is given to the absolute measure of deep to avoid any misspecification of deepness that may arise from reference to external (other than PTA) texts.

Outcome and predictor variables: The key outcome variable is the log-transformed dyadic value added trade (in thousand constant United States dollars, 2010 = 100) from country i to country j at year t ($ln(VAtrade_{ijt})$) and is derived from the Eora-UNCTAD data set (Casella et al., 2019; Lenzen et al., 2013). The Eora-UNCTAD data set estimates GVC statistics from multi-region input-output tables (MRIO) and the System of National Accounts (Aslam et al., 2017; Koopman et al., 2014). Compared with other data sets, the Eora-UNCTAD data set covers a greater number of developing countries or economies and years.[7]

The main predictor is a dummy variable (PTA_{ijt}) that takes the value of one if the dyad is in a PTA and zero otherwise. As noted, this and other characteristics of PTAs are based on DESTA. It also provides a straightforward additive index of depth (*Depth Index*) that ranges between 0 (very shallow) and 7 (very deep) and covers, as noted before, provisions on such issues as standards, investment, services, procurement policy, competition policy, IPRs and whether a PTA is a partial or full agreement. The depth of a PTA in this paper is captured by a *Depth* dummy that equals one if a PTA's *Depth Index* is above the sample's median, i.e., it includes two or more provisions, and zero otherwise. For a robustness check, I also use the Rasch Index of depth (*DRI*) from DESTA, which is a continuous measure of depth, based on item response theory, and gives more weight to provisions that are more difficult to negotiate and agree upon, e.g. IPRs (Dür et al., 2014, p. 360).

The presence of *investment-related provisions* is measured by a dummy if a PTA covers either investment, services or IPRs areas. The presence of *market-access provisions* is measured by a dummy if a PTA covers either procurement or

[7] In appendix table B.2 and figure B.1, I conduct further robustness checks and compare the Eora-UNCTAD bilateral value added trade variable with the bilateral value added trade variable from the Trade in Value Added database of the Organisation for Economic Co-operation and Development for 35 member countries. The two variables produce comparable results, and the correlation between the two variables is 0.95.

competition policies. *Other provisions* are captured by a dummy if a PTA either includes a provision on standards or has a full rather than partial PTA. To benchmark the effect of PTAs on value added trade with final export, I use the log-transformed value of dyadic export in constant 2010 United States dollars $ln(export_{ijt})$.[8] Finally, I use BIT_{ijt}, WTO_{ijt} dummies and their lags to capture the effect of signing a *BIT* and *WTO membership*. Descriptive statistics are presented in appendix table A.3.

Time variable: Similar to Dür et al. (2014), the variable *year* in this paper shows the year of signature of a PTA and not the year when a PTA enters into force, because "the large majority of agreements enter into force after a relatively short period [i.e. within one or two years] where states seek domestic ratification" (p. 364). Although this dyadic data set records observations consecutively by year (from 1990 to 2018), I use four-year interval data for estimations, i.e. 1990, 1994, 1998, 2002, 2006, 2010, 2014 and 2018. Using interval data in gravity estimation is proven to be important because trade volumes adjust to changes in trade policy after a few years (Baier and Bergstrand, 2007; Yotov et al., 2016). The choice of the length of intervals in gravity estimations is not justified and can range from three to five years (Anderson and Yotov, 2016; Baier and Bergstrand, 2007; Olivero and Yotov, 2012; Trefler, 2004). It is, however, "recommended experimenting with alternative intervals while keeping estimation efficiency in mind" (Yotov et al., 2016, p. 24). This paper uses four-year intervals because the effect of PTAs on value added trade stabilizes three years after signing a PTA as our experiments with two-, three-, and five-year intervals confirm.[9]

Other key variables: Measure of income is a three-level categorical variable (*NS*) that encodes the income group of dyads, based on World Bank Atlas data, as *S-S* if both partners are middle- or low-income countries, *N-S* if one is high-income and the second is middle- or low-income, and *N-N* if both partners are high-income countries. The key challenge in using the *NS* variable is that it is time-invariant: developing economies rarely become developed over a few years and the within-group variation for developed ones is even more invariant. To estimate the effect of PTAs, given income variations among dyads, I use *NS* to split the observations into *N-N*, *N-S* and *S-S* sub-samples and estimate the effect of PTAs in separate models.[10]

[8] Bilateral export data are from the IMF Direction of Trade Statistics (DOTS) online database (https://data.imf.org/?sk=9D6028D4-F14A-464C-A2F2-59B2CD424B85, accessed 1 September 2021).

[9] See appendix tables B.3 and B.4.

[10] Other macroeconomic indicators, such as United States consumer price index, gross domestic product and gross domestic product per capita are from the World Development Indicators (https://databank.worldbank.org/source/world-development-indicators, accessed 1 September 2021).

4. Empirical strategy

This paper implements a structural gravity model and estimates the effect of PTAs on value added trade between dyads. One issue that may seriously affect the reliability of estimations and lead to attenuation bias is that trade policy is endogenous to trade flows. As argued by others, endogeneity bias has become the "gold medal mistake" (Baldwin and Taglioni, 2006, p. 793) in gravity estimations because the gravitational effects of unobserved characteristics at the level of the economy or dyad too often are not considered. No empirical strategy other than a lab-controlled experiment can, of course, fully account for the endogeneity issue; however, to minimize the issue, the accumulated best practices in gravity literature recommend the following three steps: using directional dyadic panel data, using intervals instead of consecutive periods and including the full set of the dyad (ij), year (t) and country-year (it and jt) FE (Baier and Bergstrand, 2007; Yotov et al., 2016).

This paper implements all the recommended steps.[11] Applying the full set of FE is justified in our context as follows. FE controls for time-invariant (observable and unobservable) country-specific, dyad-specific, and time-specific characteristics, including various national policies, institutions, and exchange rates (Yotov et al., 2016, p. 19). The directed dyad FE controls for bilateral characteristics (e.g. distance, contiguity, and language) and the general level of trade costs between i and j. Country-specific time FEs are necessary to control for multilateral trade resistance terms, which are unobserved trade barriers between a dyad and the rest of the world (Feenstra and Hanson, 1996; Hummels et al., 2001; Olivero and Yotov, 2012). Controlling for multilateral trade resistance terms with country-year FE for both partners is expected to produce more reliable results when the sample covers nearly the entire population, which is the case in this paper as it covers the entire universe of PTAs and a large number of economies.[12] Based on these details, I estimate the effect of PTAs given their depth and phased-in effect over the long term, with full samples and samples split by income groups, in the following log-linear form:

$$ln(VAtrade_{ijt}) = \beta_1(PTA_{ijt}) + \beta_2(X_{ijt}) + \gamma_{ij} + \delta_{it} + \tau_{jt} + \epsilon_{ijt},$$

[11] One more recommendation is the implementation of Poisson Pseudo Maximum Likelihood (PPML) estimation when trade data take a lot of zero values. I do not implement a PPML model because the response variable does not take zero values after I remove 14 exporting countries with poor data reporting practices, which are flagged as problematic in Eora's documentation.

[12] Scaling the left-hand side variables by the product of gross domestic products, which is equivalent to imposing restriction of unitary income elasticities, could be an alternative solution; however, as Baier and Bergstrand (2007) indicate, imposing unitary income elasticities has no impact on the PTA coefficient if we use the full set of FE.

where $ln(VAtrade_{ijt})$ is the volume of value added trade between country i and j at period t, i.e., four-year intervals; PTA_{ijt} is a dummy showing the year when a dyad signs a PTA; X_{ijt} represents other specifications such as the depth of PTAs $Depth_{ijt}$, income groups of country-dyad (NS), provisions included in a PTA, and one- and two-period lagged effects of PTAs ((PTA_{ijt-1}), (PTA_{ijt-2})) and PTAs' depth ($(Depth_{ijt-1})$, $(Depth_{ijt-2})$). The full set of FE is represented by γ_{ij}, δ_{it}, τ_{jt}, where γ_{ij} is the directed dyad FE, δ_{it} is country1-year and τ_{jt} is country2-year FE.

