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What Role for Aid for Trade in (Deep) PTA Relations?

Empirical Evidence from Gravity Model Estimations

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Abstract

While recent preferential trade agreements (PTAs) cover an increasingly broad range of policy areas beyond their traditional competence for reducing bilateral tariffs, little is known about the implications of this new emphasis on interactions with other trade-related policy measures. We approach this gap by examining the effectiveness of bilateral aid for trade (AfT) in deep North–South PTA relations. To this end, we use a structural gravity model for bilateral panel data of 29 OECD DAC countries and 144 developing countries from 2002–2015 and find that the marginal effect of AfT decreases as the policy areas of a PTA expand. Further investigation of the underlying mechanisms suggests that the observed trade-off between PTA depth and AfT effectiveness may be due to compliance with the non-tariff provisions contained in deep PTAs. We find two lines of reasoning plausible. First, compliance efforts appear to consume large fractions of AfT and thus reduce AfT available for potentially more effective projects, as we do not observe an alignment of AfT in deep PTAs. Second, since we also observe heterogeneity in interactions across donors, depending on their specific project portfolios, AfT provided by high-income PTA partners could well be used to redirect exports to third countries with comparatively fewer bilateral obligations. Donor countries should therefore carefully weigh compliance costs to developing countries against the non-trade benefits of common deep PTAs, and accurately identify financial and technical assistance needs together with their PTA partners.

Keywords: Aid for trade effectiveness, gravity model of trade, non-tariff provisions, preferential trade agreements, PTA depth, South-North trade

JEL codes: F14, F15, F35

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Abbreviations

ACP	African, Caribbean and Pacific
AfT	aid for trade
CRS	Credit Reporting System [database]
DESTA	Design of Trade Agreements [database]
DAC	Development Assistance Committee
ESR	economic and social rights
EPA	economic partnership agreement
EP	environmental protection
EU	European Union
FDI	foreign direct investment
IPRs	intellectual property rights
ODA	official development assistance
OECD	Organisation for Economic Co-operation and Development
PPML	poisson pseudo maximum likelihood
PTA	preferential trade agreement
SPS	sanitary and phytosanitary
SITC	Standard International Trade Classification
TBT	technical barriers to trade
TPP	Trans-Pacific Partnership
WTO	World Trade Organization

1 Introduction

The 2030 Agenda for Sustainable Development emphasises the relevance of international trade for promoting inclusive economic growth and reducing poverty. Despite this perception, tapping into international trade channels is not straightforward. Indeed, many different approaches to (better) integrating developing countries into the global economy have been applied, the most prominent being the removal of visible trade barriers. At the multilateral level, developing country members of the World Trade Organization (WTO) are granted special and differentiated treatment compared to the Most Favoured Nation (MFN) clause, and commonly qualify for unilateral tariff preferences for their exports to major markets. In parallel, there is a steady increase of developing countries' participation in reciprocal preferential trade agreements (PTAs), both among themselves and with high-income countries. At the end of 2022, the WTO recorded a total of 355 PTAs in force, the majority of which were signed between countries at different stages of economic development.

North–South PTAs typically eliminate the uncertainty for developing countries about their qualification for non-reciprocal tariff preferences and thereby help to create a more favourable environment for their exports (Herz & Wagner, 2011; Manger & Shadlen, 2014; Limão, 2016), but they also entail increased competitive pressure across the board from Northern integration partners. Moreover, despite the positive effects of PTAs on reducing tariffs (e.g. Hayakawa & Kimura, 2015; Stender, 2019), it was recognised, not least through the 2005 WTO Aid for Trade (AfT) initiative, that market access alone is often insufficient to stimulate engagement in international trade or, more specifically, to adequately exploit the full potential of trade arrangements. Instead, the exports of developing countries are frequently constrained by a variety of supply-side limitations, including the lack of productive capacities, infrastructure deficits, and non-compliance with standards and regulation in particularly Northern destination markets (Suwa-Eisenmann & Verdier, 2007). AfT aims to help developing countries develop the trade capacity and infrastructure needed to reap the benefits of trade liberalisation. It is a component of broader official development assistance (ODA) that includes grants and concessional loans specifically earmarked for trade-related initiatives and efforts (WTO, 2023).

While evidence on AfT mobilisation in the wake of the WTO initiative remains mixed (e.g. Gamberoni & Newfarmer, 2014; Lee, Park, & Shin, 2015; Gnangnon, 2019a), development assistance dedicated to addressing these behind-the-border trade costs is also increasingly incorporated into PTAs. A prominent example of linking economic integration and trade-related assistance is that of the Economic Partnership Agreements (EPAs) between the European Union (EU) and a number of African, Caribbean and Pacific (ACP) states. These agreements are built on asymmetric reciprocal tariff liberalisation but, according to their legal texts, come with the promise to accompany (more) AfT (see also Holden, 2014; Kilolo, 2018).

An additional layer of trade-related assistance in North–South PTAs arises from the recent trend to expand the scope of PTAs beyond the mere removal of tariffs and to select from a menu of additional policy areas that often interfere heavily with national policy spheres (Shadlen, 2005; Mattoo, Rocha, & Ruta, 2020). Modern PTAs frequently target harmonisation of trade-related standards among integration partners, demand better protection of intellectual property, restrict domestic policy-making autonomy in the areas of competition and investment policy, or tighten environmental law and regulation in the fields of agriculture or extractive industries (Dür, Baccini, & Elsig, 2014; Hofmann, Osnago, & Ruta, 2019). Such "deep" PTAs thus increasingly aim to achieve goals beyond the promotion of trade. However, the new emphasis on these non-traditional dimensions in PTAs is not only largely driven by high-income countries, but these countries also set the scene in PTA negotiations with developing countries (e.g. Allee & Elsig, 2019; Peacock, Milewicz, & Snidal, 2019). Developing countries participating in North–South PTAs therefore increasingly face the need to implement reform requirements and to comply with a growing and diverse set of PTA provisions. In this context, trade-related assistance can help

ensure that the benefits of deep PTAs outweigh the costs of their implementation. However, a PTA-related allocation of these funds may not necessarily be consistent with the most pressing national development priorities to improve supply capacity (Hoekman, 2011).

It therefore remains unclear whether the deepening of PTAs and AfT are truly complementary in promoting bilateral trade, or whether the former might even constrain the effectiveness of the latter. In view of several explanations supporting either line of reasoning (see Section 2), the combined effect of PTA depth and AfT is ultimately an empirical question. In this paper, we systematically test the interaction of both policies on developing countries' export patterns in an augmented gravity model of trade.

Our paper is not the first one in this endeavour. Nevertheless, to the best of our knowledge, there is only a sparse empirical literature of two papers that directly considers the role of aid in PTA relations. The first to address this issue, Vijil (2014) finds strong complementarities between AfT *summed* across donors and the (formal) degree of economic integration between trading partners in the bilateral export patterns of developing countries. More recently, however, the empirical findings by Martínez-Zarzoso (2019) suggest, on the contrary, a generally negative interaction effect between *bilateral* overall ODA and common PTA membership on bilateral trade.

Apart from other data and methodological differences from these two papers, which we discuss further below, our empirical results show that the effect of bilateral AfT in PTA relations is neither fully black nor white. Using a structural gravity model for bilateral panel data of 29 Organisation for Economic Co-operation and Development (OECD) Development Assistance Committee (DAC) countries and 144 developing countries from 2002-2015 and recently available data on the content of PTAs, we find no evidence of a complementary effect of the two policies on developing country exports in our generalised estimates, but that the effectiveness of bilateral AfT appears to depend on the depth of a PTA. More specifically, while AfT can still boost trade within deep PTA relations, the marginal effect of AfT decreases as the policy areas of a PTA expand. In other words, we find an overall tendency for a trade-off between the increased deepening of PTAs and the effectiveness of bilateral AfT.