As noted, for comparison, I also estimate the effect of PTAs on log-transformed dyadic export $ln(export_{ijt})$ as well as the effect of BITs (BIT_{ijt}) and WTO (WTO_{ijt}) membership on both log-transformed value added trade and dyadic export.

5. Results and discussion

Table 1 presents the main and phased-in effects of shallow and deep PTAs.[13] Results of model 1 show that countries or economies that are in a PTA trade more in GVCs than those that are not in a PTA: for every 1 per cent increase in shallow or deep PTAs, bilateral value added trade increases by more than 3 per cent.[14] These results only partially confirm $H1a$. In other words, in the short term, there is no difference between dyads that are in a deep PTA and dyads that are in a shallow PTA; bilateral GVC relations of both groups benefit from preferential liberalization in the same way. This observation is confirmed when I use the two other measures of depth provided in DESTA for a robustness check: categorical $Depth\ index$ and depth Rasch $Index$, DRI (appendix table B.1). Coefficients for both alternative predictors are nearly zero (and even turning negative for $DRI\ (e^{0.003})$, suggesting that entering a deep PTA may even disrupt the flow of bilateral value added trade in the short term. The short-term (one to three years) non-significant effect of deep PTAs is explained by the fact that in anticipation of a deep PTA and its associated reforms, firms may adjust the organization of their supply chains and switch to new suppliers from the PTA market to gain from the phased-in effect of deep PTAs later.

[13] Because the 2019 version of Eora-GVC data set that I used in 2018 is nowcasted, I re-estimated all models in this paper after dropping the observations for 2018. The re-estimated results (not reported) were not different from those shown here with the 2018 data included, which shows that nowcasted data do not affect our results.

[14] Unless otherwise stated, all coefficients that are expressed in percentage in this paper reflect the average percentage change in the exponentiated coefficients of the response variable per 1 per cent change in the predictor variable, i.e. $(e^{\beta}-1)*100$.

Table 1. The main and long-term effects of PTAs

	ln(VA trade)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample			Split samples		
				N-N	N-S	S-S
Shallow	0.034*** (0.004)	0.031*** (0.003)	0.035*** (0.004)	0.020** (0.008)	-0.008* (0.005)	0.102*** (0.008)
Shallow (medium term)		0.005** (0.002)				
Shallow (long term)		-0.000 (0.002)				
Depth	0.033*** (0.003)	0.033*** (0.003)	0.022*** (0.003)	-0.002 (0.006)	0.022*** (0.005)	0.140*** (0.012)
Depth (medium term)			0.016*** (0.002)			
Depth (long term)			0.013*** (0.003)			
Constant	6.252*** (0.001)	6.252*** (0.001)	6.251*** (0.001)	9.027*** (0.002)	6.697*** (0.001)	5.012*** (0.001)
Observations	232 242	232 242	232 242	27 360	105 667	99 215
R-squared	0.998	0.998	0.998	0.999	0.998	0.995
Dyad FE	Yes	Yes	Yes	Yes	Yes	Yes
country1-year FE	Yes	Yes	Yes	Yes	Yes	Yes
country2-year FE	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author's estimation.
Note: Clustered standard errors at the dyad level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The devil, however, appears when we explore the details of PTAs across time and national income. Models 2 and 3 indicate the main and phased-in effect of shallow and deep PTAs over four (*t-1*) and then eight (*t-2*) years. These results confirm *H1b*: deep PTAs outperform shallow PTAs over the long term. If we follow Baier and Bergstrand's (2007) suggestion and add up significant coefficients of the main and lagged effects of deep PTAs, for example in model 3, for every 1 per cent increase in deep PTAs, trade in GVCs increases by 3.8 per cent after four years and by 5.2 per cent after eight years. Under shallow PTAs, there is no difference in GVC

trade after four and eight years although in the short term the effect remains significant and above 3 per cent.[15] These findings are consistent with previous research on final exports that shows that trade policy and "terms-of-trade changes tend to have lagged effects on trade volumes" (Baier and Bergstrand, 2007, p. 90).

Models 4–6 stratify the data set by income levels (by *NS* variable) and estimate the effect of deep and shallow PTAs with split samples. The results suggest that deep PTAs have a strong and positive effect on value added trade only if at least one partner is a developing economy: signing deep PTAs accounts for a 2.2 per cent and a 15 per cent increase in bilateral value added trade between North-South and South-South dyads, respectively. These results confirm *H1c* and add that the effect on South-South GVC relations is even higher than on North-South GVC relations. The effect of shallow PTAs is also positive and significant for South-South dyads, but for North-South dyads, the effect is nearly zero.

Given that the South often has a comparative advantage in terms of the cost of labour and raw inputs and hosts offshored tasks and operations along the supply chains, it is not unusual to see that trade liberalization is stronger if at least one partner in the dyad is a developing economy. What is novel, however, is that, unlike trade in final exports, the effect of PTAs and their depth is stronger on South-South value added trade than on North-South value added trade. One explanation is that when we look at bilateral trade relations from a value added angle, South-South dyads trade more in GVCs because they perform most of the processing activities, exchanging more partially processed rather than fully finished items. Their bilateral trade, thus, carries more value added than North-South bilateral trade and, therefore, is more responsive to changes in the scope and coverage of trade liberalization.

For this reason, the development and strengthening of South-South trade integration and production relations may not only increase the participation of developing economies in GVCs but also can strengthen the development of specialized production hubs in the South. The presence of variations in the effect of deep PTAs across dyads and over time suggests that policy areas that constitute the depth of PTAs determine the effect of PTAs and their depth on bilateral value added trade, depending on the institutional and economic contexts of partners.

Table 2 estimates the effect of provisions *H2*, using full and split samples stratified by income groups. While the effect of provisions varies across dyads stratified by income groups, PTAs that include investment-related provisions (investment,

[15] In appendix table B.4, I also estimate the effect of PTAs and their 1- to 10-year lags. This re-estimation confirms model 3's result that the full effect of trade liberalization on value added trade materializes over the long term (after four to nine years).

services or IPRs) have an economically large positive and significant effect on bilateral value added trade across all dyads. Model 1 with the full sample confirms *H2* – that investment-related provisions have a greater effect on bilateral value added trade than market-access provisions (procurement or competition) or other provisions (standards or full free trade area). When I split the sample by income group in models 2–4, the effect of investment-related provisions stays positive for all dyads but more strongly for North-North and South-South bilateral value added trade (more than 3 per cent each) than for North-South. The effect of market-access provisions is also notable but only for South-South dyads (over 4 per cent). Finally, the other two provisions have a strong positive effect on both North-North and South-South dyads (approximately 8 per cent and 3 per cent, respectively), while the same effect is negative for North-South dyads.

Table 2. The effect of provisions

	ln(VA trade)			
	(1)	(2)	(3)	(4)
	Full sample	Split samples		
		N-N	N-S	S-S
PTA	0.028*** (0.006)	-0.064*** (0.015)	0.020*** (0.007)	0.084*** (0.012)
Investment-related provisions	0.015** (0.007)	0.035** (0.016)	0.020* (0.011)	0.032** (0.014)
Market-access provisions	-0.018*** (0.007)	-0.051*** (0.016)	-0.004 (0.01)	0.046** (0.019)
Other provisions	0.009* (0.005)	0.083*** (0.014)	-0.021*** (0.006)	0.038*** (0.012)
Constant	6.250*** (0.001)	9.027*** (0.002)	6.695*** (0.001)	4.999*** (0.002)
Observations	232 242	27 360	105 667	99 215
R-squared	0.998	0.999	0.998	0.995
Dyad FE	Yes	Yes	Yes	Yes
country1-year FE	Yes	Yes	Yes	Yes
country2-year FE	Yes	Yes	Yes	Yes

Source: Author's estimation.
Note: Clustered standard errors at the dyad level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

To check that these results are not driven by collinearity among provisions (although data diagnostics point to a variance inflation factor less than 5), I also test the effects of these provisions in separate models with split samples.[16] These robustness checks confirm again our observations in models 2–4 in table 2. It must be noted, however, that this paper looks only at bilateral relations and compares dyads that have a PTA with dyads that do not. Therefore, a positive and significant effect from all provisions on South-South value added trade does not suggest that South-South PTAs have a greater effect on GVC trade than North-North and North-South PTAs, or that South-South integration is better than North-South integration. I do not have evidence for such a suggestion. It is, however, clear from these results that signing PTAs with investment-related provisions helps South-South dyads more than others to trade bilaterally in value added, establish production linkages and participate in GVCs.

Previous models show that the depth of integration matters for trade in GVCs when PTAs cover investment-related provisions. Given that attracting foreign investment plays an important role in upgrading and in the competitiveness of production processes, the effect of PTAs on trade in GVCs may depend on the presence of other institutions such as BITs and the WTO membership of both partners.

Table 3, therefore, compares the effect of PTAs, BITs and joint WTO membership on bilateral value added trade over time. Overall, the results of models 1–3 suggest that economies with a joint PTA, BIT and WTO membership trade more in value added than others. More precisely, model 1 shows that the effect of a joint BIT (5 per cent) on bilateral value added trade is greater than the effect of a joint PTA (3 per cent) and joint WTO membership (1 per cent) across all dyads. This means that when compared with one another, a joint BIT explains more of the variations in bilateral value added trade than joint PTAs or WTO memberships. The coefficient of PTAs in model 1 does not differ significantly from the coefficient of PTAs in models 1–3 in table 1. This means that, for all economies, signing BITs does not divert the impact of PTAs on GVCs. In contrast, BITs seem to only strengthen bilateral GVC integration because BITs can facilitate investment in production processes, causing an increase in the quality and value added content of exports.[17]

Models 4–6 in table 3 show the disaggregated effect of joint institutional memberships on GVC trade for different dyads. Joint memberships in PTAs, BITs and WTO increases GVC integration of developing economies more than of

[16] See appendix table C.1.

[17] Although the causal question in this paper differs from previous seminal studies on the relationship between PTAs and BITs (Tobin and Busch, 2010), findings in table 3 also show that for developing countries stand-alone BITs may not be "better than a lot" in the context of bilateral trade in GVCs. For all dyads (models 1–3), there are no substitution or supplementary effects from BITs and PTAs on GVC trade. The effect of each of these institutions remains significant and nearly unchanged in the presence of others.

developed ones. This effect is particularly strong for South-South dyads (model 6): they engage more in GVCs with one another when they share a PTA as well as a BIT. This means that signing BITs further supports preferential trade liberalization and strengthens GVC integration, providing developing economies with further opportunities for development. Since most processing facilities and plants producing parts and components are located in developing economies, a strong and complementary effect from BITs or PTAs with investment-related provisions on GVC trade (table 2, models 2–4) is expected. The implication is that for developing economies, signing PTAs with investment-related provisions is more important to trade more in GVCs than signing a shallow PTA or a stand-alone BIT.

The effect of joint membership in the WTO is also more important for bilateral GVCs relations between South-South dyads than between North-North and North-South dyads, but this effect is not as significant as the other two institutions. The low impact of joint WTO membership on bilateral trade in GVC is also expected because tariff cuts and trade liberalization through the WTO are small in those sectors that use highly customized inputs and are important for the durability of GVC relations.

Models 2 and 3 in table 3 and model 1 in table 1 confirm *H3*: the long-term effect of stand-alone BITs or joint WTO membership on value added trade are smaller than the phased-in-effect of deep PTAs. Although the effect of BITs on GVCs declines gradually over time, it remains positive over the medium and long terms. The effect of WTO, however, is positive and significant only over the short term, pointing again to the fact that shallow liberalization, through the removal of tariffs and customs-related barriers, does not have a long-term reformative effect on the development and expansion of bilateral GVC trade among economies. Comparing the significance of the dynamic effects of BITs and WTO with the effects of shallow and deep PTAs (models 2 and 3, table 1), we see that, indeed, the cumulative effect of WTO over time is similar to the effect of shallow PTAs, whereas the cumulative effect of deep PTAs is more important than BITs. To check that institutional complementarity does not drive these results, I estimate separately the individual effect of the three institutions with split samples.[18] The results are similar to the results presented in table 3.

Tables 1–3 show that although the overall effect of PTAs and their depth on GVCs is similar to their effect on final export, significant variation in the magnitude of this effect on the two outcome variables appears when we zoom in on specific design features of PTAs, such as the time effect, the content of depth and the income levels of members. To ensure that the estimation approach taken in this paper is as

[18] See appendix table C.2.

Table 3. The main and long-term effect of BITs and joint WTO membership

	ln(VA trade)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample			Split samples		
				N-N	N-S	S-S
PTA	0.030*** (0.003)			-0.001 (0.006)	0.010** (0.004)	0.113*** (0.008)
BIT	0.049*** (0.004)	0.043*** (0.004)		0.039*** (0.007)	0.026*** (0.005)	0.058*** (0.011)
WTO	0.011** (0.005)		0.012*** (0.004)	0.039 (0.024)	-0.010 (0.008)	0.029*** (0.006)
BIT (medium term)		0.011*** (0.003)				
BIT (long term)		0.005* (0.003)				
WTO (medium term)			0.001 (0.003)			
WTO (long term)			-0.008* (0.004)			
Constant	6.241*** (0.002)	6.254*** (0.001)	6.256*** (0.003)	8.998*** (0.015)	6.697*** (0.004)	4.983*** (0.004)
Observations	232 242	232 242	232 242	27 360	105 667	99 215
R-squared	0.998	0.998	0.998	0.999	0.998	0.995
Dyad FE	Yes	Yes	Yes	Yes	Yes	Yes
country1-year FE	Yes	Yes	Yes	Yes	Yes	Yes
country2-year FE	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author's estimation.
Note: Clustered standard errors at the dyad level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

robust as the state-of-the-art gravity models implemented with bilateral final export data, I re-estimate models in tables 1–3 with bilateral export in final goods as an outcome variable.[19] Results with bilateral final export data confirm previous findings (Baier and Bergstrand, 2007) that deep trade integration between two economies

[19] For bilateral export as an outcome variable, see appendix tables C.3 and C.4.

significantly increases their bilateral trade in final export (by 28 per cent), especially if the trade involves a North-South dyad, which is not the case in the context of GVCs, as table 1 shows.

In addition, BITs have a much smaller effect on trade in final export than WTO membership, which is also consistent with results in table 2, showing that GVC trade depends more on preferential investment facilitation than on multilateral trade liberalization. Benchmarking the results of tables 1–3 with bilateral exports as an outcome variable confirms that trade in value added and trade in final goods and services respond to separate sets of mechanisms. Whereas trade in final exports responds well to deep integration, mostly through the removal of tariffs and non-tariff barriers, trade in GVCs depends on deep integration when investment and time effects are considered.