These general results stand up to a number of robustness checks, including testing the endogeneity of AfT in gravity equations, and using alternative PTA depth measures. Given the bird's eye view of our analysis, we do not have a definite explanation for these findings, but further investigation of the underlying mechanisms suggests that the observed negative interaction between PTA depth and AfT may be due to compliance with the non-tariff provisions contained in deep PTAs. We find two lines of reasoning plausible. First, while it is not impossible that compliance obligations in deep PTAs may affect the existing comparative advantage of developing countries and thereby reduce AfT effectiveness, compliance efforts seem more likely to consume large fractions of AfT and thus reduce AfT available for potentially more effective projects, as we do not observe an alignment of AfT in deep PTAs. Second, since we also observe heterogeneity in interactions across donors, depending on their specific project portfolios, AfT provided by high-income PTA partners could well be used to redirect exports to third countries with comparatively fewer bilateral obligations. A notable exception among the donors in our sample is the United States, for which we find that AfT appears to be particularly effective in its deeper PTA relations. With this paper, we thus contribute to the ongoing academic and public debate on the effects of deep trade agreements, especially in developing countries, and also add to the literature on the effectiveness of AfT.

The remainder of this paper is organised as follows. Section 2 discusses the related literature and provides analytical considerations on the interaction between PTA depth and AfT on developing country export patterns. Section 3 presents the methodology and data. While Section 4 discusses our main estimation results, we make several exploratory inquiries in Section 5. Section 6 concludes.

2 Related literature and analytical considerations

Previously, the trade effects of (deep) PTAs and AfT have been studied extensively, but mainly in isolation. The existing literature suggests that deeper PTAs tend to create more trade among members when compared to their shallow counterparts (e.g. Kohl, Brakman, & Gerretsen, 2016; Baier and Regmi, 2022; Mattoo, Mulabdic, & Ruta, 2022). For developing countries specifically, PTAs have generally been shown to stimulate their exports at the aggregate level, but also to reveal sectoral and partner-specific differences. In particular, South–South PTAs appear to boost trade significantly more than North–South PTAs do (e.g. Behar & Cirera-i-Crivillé, 2013; Dahi & Demir, 2013; Cheong, Kwak, & Tang, 2015).

There is also variation in the effectiveness of AfT, both theoretically and empirically. While there is empirical evidence that AfT has the potential to reduce trade costs (e.g. Busse, Hoekstra, & Königer, 2012; Tadesse, Shukralla, & Fayissa, 2019), an early literature links AfT also to negative implications on developing country exports, most notably provoked by the famous "Dutch disease" effect, where the unproportioned expenditure on non-tradeable goods may lead to an appreciation of the recipient's real exchange rate and consequently compromise its competitiveness in tradeable goods (Suwa-Eisenmann & Verdier, 2007; Helble, Mann, & Wilson, 2012). Recent empirical studies find the effect of AfT on recipient exports to range from (small) positive to insignificant, depending on the identification strategy, performance measure, and type of AfT (e.g. Calì & te Velde, 2011; Vijil & Wagner, 2012; Pettersson & Johansson, 2013; Hühne, Meyer, & Nunnenkamp, 2014a; Martínez-Zarzoso, Nowak-Lehmann, & Rehwald, 2017; Wang & Xu, 2018; Gnangnon, 2019b; Kim, 2019).

The general ambiguity found in terms of AfT effectiveness, however, is not reflected on the policy stage. Here, instead, some donors argue that AfT helps developing countries to make the most of their (common) PTAs, especially if it is well-aligned with the policy areas included (see, e.g., WTO, 2022; European Commission, 2023). The EU, for example, has provided funding to the Caribbean Forum of ACP states for the implementation of commitments related to technical barriers to trade (TBT) and sanitary and phytosanitary (SPS) standards under the CARIFORUM-EU EPA (European Commission, 2021), and, more generally, pledges to support signatories to EPAs in developing an implementation strategy to guide future trade-related assistance. Indeed, commitment to common trade-related standards could increase developing country exports in North–South PTAs, and the full realisation of these benefits seems intuitively to depend on specific regulatory technical cooperation (Santeramo & Lamonaca, 2022).

Theoretically, complementarities between AfT and the depth of PTAs could result from a number of other explanations. From the most general perspective, AfT can complement PTAs by helping developing countries build the necessary physical infrastructure, institutions and human capital to take advantage of the opportunities created by trade liberalisation (Calì & te Velde, 2011; Vijil & Wagner, 2012; Hühne et al., 2014a). This reasoning applies to any form of economic integration but can be extended to deep PTAs. Specifically, deep PTAs in particular appear to attract more foreign direct investment (FDI) by importing or locking-in beneficial policy reforms (e.g. Kox & Rojas-Romagosa, 2020; Laget, Rocha, & Varela, 2021), and increase member participation in joint production networks and global value chains (GVCs) more generally (e.g. Orefice & Rocha, 2014; Laget, Osnago, Rocha, & Ruta, 2020; Lee & Kim, 2021). Emerging bilateral export opportunities could then potentially be strengthened, in particular through aid earmarked for building up production capacity and economic infrastructure. In reverse logic, both FDI inflows and GVC integration could likewise increase AfT effectiveness through various channels, including the transfer of new technologies and know-how, closer integration with partner markets, and positive externalities in recipient countries.

Consistent with these arguments, Vijil (2014) finds a generally positive effect of AfT on developing country exports and, moreover, strong complementarities between AfT and

economic integration, especially in trade relations with countries from the Global North. By implication, AfT effectiveness appears to be channelled mainly into formal trade relations. Methodologically, Vijil (2014) considers AfT effectiveness as a function of (the formal degree of) economic integration between trading partners, including non-reciprocal preferential trading schemes, but neglects to adequately control for endogeneity in the formation of PTAs through country-pair fixed effects. To avoid bilateral tied-aid trade effects, and to include AfT provided by multilateral donors in her gravity model estimates, the author uses AfT summed across all donors. The consideration of aggregated AfT availability on the side of recipients does not, however, allow an examination of the origin and thus the bilateral policy leverage of AfT, a particular interest of our paper.

Complementarities between *bilateral* AfT and deep PTAs, however, are neither clear nor straightforward (see, e.g., Chauffour & Maur, 2011). We do not claim to present a comprehensive discussion here, but instead focus on a few intuitive points. At its core, compliance with the non-tariff provisions contained in deep PTAs could increase the bilateral costs of trading under PTAs in some industries, especially for developing members (Hoekman, 2011; Tröster, von Arnim, Raza, Chandoul, & Ben Rouine, 2023).[1] For example, although harmonisation of trade-related standards between integration partners can have positive trade effects, as described above, harmonisation is not automatic. Instead, given their comparatively lower regulatory base, convergence usually remains on the side of developing countries (Piermartini & Budetta, 2009; Disdier, Fontagné, & Cadot, 2015).[2] Thus, without truly well-aligned AfT to support this process, ad hoc alignment with standards in countries of the Global North could lead to an increase in production and trade costs, which could not only weaken existing comparative advantage in the affected economic sectors, thereby negating potential positive export effects of the PTA in other sectors, but also jeopardise the generally positive bilateral trade effects of AfT.[3]

The argument could be extended analogously beyond trade-related standards. For example, recent results by Timini, Cortinovis, & López Vicente (2022) and Hoekman, Santi, & Shingal (2023) show that enforceable labour provisions appear to constrain developing country sectoral exports in North–South PTAs, possibly due to a related loss of comparative advantage in labour-intensive industries in PTA relations. Similarly, intellectual property rights (IPRs) provisions in PTAs may limit export potentials of developing countries by discouraging imitation and thus potentially preventing logistical improvements enabled through AfT from having their full (positive) bilateral effect.

The costs of compliance with other provisions may appear more hidden. For example, the inclusion of investment chapters and commitment to reforms in competition policy and public procurement may require changes in domestic law to accommodate the new PTA obligations, but could also come with administrative, transparency and monitoring requirements that may entail (increased and permanent) expenditures on staff and expertise (Chauffour & Maur, 2011).

1 In a recent paper, Hou (2023) finds that trade costs between trading partners are generally reduced dependent on the coverage of non-tariff provisions in common PTAs. However, her analysis does not explicitly distinguish between the directions of trade for countries at different stages of economic development.

2 While both the Generalised System of Preferences Plus (GSP+) and the Everything But Arms preference scheme also require compliance to international conventions and standards to some degree, reform pressure is much less comprehensive when compared with formal PTAs, and frequently focuses on comparatively soft measures, e.g. good governance.