6. Conclusions and policy implications

The deepening and proliferation of PTAs and the rise of GVCs have become the defining features of global trade and the policy headlines of international organizations in the past few years. Despite the significant implications that the interplay of these two trends holds for trade and development policy, we know surprisingly little about whether and how the change in the design features of trade agreements affects the way economies, especially developing ones, can trade more in and benefit from GVCs. To address this gap, this paper used a comprehensive bilateral data set on PTAs and trade in GVCs and assessed the effect of the deepening of trade agreements on bilateral trade in GVCs, accounting for heterogeneous characteristics of PTAs and economies. In doing so, it improved upon, and added to, the coverage and mechanisms of the scant and recent number of empirical works on the subject.

The main finding in this paper suggests that comprehensive (deep) trade agreements increase bilateral trade in GVCs, but the devil of this effect is in its details: the significance and magnitude of deep PTAs on GVC integration vary with the design features of PTAs. Compared with shallow and multilateral trade agreements, deep PTAs that facilitate GVC trade have a strong cumulative long-term effect; they involve at least one developing economy, and they specifically include provisions that support investment and investment-related activities.

Several important policy implications follow from these findings. First, GVC-facilitating deep PTAs are an effective development policy instrument at the micro level because an increase in the value added to export means improvement in the production processes and capabilities of domestic firms. By supporting economies in the process of designing, negotiating and acceding to GVC-facilitating PTAs,

intergovernmental development organizations and advanced economies can play leading roles in using the proliferation of deep PTAs and the fragmentation of international production for development.

Second, the significance of deep PTAs over the long rather than short term also indicates that deep PTAs are more conducive to institutional changes and to creating an enabling environment for firms to produce and add more value to their export. This outcome is not surprising because deep trade integration involves more extensive industrial and institutional changes in the member States that can increase the short-term costs of trade liberalization. Therefore, reference to a small (or even negative) short-term effect on the economy from deep trade integration may further strengthen economic-nationalistic and protectionist sentiments of the incumbent governments, as was the case with the withdrawals of India from the Regional Comprehensive Economic Partnership in 2020 and the United States from the Trans-Pacific Partnership in 2017. In these situations, it is important to remember and weigh the long-term economic gains from deep integration against its short-term costs before outright rejecting a comprehensive deal that may benefit the economy a few years after the accession. In this context, to withstand the short-term costs of joining and implementing deep agreements developing economies may be more in need of assistance than developed ones.

Third, the significance of investment and investment-related provisions, especially for developing economies, underlines that the effect of trade policy on development depends on the effectiveness of investment policy and vice versa. Whereas shallow trade liberalization, for example, may boost the export of upstream inputs from a resource-rich developing economy, the prospects for its long-term growth and development will improve when it can upgrade to higher value added tasks and processes along the GVCs. The primary sources of an increase in value added production are technology and knowledge transfer, which can be induced by the liberalization of services and (or) investment in new and better products or production processes, which can be facilitated through investment liberalization. As the results of the analysis for developing economies in this paper show, BITs in conjunction with deep PTAs with investment-related provisions can achieve these goals more effectively than shallow preferential and multilateral agreements.

Finally, the significant effect of deep PTAs on GVC trade of dyads that include a developing economy, i.e. North-South and South-South dyads, point to developing economies' unparalleled comparative advantages in terms of low costs of production and resource endowment. At the same time, it also underlines the importance of an open international trade system – first and foremost for developing economies, most of which are upstream exporters, to access downstream buyers. Therefore, it is important to acknowledge that any intentional (e.g. global trade wars)

or unintentional (e.g. global pandemics) disruptions of supply chains, especially in the context of the current fragile economic and geopolitical environment, will be more costly for developing economies than for developed ones.

It must be emphasized that the findings in this paper are based on a macro country-level analysis. For a more fine-grained micro-level analysis of the effect of comprehensive trade agreements on GVCs, future research should focus more on the variation across sectors and firms' responses to trade and development policy in the context of GVCs. After all, the evolving production patterns depend directly on firms' decisions and performances, as they are the ones that import, process, produce, add value and trade internationally.

References

Allee, Todd, and Clint Peinhardt (2014). "Evaluating three explanations for the design of bilateral investment treaties", *World Politics*, 66(1), pp. 47–87.

Amendolagine, Vito, Amadou Boly, Nicola Daniele Coniglio, Francesco Prota and Adnan Seric (2013). "FDI and local linkages in developing countries: Evidence from sub-Saharan Africa", *World Development*, 50, pp. 41–56.

Anderson, James, and Yoto Yotov (2016). "Terms of trade and global efficiency effects of free trade agreements, 1990–2002", *Journal of International Economics*, 99, pp. 279–298.

Anderson, Robert, Anna Mueller, Kodjo Osei-lah, Josefita de Leon, and Philippe Pelletier (2012). "Government procurement provisions in Regional Trade Agreements: A steppingstone to GPA accession?", in Sue Arrowsmith and Robert Anderson, eds., *The WTO Regime on Government Procurement* (Cambridge: Cambridge University Press), pp. 561–656.

Anderson, Robert, and Anna Muller (2008). "Market access for government procurement of services: Comparing recent PTAs with WTO achievements", in Martin Roy and Juan Marchetti, eds., *Opening Markets for Trade in Services Countries and Sectors in Bilateral and WTO Negotiations* (Cambridge: Cambridge University Press), pp. 435-474.

Antras, Pol (2020). "Conceptual aspects of global value chains", *The World Bank Economic Review*, 34(3), pp. 551–574.

Antras, Pol, Davin Chor, Thibault Fally and Russell Hillberry (2012). "Measuring the upstreamness of production and trade flows", *American Economic Review*, 102(3), pp. 412– 416.

Antras, Pol, and Robert W. Staiger (2012). "Offshoring and the role of trade agreements", *American Economic Review*, 102(7), pp. 3140–3183.

Aslam, Aqib, Natalija Novta and Fabiano Rodrigues-Bastos (2017). "Calculating trade in value added", Working Paper, No. 2017/178, July (Washington, D.C.: International Monetary Fund).

Baccini, Leonardo, Andreas Dür and Manfred Elsig (2015). "The politics of trade agreement design: Revisiting the depth-flexibility nexus", *International Studies Quarterly*, 59(4), pp. 765–775.

_____ (2018). "Intra-industry trade, global value chains, and preferential tariff liberalization", *International Studies Quarterly*, 62(2), pp. 329–340.

Baier, Scott, and Jeffrey Bergstrand (2007). "Do free trade agreements actually increase members' international trade?", *Journal of International Economics*, 71(1), pp. 72–95.

Baldwin, Richard, Masahiro Kawai and Ganeshan Wignaraja, eds. (2014). *A World Trade Organization for the 21st Century: The Asian Perspective* (Cheltenham and Northampton, Massachusetts: Edward Elgar Publishing).

Baldwin, Richard, and Daria Taglioni (2006). "Gravity for dummies and dummies for gravity equations", Working Paper, No. 12516, September (Cambridge, Massachusetts: National Bureau of Economic Research).

Bergstrand, Jeffrey H., and Peter Egger (2013). "What determines BITs?", *Journal of International Economics*, 90(1), pp. 107–122.

Boffa, Mauro, Marion Jansen and Olga Solleder (2019). "Do we need deeper trade agreements for GVCs or just a BIT?", *The World Economy*, 42(6), pp. 1713–1739.

Brusick, Philippe, Ana Maria Alvarez and Lucian Cernat, eds. (2005). *Competition Provisions in Regional Trade Agreements: How to Assure Development Gains* (New York and Geneva: United Nations).

Büthe, Tim, and Helen V. Milner (2014). "Foreign direct investment and institutional diversity in trade agreements: Credibility, commitment, and economic flows in the developing world, 1971–2007", *World Politics*, 66, pp. 88–122.

Carmody, Padraig (2020). "Meta-Trends in Global Value Chains and Development: Interacting Impacts with COVID-19 in Africa", *Transnational Corporations*, 27(2), pp. 143–155.

Casella, Bruno, Richard Bolwijn, Daniel Moran and Keiichiro Kanemoto (2019) "Improving the analysis of global value chains: The UNCTAD-Eora database", *Transnational Corporations*, 26(3), pp. 115–142.

Dixon, Jay, and Paul Alexander Haslam (2016). "Does the quality of investment protection affect FDI flows to developing countries? Evidence from Latin America", *The World Economy*, 39(8), pp. 1080–1108.

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

Egger, Peter, and Sergey Nigai (2015). "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: Cambridge University Press), pp. 374–391.

European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank (2008). *System of National Accounts 2008* (New York: United Nations).

Feenstra, Robert, and Gordon Hanson (1996). "Globalization, outsourcing and wage inequality", *American Economic Review*, 86(2), pp. 240–245.

Fernandez, Raquel, and Jonathan Portes (1998). "Returns to regionalism: An analysis of non-traditional gains from regional trade agreements", *World Bank Economic Review*, 12(2), pp. 197–-220.

Francois, Joseph, and Bernard Hoekman (2010). "Services trade and policy", *Journal of Economic Literature*, 48(3), pp. 642–-692.

Gereffi, Gary (2018). *Global Value Chains and Development: Redefining the Contours of 21st Century Capitalism* (Cambridge: Cambridge University Press).

Harding, Torfinn, and Beata Javorcik (2011). "Roll out the red carpet and they will come: Investment promotion and FDI inflows", *Economic Journal*, 121(557), pp. 1445–1476.

Hartman, Stephen W. 2013. "The WTO, the Doha Round Impasse, PTAs, and FTAs/RTAs", *The International Trade Journal*, 27(5), pp. 411–430.

Hofmann, Claudia, Alberto Osnago and Michele Ruta (2017). "Horizontal depth: A new database on the content of preferential trade agreements", Working Paper, No. 7981 (Washington, D.C.: World Bank Group).

Hummels, David, Jun Ishii and Kei-Mu Yi (2001). "The nature and growth of vertical specialization in world trade", *Journal of International Economics*, 54(1), pp. 75–96.

Johnson, Robert, and Guillermo Noguera (2012). "Accounting for intermediates: Production sharing and trade in value added", *Journal of International Economics*, 86(2), pp. 224–236.

Kerner, Andrew, and Krzysztof J. Pelc (2022). "Do investor–state disputes (still) harm FDI?", *British Journal of Political Science*, 52(2), pp. 781–804.

Konan, Denise, and Keith Maskus (2006). "Quantifying the impact of services liberalization in a developing country", *Journal of Development Economic*, 81(1), pp. 142–162.

Koopman, Robert, Zhi Wang and Shang-Jin Wei (2008). "How much of Chinese exports is really made in China? Assessing domestic value-added when processing trade is pervasive", Working Paper, No. 14109, June (Cambridge, Massachusetts: National Bureau of Economic Research).

_____ (2014). "Tracing value-added and double counting in gross exports", *American Economic Review*, 104(2), pp. 459–494.

Laget, Edith, Alberto Osnago, Nadia Rocha and Michele Ruta (2020). "Deep trade agreements and global value chains", *Review of Industrial Organization*, 57(2), pp. 379–410.

Lenzen, Manfred, Daniel Moran, Keiichiro Kanemoto and Arne Geschke (2013). "Building Eora: A global multi-region input-output database at high country and sector resolution", *Economic Systems Research*, 25(1), pp. 20–49.

Limao, Nuno. (2016). "Preferential trade agreements", in Kyle Bagwell and Robert W. Staiger, eds., *Handbook of Commercial Policy* (New York: North-Holland), pp. 279–367.

Markusen, James, and Keith Maskus (2001). "General-equilibrium approaches to the multi- national firm: A review of theory and evidence", Working Paper, No. 8334, June (Cambridge, Massachusetts: National Bureau of Economic Research).

Maskus, Keith, and Carsten Fink, eds. (2005). *Intellectual Property and Development: Lessons from Recent Economic Research* (Washington, D.C.: World Bank and Oxford University Press).

Maskus, Keith, and Mohan Penubarti (1995). "How trade-related are intellectual property rights?", *Journal of International Economics*, 39(3–4), pp. 227–248.

Olivero, Maria Pia, and Yoto Yotov (2012). "Dynamic gravity: Endogenous country size and asset accumulation", *Canadian Journal of Economics* 45(1), pp. 64–92.

Orefice, Gianluca, and Nadia Rocha (2014). "Deep integration and production networks: An empirical analysis", *The World Economy*, 37(1), pp. 106–136.

Piermartini, Roberta, and Michele Budetta (2009). "A mapping of regional rules on technical barriers to trade", in Antoni Estevadeordal, Kati Suominen and Robert Teh, eds., *Regional Rules in the Global Trading System* (Cambridge: Cambridge University Press), pp. 250–315.

Rose, Andrew (2004). "Do we really know that the WTO increases trade?", *American Economic Review*, 94(1), pp. 98–114.

Spilker, Gabriele, Thomas Bernauer, In Song Kim, Helen Milner, Iain Osgood and Dustin Tingley (2018). "Trade at the margin: Estimating the economic implications of preferential trade agreements", *The Review of International Organizations*, 13(2), pp. 189–242.

Tobin, Jennifer L., and Marc L. Busch (2010). "A BIT is better than a lot: Bilateral investment treaties and preferential trade agreements." *World Politics*, 62(1), pp. 1–42.

Trefler, Daniel (2004). "The long and short of the Canada-US free trade agreement", *American Economic Review*, 94(4), pp. 870–895.

United Nations (2013). *International Merchandise Trade Statistics: Compilers Manual, Revision 1* (New York: United Nations).

UNCTAD (United Nations Conference on Trade and Development) (2013). *World Investment Report 2013: Global Value Chains and Development: Investment and Value-Added Trade in the Global Economy* (New York and Geneva: United Nations).

_____ (2020). *World Investment Report 2020: International Production Beyond the Pandemic* (New York and Geneva: United Nations).

Van Assche, Ari, and Kristin Brandl (2021). "Harnessing power within global value chains for sustainable development", *Transnational Corporations*,28(3), pp. 135–145.

Vijil, Mariana (2014). "Aid for trade effectiveness: complementarities with economic integration", *The World Economy*, 37(4), pp. 555–566.

Wang, Zhi, Shang-Jin Wei and Kunfu Zhu (2013). "Quantifying international production sharing at the bilateral and sector levels", Working Paper, No. 19677, November (Cambridge, Massachusetts: National Bureau of Economic Research).

World Bank (2020). *World Development Report 2020: Trading for Development in the Age of Global Value Chains* (Washington, D.C.: World Bank Group).

World Bank, Institute of Developing Economies, Organisation for Economic Co-operation and Development, Research Center of Global Value Chains at the University of International Business and Economics and World Trade Organization (2017). *Global Value Chains Development Report 2017: Measuring and Analyzing the Impact of GVCs on Economic Development*, (Washington, D.C.: World Bank Group).