3 In addition to non-tariff provisions, the utilisation of tariff preferences in a PTA may also incur costs, e.g. due to compliance with rules of origin (Hayakawa, Jinji, Laksanapanyakul, Matsuura & Yoshimi, 2023). Since our dataset does not contain differentiated information on the rules of origin in each PTA, however, we will not elaborate further on this channel.

PTA depth could therefore compromise the (positive) effect of AfT if it is used primarily as a "financing" source to comply with deep PTA provisions. While funding provided under AfT may clearly be intended to facilitate compliance, the broad range of support needs arising from deep PTAs could result in these funds being tied up and unavailable for more effective use elsewhere, unless increased in deeper agreements.

In this context, AfT may also simply be used inefficiently by donors in an attempt to facilitate compliance with deep PTAs. For example, while the *EU Aid for Trade – Progress Report 2022* (European Commission, 2023) shows that the majority of AfT is formally used to help partner countries negotiate and implement common trade agreements, private sector and civil society representatives in partner countries see only about one-third of AfT actually serving implementation, revealing a significant discrepancy with the EU's own views. A look at the EU's regional and country AfT profiles further shows that at least some funding is also explicitly allocated to raising awareness, promoting the understanding of trade potentials under EU trade agreements, and establishing monitoring systems for certain provisions and their effects. While all of this is important, it is uncertain whether these areas have an immediate and positive impact on recipient exports in PTA relations.

The complexity described above arising from the plethora of non-tariff provisions increasingly included in PTAs, may (at least partially) explain the results of Martínez-Zarzoso (2019), who examines the effect of total bilateral ODA and parallel engagement in a PTA on bilateral trade. To this end, the author estimates a structural gravity model for 33 donor countries and 125 recipient countries over the period 1995 to 2016 and, in contrast to Vijil (2014), finds that aid is effective in stimulating exports only when there is no PTA. As such, aid appears to be primarily a means to strengthen trade relations with countries in the absence of formal ties. While Martínez-Zarzoso (2019) provides a first insightful clue to furthering our understanding of the interaction between economic integration and bilateral aid, her analysis only considers the presence of PTA relations but does not further explore the explicit role that the content of PTAs might play in this context.

3 Empirical strategy

3.1 Data

For empirical implementation, we utilise OECD DAC data (OECD, 2021) and construct a bilateral panel of annual AfT disbursements of 29 DAC donors towards 144 developing countries that received AfT for at least one year in the period from 2002-2015 (see Appendix Tables 1 and 2 for the complete list of sample countries).[4] We choose aid disbursements instead of commitments because our interest is in the trade effects that result from tangible financial resources rather than formalised future support.[5]

4 Ideally, we would include earlier data to capture the rise of new regionalism from the 1990s onward, but AfT data are consistently available only for more recent years. Extending the time series to years after 2015 would also be desirable. While estimation results using data through 2018 are nearly identical to those reported below (available upon request), however, we prefer to end our time series in 2015. This is because of the signing of the Trans-Pacific Partnership (TPP) in 2016 by 12 countries, including Canada, Japan, and the United States. Although the United States later withdrew from participation and TPP became the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) among the remaining countries in 2018, the signing of TPP may have triggered significant anticipation effects in both the use and impact of AfT in the respective bilateral trade relations.

5 Our empirical findings presented below are unaffected by our decision to use AfT disbursements rather than commitments.

The OECD defines AfT as ODA falling into the following categories: (1) technical assistance for trade policy and regulation; (2) trade-related infrastructure; (3) productive capacity building, including trade development; (4) trade-related adjustments; (5) other trade-related needs, identified as trade-related development priorities. While the OECD's Credit Reporting System (CRS) allows for a distinction of specific purposes attached to aid, it provides explicit data only for the first three categories. We therefore generate proxies of total AfT by summing up "aid for economic infrastructure", "aid for building productive capacities", and "aid related to trade policy and regulation" (referring to CRS purpose codes 210, 220, 230, 240, 250, 311, 312, 313, 321, 322, 331, 332).

We match the AfT data with bilateral trade flow values obtained from UN Comtrade (United Nations, 2022) and PTA information based on the Design of Trade Agreements (DESTA) database, the most comprehensive data source in terms of PTAs covered (Dür et al., 2014). The DESTA database not only collects membership information for more than 700 PTAs, but also provides (categorical) data on whether a PTA *substantially* incorporates provisions in seven specific policy areas, including (1) full tariff reductions between members (with few exceptions), and cooperation in: (2) areas of trade-related standards, (3) services trade, (4) investments, (5) public procurement, (6) competition policy, and (7) IPRs. Contingent on the scope of coverage of each of these provisions in a PTA, DESTA generates an additive PTA depth index ranging from one to seven. While not accounting for the ordering of provisions, lower scores of PTA depth generally imply shallower agreements.

Although a number of high-income countries, including the United States and those in the EU, grant non-reciprocal tariff preferences to developing countries based on their income levels, about 23 per cent of the country pairs in the sample have adopted a reciprocal PTA at some point during our study period. Some country pairs have updated previous PTA relations or merged into larger (and potentially deeper) PTAs, most notably in the context of the 2004 EU enlargement. In the case of multiple existing PTAs for a given country pair and year, we consider the one with the higher PTA depth.

Reflecting the trend of expanding the scope of PTAs beyond tariff liberalisation, the average PTA depth in our sample increased from four in 2002 to about six in 2015. Given our focus on reciprocal PTAs, all sample PTAs provide for full tariff reductions. That is, the variation in depth across PTAs in the sample is entirely due to the variation in their non-tariff provisions. Due to the additive nature of DESTA's depth index, its composition nevertheless substantially differs in other policy areas and there is no uniform character of deep PTAs, as shown in Table 1 (see also Kox & Rojas-Romagosa, 2020). While standard provisions, including SPS measures and TBT, are the second most prevalent policy area across all depth levels, public procurement provisions are rare even in deeper PTAs. Although there is considerable need for reform at all depth levels, even at the shallow end, where there are comparatively few PTA policy areas, the mere accumulation of provisions tends to make deeper PTAs more complex than their shallow counterparts.

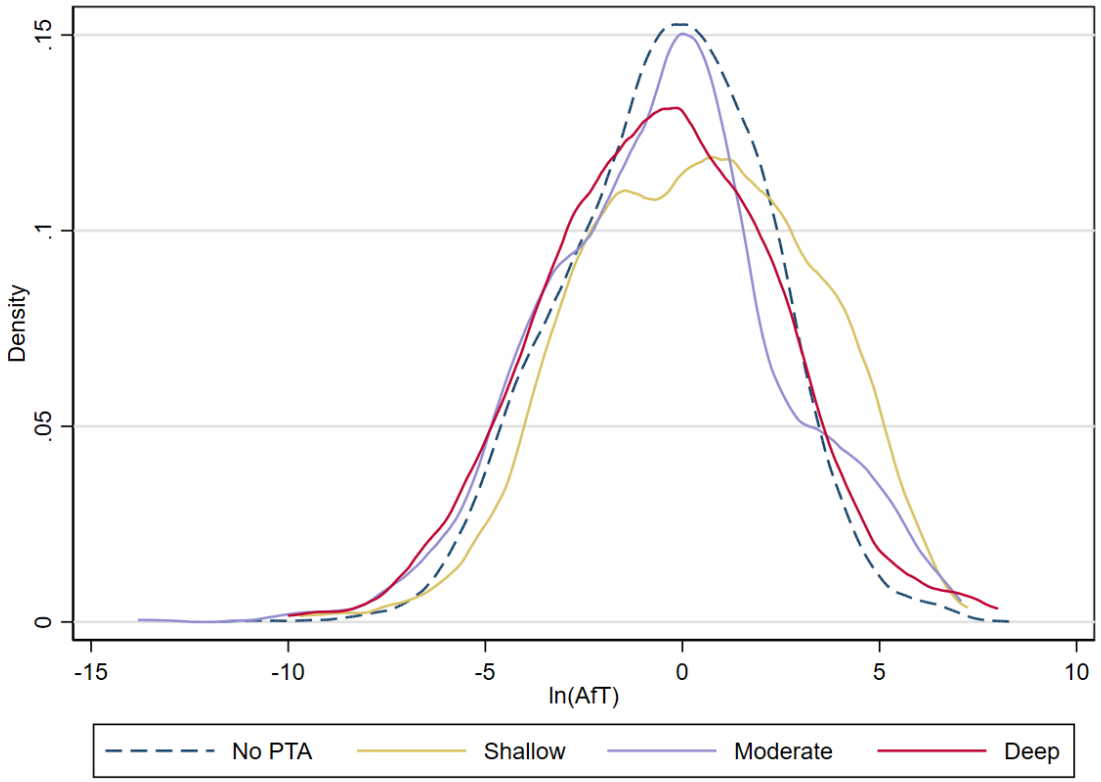
The need for reform on the part of developing countries associated with deep PTAs could determine the level of AfT disbursements (see, e.g., Hoekman et al., 2023). In terms of distribution, Figure 1 compares Kernel density estimates of AfT disbursements for country pairs with no, shallow (PTA depth scores 2-3), moderate (4-5), and deep (6-7) PTA relations. As can be seen, however, there is no clear indication that AfT disbursements are concentrated in the category of developing countries that have deeper PTA relations with donors. On the contrary, on average, the distribution of AfT disbursements is both more concentrated, and with a higher average, for countries without a PTA relation with donors.