Wooldridge, Jeffrey (2010). *Econometric Analysis of Cross Section and Panel Data* (Cambridge, Massachusetts: MIT Press).

Yotov, Yoto V., Roberta Piermartini, Jose-Antonio Monteiro and Mario Larch (2016). *An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model* (Geneva: United Nations and World Trade Organization).

Appendix A: Descriptive statistics

In table A.1, I simplify and demonstrate the relations between different components of GVC trade, bilateral value added trade, and monadic GVC variables, i.e. foreign value added to export (FVA), domestic value added to export (DVA), indirect value added to export (DVX) and their compositions: (a) total monadic GVC trade, which is the sum of FVA and DVX, and visualized in this table as the sum of green column and row; and (b) total monadic VA to export (VAX), which is the sum of FVA and DVA, and visualized here as the sum of green column and diagonal cells.

Appendix table A.1. A simplified and transposed demonstration of MRIO tables and the relations between commonly used value added variable

		Downstream countries (j)						
		country1	**country2**	**country3**	**countryk**	**…**	**countryN**	
Upstream countries (i)	**country1**	DVA country1	Bilateral VA trade country1, country2	Bilateral VA trade country1, country3	Bilateral VA trade country1, countryk	…	Bilateral VA trade country1, countryN	FVA for country1 = sum of row – DVA country1
	country2	Bilateral VA trade country2, country1	DVA country2	Bilateral VA trade country2, country3	Bilateral VA trade country2, countryk	…	Bilateral VA trade country2, countryN	FVA for country2 = sum of row – DVA country2
	country3	Bilateral VA trade country3, country1	Bilateral VA trade country3, country2	DVA country3	Bilateral VA trade country3, countryk	…	Bilateral VA trade country3, countryN	FVA for country3 = sum of row – DVA country3
	country k	Bilateral VA trade countryk, country1	Bilateral VA trade countryk, country2	Bilateral VA trade countryk, country3	DVA countryk	…	Bilateral VA trade countryk, countryN	FVA for countryk = sum of row – DVA countryk
	…	…	…	…	…	…	…	…
	country N	Bilateral VA trade countryN, country1	Bilateral VA trade countryN, country2	Bilateral VA trade countryN, country3	Bilateral VA trade countryN, countryk	…	DVA countryN	FVA for countryN = sum of row – DVA countryN
		DVX for country1 = sum of column – DVA country1	DVX for country2 = sum of column – DVA country2	DVX for country3 = sum of column – DVA country3	DVX for countryk = sum of column – DVA countryk	…	DVX for countryN = sum of column – DVA countryN	

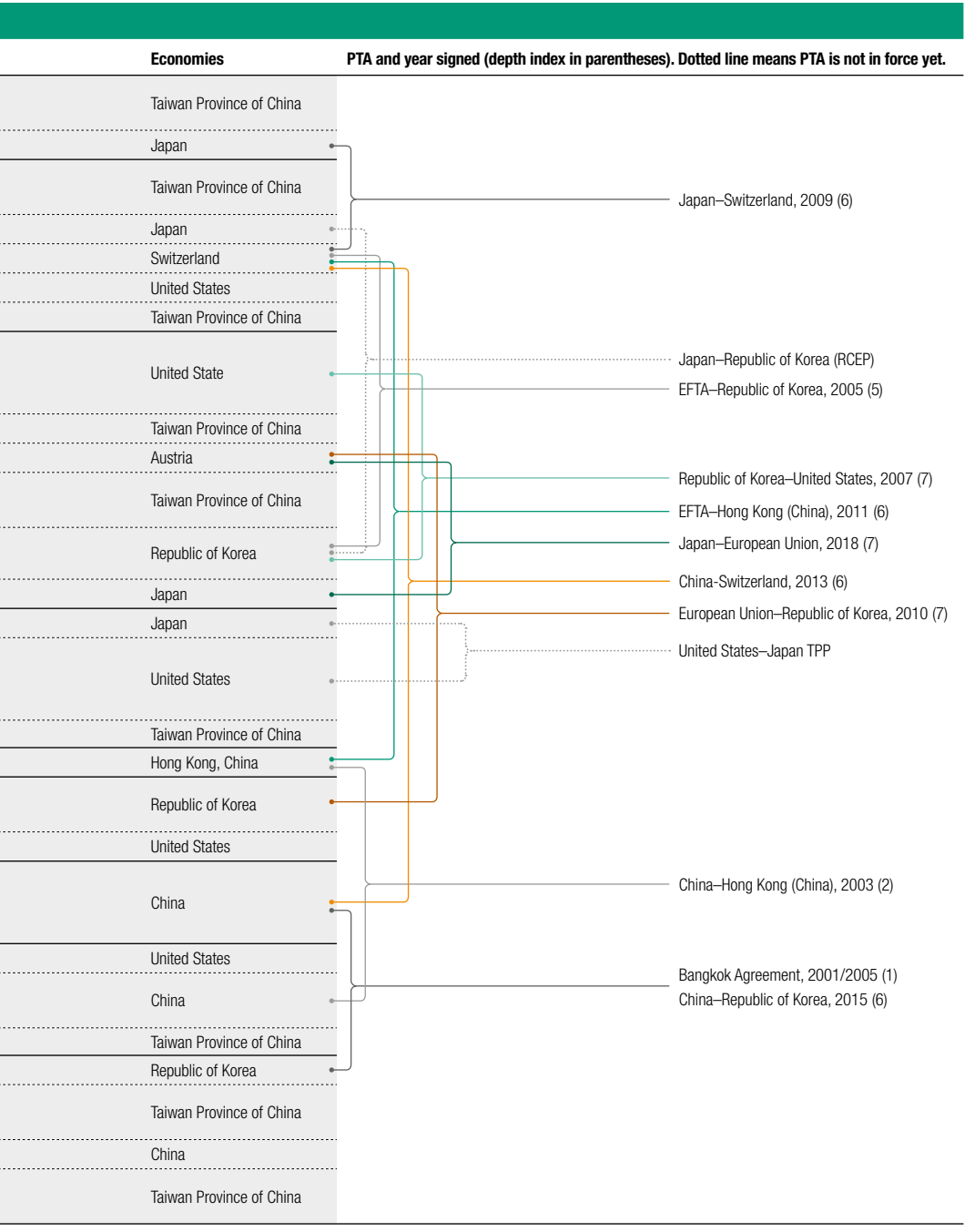
Source: Author's elaborations, based on Koopman et al. (2014).

Note: DVA = domestic value added, DVX = domestic value added embodied in exports of other countries, FVA = foreign value added, VA = value added. For more on the derivation of these GVC indicators from MRIO tables, see Aslam et al. (2017), Casella et al. (2019) and Wang et al. (2013).

Appendix table A.2. Companies, economies and PTAs involved in iPhone X GVC

Major parts	Minor parts	Company
Dual camera	Lens	Largan Precision
		Genius Electronic Optical
	CMOS image sensors	Sony
True depth 3D-sensing camera	Receiver	Largan Precision
		Genius Electronic Optical
		Kantatsu
	Sensor	STMicroelectronics
	Infrared filter	Viavi
	Sensor assembly	Tong Hsing
Projector	Vertical-cavity surface-emitted laser	Lumentum
		Finisar
		II-VI
	Wafer-level lens	Himax
		Ams
	Laser manufacturer	Win Semi
	Laser tester	Chorma
	3D camera module assembly	LG innotek Sharp (Japan-based unit of Taiwan's Foxconn)
	Ceramic substrate	Kyocera
NAND flash memory chips		Toshiba
		Western Digital/SanDisk
Modem chips		Qualcomm
		Intel
Bionic core processors (A11)		TSMC
Casing	Glass back, cover glass	Biel Crystal
DRAM chips		Samsung Electronics
		SK Hynix
		Micron
Batteries		Desay Battery
		Sunwoda
		Simplo Technology
Audio	Microphones, speakers	Knowles
		AAC Technologies
		GoerTek
		Merry Electronics
Display	OLED panels	Samsung Electronics
	3D force touch module	TPK Holding
		General Interface Solution (Foxconn)
		Lens Technology
	Stainless steel frames, casing assembly	Foxconn Technology
Assembly	Final product	Foxconn

Source: Author's elaborations, based on Nikkei Asian Review, "How the iPhone reshaped Asian tech", 20 December 2017 (for information about parts, companies



s and economies); and DESTA (for information on PTAs).