Table 1: PTA depth and provisions coverage in sample PTAs

PTA depth	Number of PTAs (%)	Example (year of entry into force)	Coverage of provision besides full tariff reductions (%)
2	9 (7.8)	Canada–Jordan FTA (2012)	Standards (88.9) Investments (11.1)
3	15 (13.0)	ASEAN–Japan FTA (2008)	Standards (93.3) IPRs (53.3) Investments (20.0) Services/competition (13.3) Public procurement (6.7)
4	17 (14.8)	EFTA–SACU FTA (2008)	Standards (100) Investments/IPRs (58.8) Competition (47.1) Services (23.5) Public procurement (11.8)
5	9 (7.8)	Australia–China FTA (2015)	Standards (88.9) Investments/services (77.8) Competition (66.7) IPRs (55.6) Public procurement (33.3)
6	36 (31.3)	EU–Central America AA (2013)	Standards (100) Investments/services (94.4) IPRs (86.1) Competition (75.0) Public procurement (50.0)
7	29 (25.2)	United States–Peru FTA (2009)	All

Source: Own illustration based on data from Dür et al. (2014).

Figure 1: Distribution of AfT disbursements by PTA depth



Source: Own illustration based on sample used for empirical analysis. See section 3.1 for details. Epanechnikov kernel used.

3.2 Estimation model

To test the combined effect of AfT and PTA depth on bilateral trade, we use Poisson pseudo maximum likelihood (PPML), proposed by Santos Silva and Tenreyro (2006), and estimate an augmented gravity equation of the following baseline form:[6]

$$M_{ijt} = \exp\big(\beta \ln AfT_{ijt} + \gamma\, PTA\ depth_{ijt} + \delta \ln AfT_{ijt} * PTA\ depth_{ijt} + \pi_{ij} + \eta_{it} + \mu_{jt}\big) + \varepsilon_{ijt} \quad (1)$$

where M_{ijt} denotes total imports of OECD DAC country i from developing country j in period t. We rely on donor imports instead of recipient exports because the former are typically better reported. On the right-hand-side, AfT disbursements are incorporated in logarithmic form to primarily reduce skewness in the AfT distribution.[7] Both variables are expressed in current US dollars.

6 PPML yields consistent estimates under residual heteroscedasticity and is compatible with the existence of zeros in trade flow data.

7 In our sample, about 70 percent constitute zero-AfT observations. To avoid losing these observations in the estimation of equation (1) by taking their logarithm, we applied the inverse hyperbolic sine transformation to our AfT data, formally expressed as $\ln\left(x + \sqrt{(x^2+1)}\right)$, with x being the value of AfT disbursements. We also incorporated a no-AfT dummy variable in equation (1), following Wagner (2003). For both of these alternative approaches, estimation results are, however, nearly identical to those reported below and available upon request.

$PTA\ depth_{ijt}$ is a count variable based on DESTA's PTA depth index, as described above. If countries i and j have a common PTA in period t, it ranges from two to seven, depending on the scope of key policy areas included in the PTA, and zero otherwise.[8] Note that the joint incorporation of AfT and the PTA depth variable incidentally offsets a potential omitted variables bias in previous gravity applications in the literature due to the fact that AfT could determine the willingness of recipients to accept non-economic provisions in their PTAs with donors (see Hoekman et al., 2023).

Our primary interest is in the interaction of the AfT and PTA depth variable. Recalling from our discussion in Section 2, a priori its coefficient, δ, could be both positively and negatively signed. Following the interaction specification between bilateral overall ODA and economic integration in Martínez-Zarzoso (2019), we additionally use a plain dummy variable, signalling the existence of a PTA between countries i and j in period t, zero otherwise, in exchange for the PTA depth variable.

Given the wide variation in PTA depth in the sample (see Table 1), we deliberately do not include the depth of PTAs as explicit categories in equation (1), as this would likely capture the effects of specific PTAs rather than allow identification of a generalised relationship. Similarly, because of strong multicollinearity among the seven PTA policy areas, it is not possible to properly isolate the effect of each provision separately.[9]

As suggested by Baier and Bergstrand (2007), we include time-invariant country-pair (π_{ij}), and two-way importer-year and exporter-year fixed effects (η_{it} and μ_{jt}, respectively) in equation (1). The former control for a number of standard gravity variables, such as the distance or cultural and historical commonalities between trading partners, as well as the endogeneity of trade policies, including the formation of PTAs. The latter two fixed effects control for time-varying multilateral trade resistance (Baldwin & Taglioni, 2007) but also capture any country-year specific supply or demand shock affecting bilateral trade patterns, including FDI flows. More specifically, the country-year fixed effects additionally proxy trading partners' interest and bargaining power to shape the content of PTAs. Due to using country-pair fixed effects, however, note that we only consider country pairs with time-varying PTA (depth) observations during the period of analysis in our estimations.

4 Main results and discussion

4.1 Baseline estimation results

The results of our baseline estimation are presented in Table 2. Columns (1)-(3) consider the years of signature for the PTA variables and their respective interactions with AfT, while columns (4)–(6) consider the years the PTA entered into force. The average time between signature and entry into force for the PTAs in the sample is roughly 1.6 years. While some PTAs start (provisional) implementation immediately after signature (e.g. the China–New Zealand FTA or the CARIFORUM–EU EPA), other PTAs did not enter into force until several years after signature (e.g. the United States–Colombia FTA or the Bosnia and Herzegovina–EU

8 The bilateral country sample used for empirical analysis does not include any reciprocal PTA with a depth level of one during the study period (also see Section 3).

9 Without prejudice to the results below, notwithstanding these concerns, we ran regressions in which we included dummies for the seven PTA policy areas and their respective interactions with AfT separately. However, all interactions are statistically significant when we include them one by one, but all are insignificant when we include them jointly. In our point of view, then, there is no heterogeneity across PTA policy areas that could be of interest for deeper analysis.

Stabilisation and Association Agreements), or did not yet enter into force during the period of our analysis (the EU–Ukraine Deep and Comprehensive FTA, the Japan–Mongolia EPA, and the Republic of Korea–Colombia FTA). While there may occasionally be a need for reform with respect to implementation or compliance with the provisions included in a PTA prior to its entry into force, we suggest that both have implications, in particular once a PTA takes effect. Therefore, we treat specifications that take into account the years in which the PTA enters into force as our preferred model, even though the results for both ways of coding are nearly identical.

Table 2: Baseline estimation results

	PTA signature		PTA entry into force			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
ln AfT	0.0146***	0.0144***	0.0143***	0.0145***	0.0145***	0.0144***
	(0.00508)	(0.00497)	(0.00497)	(0.00512)	(0.00501)	(0.00500)
PTA dummy	0.0599		-0.148	0.0777		0.0161
	(0.0555)		(0.209)	(0.0544)		(0.157)
ln AfT ∗ PTA dummy	**-0.0178****			**-0.0189****		
	(0.00856)			**(0.00808)**		
PTA depth		0.0118	0.0362		0.0150	0.0123
		(0.00918)	(0.0337)		(0.00980)	(0.0284)
ln AfT ∗ PTA depth		**-0.00347****	**-0.00342****		**-0.00380*****	**-0.00380*****
		(0.00152)	**(0.00152)**		**(0.00147)**	**(0.00147)**
Observations	19,588	19,588	19,588	19,588	19,588	19,588
Pseudo R^2	0.996	0.996	0.996	0.996	0.996	0.996
Country pairs	2,119	2,119	2,119	2,119	2,119	2,119

Notes: Robust, clustered (at the country-pair level) standard errors in parentheses. Asterisks denote the level of statistical significance with *** p<0.01, ** p<0.05, * p<0.1. Country-pair and country-year fixed effects always included but not reported.

Across columns, our estimations hint at a positive and statistically highly significant general effect of AfT on the exports from recipients to donors.[10] By contrast, economic integration does not appear to influence developing country exports to Northern markets per se, a finding consistent with all of the specifications in Table 2. Although surprising, the insignificant coefficient estimate of both the PTA dummy and the PTA depth variable could reflect increased sectoral regulatory burdens for developing countries under deep PTAs due to compliance obligations with some of the non-tariff provisions included in the PTAs (compare, e.g., Timini et al., 2022; Hoekman et al., 2023), but could also be owing to the PTA observations considered for estimation. More specifically, not only does our sample include only OECD DAC donors as importers, but our estimations consider only those PTA relations with a contemporaneous positive AfT-observation. In other words, our results for the PTA dummy and the PTA depth variable could suffer from a sample selection bias in comparison to previous findings in the literature. Alternatively, the non-significance of the PTA dummy coefficient and PTA depth coefficient estimates could simply be due to the limited improvement in the tariff treatment of

10 This finding is confirmed by regressions in which the interaction term is not used.

developing countries under North–South PTAs, as other preferential arrangements were often pre-existing.

Turning to the interaction between AfT and economic integration, columns (1) and (4) first report estimation results for the interaction between AfT and the plain PTA dummy. In line with the findings by Martínez-Zarzoso (2019) on overall ODA, we find that the interaction between AfT and economic integration is negative and statistically significant at the five-percent level. When investigating the negative interaction more closely, columns (2)-(3) as well as (5)-(6) suggest that the negative interaction is driven by the content of a PTA, rather than by its mere existence. More specifically, instead of being complementary with deep PTA provisions to promote bilateral trade, we find AfT effectiveness in North–South PTA relations to be conditional on the extent of the policy areas included therein. Given our discussion in Section 2, the negative interaction between AfT and the PTA depth variable could be due to compliance with the non-tariff provisions contained in deep PTAs. In Section 5, we explore this conjecture more deeply by breaking down the results by the timing around PTA implementation, the direction of trade flows, economic sector, and AfT donor profiles.

Importantly, the negative interaction does not mean that bilateral AfT hampers recipient exports in deep PTA relations. Given the positive and statistically significant coefficient estimate for unconditional AfT effectiveness, and the non-significant coefficient estimate of the PTA depth coefficient, our interpretation is that the generally positive effects of AfT, however, gradually diminish as the depth of PTAs increases. Therefore, the overall effect of AfT on recipient exports under PTAs may remain positive, depending on the scope of the provisions included in the PTA. We intentionally do not compute a threshold PTA depth level at which the positive base effect of AfT is fully absorbed. This is due to the count-data nature of the PTA depth variable, where an increase could imply the inclusion of *any* additional policy area, and this expansion is not subject to any strict ordering (see Section 3.1). Therefore, the composition of policy areas can vary significantly even for PTAs within the same depth level.[11]

Since the simultaneous inclusion of the PTA dummy and the PTA depth variable (columns 3 and 5) does not alter estimation results qualitatively or quantitatively, we refrain from including both variables simultaneously in further estimations. For a more technical consideration, omitting the plain PTA dummy also avoids collinearity problems with the PTA depth variable.[12] However, tariff liberalisation efforts between PTA members may be correlated with the inclusion of other non-tariff PTA provisions. While the plain PTA dummy picks up the tariff liberalisation component of PTAs (as a residual) in the specification with the PTA dummy and the PTA depth variable, we therefore also tested specifications that explicitly incorporate annual effectively applied tariffs between trading partners. However, their inclusion does not change the results reported, and the coefficients on the tariffs themselves is not statistically significant (results are available upon request).

11 We are also reluctant to report results for bilateral AfT broken down by the sub-categories “aid for economic infrastructure”, “aid for building productive capacities”, and “aid related to trade policy and regulation”, because donors may report aid for several main objectives in the OECD CRS. In addition, the breakdown of total AfT by category partly leads to a drastic reduction in the observations used for estimation, as some recipients never received aid in any of the above categories. However, taking these caveats into account, interactions with each AfT category in separate regressions are throughout negative and statistically significant (results are available upon request).

12 The PTA dummy and the PTA depth variable are correlated with a correlation coefficient of 0.96.

4.2 Robustness checks

Endogeneity of AfT

While the country-year and country-pair fixed effects in equation (1) control for an omitted variable bias with respect to the endogeneity of PTA formation, their inclusion does not address a potential estimation bias stemming from reverse causality issues. More specifically, while AfT might influence recipient export performance, it might likewise be determined by it. As a first remedy, we therefore lag the AfT variable by various years, also because we expect a positive impact of AfT on recipient exports to materialise only with a certain time delay. Corresponding estimation results are shown across columns (1)–(3) in Table 3, and lagging the AfT variable by one, two or three years does not alter our baseline results with respect to the negative interaction between AfT and PTA depth.

However, we also note that the estimated coefficient for the general effect of AfT turns statistically non-significant when lagging the AfT variable by three years. This finding would suggest that AfT generally does not help increase recipient exports to donors, but could also suggest that AfT effectiveness declines after a period of time after disbursement. Alternatively, this observation could be caused by differences in estimation samples due to the reduction of observations compared to our baseline results and those reported in columns (1)–(2) in Table 3. Moreover, we find a positively signed and only marginally, but still statistically significant, PTA depth coefficient estimate when we lag the AfT variable in column (1) by one year. Apart from the fact that this effect is not robust across all model specifications, note that this does not imply a change in our interpretation of the negative interaction above.

Table 3: Estimation results for varying lags for AfT & control function approach

	Varying lags for AfT			Control function
	1 year	2 years	3 years	approach
VARIABLES	(1)	(2)	(3)	(4)
ln AfT	0.0114**	0.0104**	0.00468	0.0205*
	(0.00486)	(0.00500)	(0.00398)	(0.0111)
PTA depth	0.0146*	0.00876	0.00749	0.0175
	(0.00847)	(0.00752)	(0.00661)	(0.0139)
ln AfT ∗ PTA depth	**-0.00377*** **	**-0.00261** **	**-0.00317*** **	**-0.00457** **
	(0.00129)	**(0.00129)**	**(0.00123)**	**(0.00208)**
Reduced form residuals				-0.00971
				(0.00665)
Observations	18,112	16,647	15,208	13,850
Pseudo R^2	0.996	0.996	0.996	0.996
Country pairs	2,074	2,034	1,999	1,564

Notes: Robust, clustered (at the country-pair level) standard errors in parentheses in columns (1)–(3). Column (4) shows the second-stage PPML estimation results of a two-stage control function approach. Bootstrapped standard errors in parentheses (1,000 replications). Asterisks denote the level of statistical significance with *** p<0.01, ** p<0.05, * p<0.1. Country-pair and country-year fixed effects always included but not reported.