Appendix table A.3. Descriptive statistics (N = 232,242)

	Mean	Standard deviation	Minimum	Maximum
ln(VA trade)	6.26	2.91	-2.11	18.42
ln(dyadic export)	14.90	4.08	-0.14	26.76
PTA	0.28	0.45	0	1
Depth	0.09	0.28	0	1
Depth index	0.56	1.34	0	7
BIT	0.11	0.31	0	1
Depth Rasch Index	-0.03	0.61	-1.43	2.27
WTO	0.48	0.50	0	1
NS	2.31	0.67	1	3
Investment-related provisions	0.08	0.28	0	1
Market-access provisions	0.07	0.26	0	1
General provisions	0.20	0.40	0	1

Source: Author's estimation.
Note: All financial values are in constant United States dollar prices (2010 = 100).

Appendix B: Additional tests

Exogeneity test

To test the strict exogeneity assumption, i.e. that there is no feedback effect from the changes in trade flows to the changes in trade policy, I add one-period lead dummies for PTA and depth variables in models 1 and 2 in table B.1 (Baier and Bergstrand, 2007; Wooldridge, 2010). A negative and statistically significant coefficient of the PTA lead confirms previous findings that PTAs are endogenous to trade policy. In the context of GVC trade too, firms "delay trade temporarily in anticipation of an impending agreement" (Baier and Bergstrand, 2007, p. 90). With the full set of FE and interval data, the total effect of PTAs on value added trade remains positive and significant (5.4 per cent) as model 1 shows.

Appendix table B.1. Strict exogeneity test

	ln(VA trade)		
	(1)	(2)	(3)
PTAs	0.019*** (0.002)	0.036*** (0.003)	0.061*** (0.005)
PTAs (medium term)	0.024*** (0.002)		
PTAs (long term)	0.018*** (0.002)		
PTAs (anticipatory)	-0.008*** (0.002)		
Depth		-0.014*** (0.003)	
Depth (medium term)		0.017*** (0.002)	
Depth (long term)		0.016*** (0.003)	
Depth (anticipatory)		0.005** (0.002)	
DRI			-0.015*** (0.002)
Constant	6.246*** (0.001)	6.249*** (0.001)	6.248*** (0.001)
Observations	232 242	232 242	232 242
R-squared	0.998	0.998	0.998
Dyad FE, country1-year FE, country2-year FE	Yes	Yes	Yes

Source: Author's estimation.
Note: Clustered standard errors at the dyad level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

A comparison of bilateral value added trade variables in the Eora-UNCTAD data set and the OECD's TiVA data set

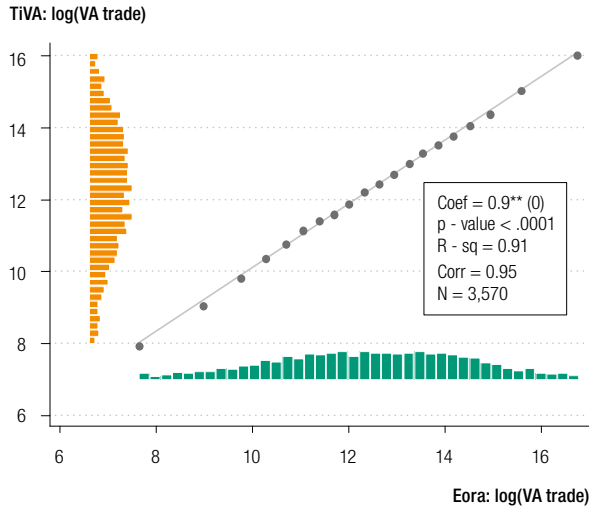
To make sure that this paper's main results are not driven by the underlying characteristics of the Eora-UNCTAD data set, I run a comparison between it and the bilateral value added trade variables for a sample of 35 member countries in the Organisation for Economic Co-operation and Development's Trade in Value-Added data set. Bilateral value added trade in the TiVA (2016 version) data set is captured by the *origin of value added in gross exports, USD million (EXGR_BSCI)* variable. After making TiVA data comparable with Eora data, i.e. after controlling for inflation and converting TiVA data in constant (2010 = 100) thousand United States dollars, I estimate the effect of PTAs on bilateral value added trade with both TiVA and Eora data. Since we cannot implement multi-way FE with a smaller sample size, I implement a simple FE OLS with interval data and clustered standard errors at the dyad level. As table B.2 shows, results between models 1 and 2 (with Eora data) and models 3 and 4 (with TiVA data) do not differ significantly. These results are consistent with those presented in the main models (table 1) in terms of signs and long- versus short-term differences. Figure B.1 presents the correlations between the two variables.

Appendix table B.2. The main and long-term effect of PTAs (Eora and TiVA data sets)

	ln(VA trade)			
	(1)	(2)	(3)	(4)
	Eora-UNCTAD		TiVA	
PTA	0.856*** (0.025)	0.754*** (0.023)	0.923*** (0.052)	0.805*** (0.05)
PTA (medium term)		0.441*** (0.02)		0.509*** (0.038)
PTA (long term)		0.638*** (0.023)		0.615*** (0.039)
Constant	11.804*** (0.017)	11.229*** (0.021)	11.477*** (0.036)	10.881*** (0.04)
Observations	3 570	3 570	3 570	3 570
R-squared	0.091	0.24	0.081	0.201
Number of dyads	1 190	1 190	1 190	1 190
FE	Yes	Yes	Yes	Yes

Source: Author's estimation.
Note: Standard errors at the dyad level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Appendix figure B.1. Binned scatterplot of Eora and TiVA bilateral value added trade variables



Source: Author's calculations, based on the data set created for this paper.
Note: ** p<0.05.

Appendix table B.3. Comparing the main effect of PTAs with three-, four-, five- and six-year interval data

	ln(VA trade)				
	(1)	(2)	(3)	(4)	(5)
	Consecutive years	Three-year interval	Four-year interval	Five-year interval	Six-year interval
PTA	0.017*** (0.001)	0.007*** (0.002)	0.035*** (0.002)	0.006*** (0.002)	-0.005* (0.002)
Constant	6.240*** (0.001)	6.231*** (0.001)	6.250*** (0.001)	6.312*** (0.001)	6.337*** (0.001)
Observations	841 037	289 640	232 242	174 236	145 083
R-squared	0.998	0.998	0.998	0.998	0.998
Dyad FE, country1-year FE, country2-year FE	Yes	Yes	Yes	Yes	Yes

Source: Author's estimation.
Note: Clustered standard errors at the dyad level are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

The phased-in and anticipatory effect

The results in the following table point to the differences (and some similarities) between the long-term and anticipatory effects of PTAs and BITs: (1) both PTAs and BITs are endogenous to value added trade flows; (2) while in the anticipation of PTAs, firms indeed withhold their decisions (consistent with previous research on the anticipatory effect of PTAs (Baier and Bergstrand, 2007; Dür et al., 2014)), in the anticipation of a BIT, firms fast-track their activities in the BIT-covered market, which can eventually lead to an increase in trade; and (3) the total effect of PTAs diminishes after nine years, while the total and main effects of BITs only solidify over time.