We complement the use of lagged values for AfT by a two-stage control function approach to test for possible endogeneity of AfT in equation (1). The control function approach shares identification conditions with instrumental variables estimation, but provides greater

computational flexibility, particularly in the context of high-dimensional three-way fixed effects estimation. Moreover, it is also suitable in non-linear models such as PPML. For implementation, we first estimate a linear regression model of selection into AfT disbursements. This model includes standard gravity variables obtained from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) gravity dataset (Head, Mayer, & Ries, 2010), which include time-varying donor and recipient gross domestic products and population sizes, time-invariant bilateral distance, language commonality and colonial ties, as well as the second lag of AfT commitments as exclusion variable. The obtained regression residuals then serve as an additional control variable in equation (1). Estimation results for the second-stage equation are presented in column (4) in Table 3 and confirm our baseline results. Notably, the residuals included in the second-stage are not statistically significant at any of the standard levels, indicating that endogeneity does not appear to be a pressing issue for our analysis.

Data variation & other PTA depth measures

Table 4: Estimation results for averaged AfT data & alternative PTA depth indicator

	Averaged AfT data		World Bank horizontal depth data	
	2 years moving avg	3 years moving avg	All provisions	Core provisions
VARIABLES	(1)	(2)	(3)	(4)
ln AfT	0.0165***	0.0180***	0.0136**	0.0137***
	(0.00635)	(0.00677)	(0.00552)	(0.00521)
PTA depth	0.0153*	0.0178*	0.00248	0.00414
	(0.00919)	(0.00992)	(0.00233)	(0.00398)
ln AfT ∗ PTA depth	**-0.00381****	**-0.00385****	**-0.000629***	**-0.00122****
	(0.00155)	**(0.00167)**	**(0.000338)**	**(0.000577)**
Observations	22,207	25,456	19,588	19,588
Pseudo R^2	0.995	0.995	0.996	0.996
Country pairs	2,426	2,479	2,119	2,119

Notes: Robust, clustered (at the country-pair level) standard errors in parentheses. Asterisks denote the level of statistical significance with *** p<0.01, ** p<0.05, * p<0.1. Country-pair and country-year fixed effects always included but not reported.

Our baseline results further withstand the averaging of AfT data or considering other PTA depth indicators in Table 4. More specifically, we use moving-averaged AfT data over two and three years to account for volatility and the missing data points in the annual AfT observations (columns 1 and 2), and an alternative source of PTA depth (columns 3 and 4). For the latter, we use data from the World Bank's "Horizontal Depth" database (Hofmann, Osnago, & Ruta, 2017), which covers a wide range of 52 WTO+ and WTO-X policy areas in 279 PTAs notified to the WTO. While the World Bank's depth indicator covers fewer PTAs than the DESTA depth index, it also includes provisions related to the environment and labour standards. Coverage of a policy area does not, however, necessarily imply its relevance in a PTA. Thus, unlike the DESTA depth indicator, the World Bank data do not provide information on the operational depth of PTAs. As a remedy, the World Bank's depth indicator also allows a division into "core" and "non-core" provisions. Core provisions are defined as provisions under the WTO mandate (WTO+), such as customs regulations or trade-related standards, and additionally four of the WTO-X provisions concerning competition policy, investment, movement of capital and intellectual property rights protection. Therefore, "core" provisions are more relevant regarding overall trade

impacts. We use the simple count of provisions covered as an alternative depth measure compared to the one provided by DESTA. Note that, unlike the DESTA index, the World Bank data only include non-tariff provisions of PTAs.

As can be seen in columns (1)–(2), our results for base AfT effectiveness and its interaction with PTA depth remain unchanged when using averaged AfT data. However, a notable difference from our baseline estimation results is the positively signed and slightly statistically significant coefficient estimate for PTA depth. One explanation for the now significant effect of PTA depth may be found in the underlying difference in the PTA-observations considered for estimations. More specifically, averaging the AfT data over several years reduces zero-AfT observations, which has a positive effect on the PTA relations considered for estimation. In other words, averaging the AfT data over several years reduces the sample selection bias potentially present in the estimations of Table 2.

Turning to the results using the World Bank data, we find qualitatively similar findings as when using the DESTA depth index. However, a direct comparison of the effect size using the two different indicators is not possible because their maximum values (52 for the World Bank data against seven for the DESTA data) and structure are different. Although differences in magnitude between the core and non-core provisions may indicate that the more economically relevant provisions are responsible for the observed negative interaction, a causal comparison between the two is not possible for similar reasons.

5 Exploratory extensions

Following our conjecture that compliance with the non-tariff provisions contained in deep PTAs reduces bilateral AfT effectiveness, in Table 5 we present the results of our examination of various time effects in more detail for the periods before and after a PTA takes effect. To this end, for the country pairs with a PTA relation at any time during our sample period, we first add to columns (1) and (2) temporal placebo PTA depth variables and respective interaction terms with AfT specified to three and five years respectively before the agreement enters into force. Thus, for the average PTA in our sample, the placebo interaction captures a phase much further back in time before implementation than the signature specification in Table 2. While there could be anticipatory effects between signature and the PTA taking effect we would not generally expect a statistically significant interaction between AfT and PTA depth prior to the implementation of the agreement if bilateral AfT effectiveness is mainly reduced by the implications stemming from compliance with the non-tariff provisions contained in deep PTAs.

As can be seen in columns (1)–(2), our baseline results regarding the negative interaction between AfT and PTA depth are robust to this exercise. Moreover, there is no evidence that anticipatory compliance seems to play a role in reducing bilateral AfT effectiveness in deep PTA relations. Also, the results from column (1)–(2) may explain the somewhat smaller size of the estimated coefficient on the interaction effect upon PTA signature in Table 2 for signature. In fact, the inclusion of the years between a PTA's signature and entry into force could even lead to a downward bias in the interaction effect if there are no anticipation costs in these years.

An alternative interpretation of the test for anticipatory effects is to examine whether countries with deeper PTA relations and those with no or shallower agreements exhibit a parallel trend prior to the creation of a (deep) PTA. Country pairs with shallow PTAs could differ systematically from those with deeper PTA relations, and this form of heterogeneity could bias the estimation results if countries forming deeper PTAs are already increasing their trade with each other more than other country pairs. While we explicitly test for endogeneity in PTA formation in equation (1) by means of the country-pair fixed effects, here we can test the hypothesis that the response of country pairs to AfT and deep PTAs does not stem from uncaptured heterogeneities that

existed before the actual PTA formation. Our results show that treated and untreated country pairs, those with and without deep PTAs respectively, do not differ in their response to AfT prior to a forthcoming PTA. This gives us further confidence in the robustness of our results.

Table 5: Estimation results for different pre- and post-entry into force periods

	Placebo period		Implementation period	
	3 years before PTA entry into force	5 years before PTA entry into force	3 years after PTA entry into force	5 years after PTA entry into force
VARIABLES	(1)	(2)	(3)	(4)
ln AfT	0.0137***	0.0136***	0.0133**	0.0128**
	(0.00500)	(0.00522)	(0.00529)	(0.00522)
PTA depth	0.0141	0.00906	0.0151	0.0182
	(0.0127)	(0.0145)	(0.0128)	(0.0120)
ln AfT ∗ PTA depth	**-0.00337***	**-0.00336***	**-0.00346****	**-0.00354****
	(0.00173)	**(0.00182)**	**(0.00165)**	**(0.00158)**
Pre-entry-into-force period:				
Future PTA depth	-0.00317	-0.00716		
	(0.00930)	(0.0113)		
ln AfT ∗ future PTA depth	0.00143	0.00101		
	(0.00173)	(0.00196)		
Observations	19,588	19,588	19,588	19,588
Pseudo R^2	0.996	0.996	0.996	0.996
Country pairs	2,118	2,118	2,118	2,118

Notes: Robust, clustered (at the country-pair level) standard errors in parentheses. Asterisks denote the level of statistical significance with *** p<0.01, ** p<0.05, * p<0.1. Country-pair and country-year fixed effects always included but not reported.

We also consider PTA depth and its interaction with AfT with a lag of three or five years, respectively, from the year in which the PTA enters into force. Corresponding estimation results presented in columns (3) and (4) of Table 5, however, do not show significant differences from the results of our baseline estimations. Thus, the trade-off between deep PTAs and the effectiveness of bilateral AfT does not appear to be a one-time adjustment process, but rather to persist over the medium term, a finding which corresponds with the fact that the costs of compliance associated with deep PTAs appear to linger over time (compare Chauffour & Maur, 2011).

The results in Table 5 also make it less likely that the negative interaction is due to AfT being provided as a purely strategic side-payment to motivate developing countries to sign deeper PTAs (see, e.g. Hoekman et al. 2023). Indeed, aid provided based on economic and political considerations of donors, rather than based on recipient needs, often has negative implications on aid effectiveness (Bearce & Tirone, 2010; Kilby & Dreher, 2010). However, while there may well be a temporal overlap between AfT disbursements as a side-payment and the entry into force of corresponding PTAs, we would not expect the negative interaction to occur several years after entry into force, given that aid side-payments associated with PTAs tend to be particularly short-lived (e.g. Baccini & Urpelainen, 2012; Brandi, Morin, & Stender, 2022).

The estimation results presented in Table 6 lend additional support to the assumption that compliance with deep PTAs has real effects particularly on the side of developing PTA members. More specifically, regressing *donor* exports to recipients on AfT, PTA depth and their interaction reveals a positive and statistically significant effect of the former two policies individually, but renders the interaction statistically insignificant. While AfT could stimulate donor exports to recipients not only through logistics improvements in recipient countries but also through tied aid effects, notably, PTA depth does not seem to compromise bilateral AfT effectiveness. The significant and positive PTA (depth) effect for high-income country exports compared to the predominantly non-significant counterpart on the side of developing countries may also indicate a relatively biased improvement in tariff-based market access in favour of developed countries in North–South PTAs.

Table 6: Estimation results for donor exports

	PTA dummy	PTA depth
VARIABLES	(1)	(2)
ln AfT	0.00728*	0.00808*
	(0.00442)	(0.00424)
PTA dummy	0.195***	
	(0.0407)	
ln AfT ∗ PTA dummy	0.00708	
	(0.00628)	
PTA depth		0.0317***
		(0.00754)
ln AfT ∗ PTA depth		0.00135
		(0.00119)
Observations	19,629	19,629
Pseudo R^2	0.996	0.996
Country pairs	2,125	2,125

Notes: Robust, clustered (at the country-pair level) standard errors in parentheses. Asterisks denote the level of statistical significance with *** p<0.01, ** p<0.05, * p<0.1. Country-pair and country-year fixed effects always included but not reported.

Next, we examine the interaction between AfT and PTA depth on trade in two sectoral clusters, that is, agriculture (sum of Standard International Trade Classification [SITC] Revision 3 sections 0, 1, 2, excluding 27 and 28, and 4) and manufactures (sum of SITC Revision 3 sections 5, 60, 61, 62, 63, 64, 65, 66, 67, 69, 7, and 8). While we recognise that the trade profiles of individual developing countries can vary widely, developing countries generally tend to have a comparative advantage in agricultural over manufacturing trade, particularly in competition with high-income countries. Indeed, the results presented in Table 7 show significant differences in outcomes for the two sectors. Not only do we find that AfT generally does not seem to stimulate exports from recipients to donors in manufacturing, but also the interaction between PTA depth and AfT for manufacturing trade is not statistically significant. This contrasts with the coefficient estimate of the interaction term for agricultural trade, which remains qualitatively unchanged compared to our baseline estimate, although of smaller magnitude. At first uncritical glance, this might give the impression that the costs of complying with the provisions included in deep PTAs are higher for agricultural than manufactured goods, potentially jeopardising existing comparative advantage of developing countries in the former and thus making AfT less effective.

This impression is reinforced by the difference in statistical significance of the estimated coefficient on PTA depth in agriculture compared to manufactures.

Compliance costs incurred in agriculture may arise from implementing mutual agreements on, in particular, SPS measures or other trade-related standards between integration partners. SPS clauses are among the most common non-tariff provisions in PTAs today and primarily affect trade in agricultural sectors. SPS measures are rules and procedures designed to ensure food safety for consumers and protect animals and plants from pests and diseases. Implementing these measures could, therefore, have a positive impact on trade. However, ad hoc harmonisation of SPS measures among integration partners could imply not only direct costs for establishing and maintaining the necessary quality infrastructure, but also indirect costs through more expensive production due to recurring certification requirements or, for example, adherence to maximum pesticide levels. These factors potentially undermine the existing comparative advantage of developing PTA members and harm their trade. Our results would hint at the cost of standard harmonisation outweighing potential benefits for bilateral trade values.

Table 7: Estimation results for commodity clusters

	Agriculture	Manufactures
VARIABLES	(1)	(2)
ln AfT	0.0148***	0.00493
	(0.00408)	(0.00437)
PTA depth	0.00515	0.0191***
	(0.00667)	(0.00628)
ln AfT ∗ PTA depth	**-0.00248****	7.35e-05
	(0.00117)	(0.00118)
Observations	19,322	19,584
Pseudo R^2	0.995	0.999
Country pairs	2,071	2,117

Notes: Robust, clustered (at the country-pair level) standard errors in parentheses. Asterisks denote the level of statistical significance with *** p<0.01, ** p<0.05, * p<0.1. Country-pair and country-year fixed effects always included but not reported.

However, most shallow PTAs also contain SPS provisions (see Section 3). If these provisions alone affected the comparative advantage and thus reduced effectiveness of bilateral AfT, this would not necessarily relate to the depth of the PTA, and the interaction terms should therefore not be negative. The negative interaction, particularly in agriculture, may therefore have another cause. Namely, while non-compliance with standards and regulation in Northern destination markets is seen as a major barrier to agricultural exports from developing to high-income countries, and harmonisation of SPS measures could therefore be an appropriate way of addressing this problem, compliance with other non-tariff provisions contained in deep PTAs could also affect the necessary AfT funding in this area. This would suggest that the AfT provided is not necessarily targeted at the most promising areas.

Estimation results presented in Table 8 additionally argue against the hypothesis that the negative interaction is mainly due to a reduction of existing comparative advantage. Here we include previously uncontrolled features of PTAs which are not captured by the different components of PTA depth, namely labour standards or environmental regulation. To this end, we include multidimensional indices that assess the scope of PTA provisions on economic and social

rights (ESR) and environmental protection (EP) provided by Lechner (2016).[13] More stringent legislation in both areas is signalled by higher values in the indices. The additional inclusion of ESR and EP is also another robustness check for an omitted variables bias in previous results, as both could plausibly be correlated with PTA depth and bilateral trade. Furthermore, apart from agriculture, developing countries often have a comparative advantage in labour- and resource-intensive production, given their frequent abundance of low-skilled labour, natural resources and less stringent environmental regulation. If mainly a reduced comparative advantage affected our results, we would expect a negative interaction for both indices.

However, while estimation results in Table 8 confirm our baseline results for the interaction between AfT and PTA depth, labour and environmental regulation do not show negative interactions with AfT. It is noteworthy that only ESR provisions appear to have a slightly statistically significant negative impact on developing countries' exports in PTA relations, while neither ESR nor EP provisions show a negative interaction with AfT at any of the standard significance levels. Therefore, it really seems to be the overall depth that causes the negative interaction.

Table 8: Estimation results controlling for other PTA provisions

	Economic & social rights	Environmental protection	Combined
VARIABLES	(1)	(2)	(3)
ln AfT	0.0152***	0.0147***	0.0162***
	(0.00499)	(0.00498)	(0.00512)
PTA depth	0.0647*	0.0376	0.0334
	(0.0353)	(0.0306)	(0.0289)
ln AfT ∗ PTA depth	**-0.00936***	**-0.0100****	**-0.0124****
	(0.00498)	**(0.00506)**	**(0.00492)**
ESR provisions	-0.0775		-0.151*
	(0.0480)		(0.0788)
EP provisions		-0.0272	0.100
		(0.0325)	(0.0615)
ln AfT ∗ ESR provisions	0.00730		0.00417
	(0.00679)		(0.0111)
ln AfT ∗ EP provisions		0.00759	0.00607
		(0.00582)	(0.00992)
Observations	19,576	19,576	19,576
Pseudo R^2	0.996	0.996	0.996
Country pairs	2,119	2,119	2,119

Notes: Robust, clustered (at the country-pair level) standard errors in parentheses. Asterisks denote the level of statistical significance with *** p<0.01, ** p<0.05, * p<0.1. Country-pair and country-year fixed effects always included but not reported.