Appendix table B.4. The phased-in and anticipatory effect of PTAs and BITs on VA trade with consecutive years

	PTAs				BITs			
	Models	Lag/lead effect	Agreement's effect	Total effect	Models	Lag/lead effect	Agreement's effect	Total effect
t-1	(1)	0.026***	-0.006**	0.02	(16)	0.016***	0.025***	0.041
t-2	(2)	0.026***	-0.002*	0.024	(17)	0.015***	0.028***	0.043
t-3	(3)	0.028***	-0.001	0.028	(18)	0.013***	0.031***	0.044
t-4	(4)	0.029***	0.001	0.029	(19)	0.012***	0.033***	0.045
t-5	(5)	0.031***	0.003***	0.034	(20)	0.011***	0.034***	0.045
t-6	(6)	0.028***	0.007***	0.035	(21)	0.010***	0.035***	0.045
t-7	(7)	0.028***	0.009***	0.037	(22)	0.009***	0.036***	0.045
t-8	(8)	0.027***	0.011***	0.038	(23)	0.008***	0.037***	0.045
t-9	(9)	0.025***	0.014***	0.039	(24)	0.008***	0.038***	0.046
t-10	(10)	0.023***	0.015***	0.038	(25)	0.008***	0.038***	0.046
t+1	(11)	-0.013***	0.028***	0.015	(26)	0.010***	0.032***	0.042
t+2	(12)	-0.009***	0.023***	0.014	(27)	0.009***	0.035***	0.044
t+3	(13)	-0.010***	0.022***	0.012	(28)	0.008***	0.037***	0.045
t+4	(14)	-0.013***	0.022***	0.009	(29)	0.007***	0.038***	0.045
t+5	(15)	-0.011***	0.020***	0.009	(30)	0.008***	0.040***	0.048
Constant		6.230***	6.230***	6.230***		6.240***	6.240***	6.240***
Observations		841 037	841 037	841 037		841 037	841 037	841 037
R-squared		0.998	0.998	0.998		0.998	0.998	0.998
Dyad FE, country1-year FE, country2-year FE		Yes	Yes	Yes		Yes	Yes	Yes

Source: Author's estimation.

Note: All clustered standard errors are =< 0.002 (not shown here). *** p < 0.01, ** p < 0.05, * p < 0.10.

Appendix C: Split samples

Appendix table C.1. Group of provisions by dyad

	ln(VA trade)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Split samples								
	Full sample	N-N	N-S	S-S	N-N	N-S	S-S	N-N	N-S	S-S
PTA	0.028*** (0.006)	0.006 (0.007)	0.001 (0.005)	0.114*** (0.008)	0.014* (0.007)	0.003 (0.005)	0.116*** (0.008)	-0.076*** (0.014)	0.033*** (0.006)	0.080*** (0.012)
Investment-related provisions	0.015** (0.007)	-0.009 (0.007)	0.023*** (0.005)	0.058*** (0.012)						
Market-access provisions	-0.018*** (0.007)				-0.021*** (0.007)	0.020*** (0.005)	0.082*** (0.017)			
Other provisions	0.009* (0.005)							0.085*** (0.014)	-0.027*** (0.006)	0.052*** (0.011)
Constant	6.250*** (0.001)	9.028*** (0.002)	6.695*** (0.001)	4.997*** (0.002)	9.028*** (0.002)	6.695*** (0.001)	4.997*** (0.002)	9.027*** (0.002)	6.694*** (0.001)	4.999*** (0.002)
Observations	232 242	27 360	105 667	99 215	27 360	105 667	99 215	27 360	105 667	99 215
R-squared	0.998	0.999	0.998	0.995	0.999	0.998	0.995	0.999	0.998	0.995
Dyad FE, country1-year FE, country2-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author's estimation.
Note: Clustered standard errors at the dyad level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Appendix table C.2. The effect of PTAs and BITs on dyadic VA trade by income group

	ln(VA trade)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Split samples					
	N-N	N-S	S-S	N-N	N-S	S-S	N-N	N-S	S-S
PTA	0.001 (0.006)	0.012*** (0.004)	0.121*** (0.008)						
BIT				0.039*** (0.007)	0.027*** (0.005)	0.076*** (0.011)			
WTO							0.04 (0.025)	-0.01 (0.008)	0.035*** (0.006)
Constant	9.027*** (0.002)	6.695*** (0.001)	4.996*** (0.002)	9.021*** (0.001)	6.694*** (0.001)	5.026*** (0.001)	9.004*** (0.014)	6.703*** (0.004)	5.015*** (0.003)
Observations	27 360	105 667	99 215	27 360	105 667	99 215	27 360	105 667	99 215
R-squared	0.999	0.998	0.995	0.999	0.998	0.995	0.999	0.998	0.995
Dyad FE, country1-year FE, country2-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author's estimation.
Note: Clustered standard errors at the dyad level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Appendix table C.3. The effect of provisions on dyadic export

	ln(dyadic export)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Split samples								
	Full sample	N-N	N-S	S-S	N-N	N-S	S-S	N-N	N-S	S-S
PTA	0.046 (0.041)	0.027 (0.063)	-0.04 (0.045)	0.202*** (0.073)	0.037 (0.065)	-0.055 (0.046)	0.184** (0.073)	0.263** (0.118)	0.138*** (0.053)	0.112 (0.085)
Investment-related provisions	0.090* (0.049)	0.019 (0.058)	0.141*** (0.042)	-0.131 (0.083)						
Market-access provisions	0.168*** (0.051)				0.003 (0.062)	0.170*** (0.044)	-0.001 (0.09)			
Other provisions	-0.141*** (0.033)							-0.251** (0.118)	-0.148*** (0.051)	0.101 (0.073)
Constant	15.031*** (0.01)	17.398*** (0.022)	15.116*** (0.014)	13.729*** (0.03)	17.399*** (0.022)	15.118*** (0.014)	13.730*** (0.03)	17.403*** (0.022)	15.110*** (0.013)	13.735*** (0.03)
Observations	142 379	21 892	73 749	46 731	21 892	73 749	46 731	21 892	73 749	46 731
R-squared	0.892	0.942	0.888	0.858	0.942	0.888	0.858	0.942	0.888	0.858
Dyad FE, country1-year FE, country2-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author's estimation.
Note: Clustered standard errors at the dyad level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Appendix table C.4. The effect of deep PTAs on dyadic export

	ln(dyadic export)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample			Split samples		
				N-N	N-S	S-S
PTA	0.052** (0.025)	0.055** (0.025)	-0.074** (0.031)	0.017 (0.066)	-0.067 (0.046)	0.205*** (0.073)
Depth			0.252*** (0.028)	0.033 (0.062)	0.181*** (0.041)	-0.127 (0.079)
BIT	0.028 (0.025)					
WTO	0.146** (0.074)					
Constant	14.930*** (0.045)	15.021*** (0.01)	15.036*** (0.01)	17.398*** (0.022)	15.119*** (0.014)	13.727*** (0.03)
Observations	142 379	142 379	142 379	21 892	73 749	46 731
R-squared	0.892	0.892	0.892	0.942	0.888	0.858
Dyad FE, country1-year FE, country2-year FE	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author's estimation.

Note: Clustered standard errors at the dyad level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.