13 Economic and social rights include the right to work, rights at work, and the rights to education, development, and health. Environmental protection includes the means to care for natural resources (water, soil, forest), to reduce waste and air pollution, and to protect wildlife and game.

As a partial conclusion, an overall consideration of Tables 5–8 supports our conjecture that the negative interaction between AfT and PTA depth on recipient exports may be due to compliance with the non-tariff provisions contained in deep PTAs. This interpretation could be seen as grist to the mill of those who fear that non-tariff provisions in PTAs could lead to a deterioration of developing countries' existing comparative advantages and thus their export potentials. Following this line of reasoning, AfT might be less effective, especially in deep PTA relations. We cannot completely rule out these concerns. However, given the widespread institutional and technical capacity constraints in meeting obligations of deep PTAs in developing countries, the broad range of reforms, requirements, and efforts arising from deep PTAs seem instead to simply consume large portions of AfT, reducing the AfT available for potentially more, or the most effective, projects. Although it is difficult to assess from a bird's eye view whether donors or recipients are responsible for the potentially inefficient use of AfT, we approach the question of the specific role of donors in this context in a final step.

In Table 9, we therefore differentiate our estimates by the five largest bilateral AfT providers in recent years, namely Japan, as well as Germany, France and the United Kingdom (hereafter grouped as EU3), and the United States. To this end, we add donor-specific deviations from the base interaction between AfT and PTA depth in equation (1).[14] We first consider each donor (grouping) separately in columns (1)–(3) and then their joint incorporation in column (4).

With respect to the base interaction between AfT and PTA depth, we find no difference from our previous results in all columns. However, we find considerable heterogeneity in donor-specific interactions between AfT and PTA depth. While we find no statistically significant deviation for the EU3 from the average donor-effect in our sample, the estimates in column (3) suggest an even more pronounced reduction in the effectiveness of bilateral AfT in deep PTA relations with Japan. In contrast, the coefficients on the US-specific interaction consistently signal a less pronounced negative relationship relative to the average donor in our sample. It should be noted, however, that the specific effects for the EU might be difficult to determine because AfT activities are coordinated among its members, recipients and sectors.

While the observed heterogeneity does not reject our earlier argument that compliance efforts seem to consume large fractions of AfT and thus reduce AfT available for potentially more effective projects, we can only speculate about the differences in trade effects of AfT in deep PTA relations among donors, particularly the United States and Japan. A simple explanation might be that US AfT is comparatively well-aligned with the particularly trade-related provisions contained in its deep PTAs and recipient supply-side constraints.[15] However, a more detailed explanation may be found in the differences in the design of AfT programmes among donors. In this regard, Brazys (2013) notes for the United States that its AfT provided is characterised by a strong focus on improving recipients' trade-related institutional environment. Although this could improve recipients' export potentials in general, the combination with improved market

14 Our estimation sample includes 11 PTAs for Japan (with an average depth of 5.9), 16 for the EU (5.9) and 11 for the United States (6.2). We believe that this fairly similar distribution allows for a reasonable comparison among these donors. Due to the different nature of financial cooperation and objectives, we also excluded the EU Stabilisation and Accession Agreements (SAA) from the estimation, but their exclusion leads to very similar results compared to those reported. Similarly, an alternative consideration of all EU member states grouped together does not change the results presented below.

15 Findings for the United States, however, do not appear to be driven by the sheer amount of AfT provided. For a more accurate comparison of AfT amounts, we also accounted for AfT provided under the auspices of EU institutions and accommodated EU institutional AfT in the bilateral data of individual EU members by using each member's contribution to the EU budget as its allocation share, following the approach of Hoekman and Shingal (2024). However, corresponding estimation results for the EU are nearly identical to those reported.

access to the United States through a PTA could also lead to highly selective export effects to the donor.

In contrast Japan's AfT programme focuses mainly on developing trade-related infrastructure (Brazys, 2013; Nishitateno & Umetani, 2023). These infrastructure investments enhance recipients' overall export capacity rather than strengthening specific trade relations. In the context of deep PTAs, this could mean that Japan's AfT comes with a relatively low threshold to bypass deep PTA compliance requirements and redirect trade created by AfT to third countries with comparatively fewer bilateral obligations. This, though, is not unreasonable given the empirical evidence of Hühne, Meyer, & Nunnenkamp (2014b), which shows that AfT granted by OECD donors appears to promote trade between recipients and other developing countries, even in the absence of policy forces that could encourage this shift. Against this background, it should be noted, however, that Japanese AfT does not fundamentally underperform US AfT, but its focus seems simply different and hence easier to redirect exports to third countries.

Table 9: Estimation results for donor-specific interactions

	Major EU	United States	Japan	Combined
VARIABLES	(1)	(2)	(3)	(4)
ln AfT	0.0137***	0.0147***	0.0162***	0.0160***
	(0.00516)	(0.00491)	(0.00476)	(0.00481)
PTA depth	0.0180*	0.0173*	-0.000416	0.00403
	(0.0102)	(0.0101)	(0.00898)	(0.0108)
EU3	-0.0336***			-0.0269*
	(0.0126)			(0.0144)
US		-0.0346***		-0.0285**
		(0.0122)		(0.0140)
Japan			0.0756***	0.0714***
			(0.0265)	(0.0272)
ln AfT ∗ PTA depth	**-0.00432*** **	**-0.00414*** **	**-0.00371* **	**-0.00508* **
	(0.00163)	**(0.00157)**	**(0.00201)**	**(0.00290)**
EU3	0.00291			0.00332
	(0.00273)			(0.00315)
US		**0.00726** **		**0.00783** **
		(0.00299)		**(0.00350)**
Japan			**-0.00875** **	-0.00746
			(0.00426)	(0.00472)
Observations	19,588	19,588	19,588	19,588
Pseudo R^2	0.996	0.996	0.996	0.996
Country pairs	2,119	2,119	2,119	2,119

Notes: Robust, clustered (at the country-pair level) standard errors in parentheses. Asterisks denote the level of statistical significance with *** p<0.01, ** p<0.05, * p<0.1. Country-pair and country-year fixed effects always included but not reported.

6 Conclusion

Recent PTAs cover an increasingly broad range of policy areas beyond their traditional competence for reducing bilateral tariffs. However, effective implementation of the full portfolio of deep PTA provisions, including, for example, harmonisation of trade-related standards among integration partners, investment chapters, and other changes to domestic regulations, often requires significant reform, particularly for developing members. While trade-related assistance can help ensure that the benefits of deep PTAs outweigh the costs of their implementation, it remains unclear whether the deepening of PTAs and AfT are also complementary in bilateral trade promotion.

Against this background, this paper aimed to contribute to our understanding of the role of AfT in deep PTAs. Using panel data of 29 DAC donors and 144 developing countries from 2002–2015, our estimations confirm a *generally* positive effect of AfT on developing country exports. However, using recently available data on PTA content, we also find that the marginal effect of AfT decreases as the policy areas of a PTA expand. Further investigation of the underlying mechanisms suggests that the observed trade-off between PTA depth and AfT may be due to compliance with the non-tariff provisions contained in deep PTAs. We find two lines of reasoning plausible. First, while it is not impossible that compliance obligations in deep PTAs may affect the existing comparative advantage of developing countries and thereby reduce AfT effectiveness, compliance efforts seem more likely to consume large fractions of AfT and thus reduce AfT available for potentially more effective projects, as we do not observe an alignment of AfT in deep PTAs. Second, since we also observe heterogeneity in interactions across donors, depending on their specific project portfolios, AfT provided by high-income PTA partners could well be used to redirect exports to third countries with comparatively fewer bilateral obligations.

The conditionality of bilateral AfT effectiveness on PTA depth has distinct policy implications. While we do not question that deep PTA provisions can be beneficial in terms of better integrating developing countries into the global economy and pursuing broader development goals, the costs associated with deep PTAs provisions appear to be unevenly distributed across high-income and developing members. Given the widespread institutional and technical capacity constraints in meeting the obligations of deep PTAs in developing countries, aligning AfT in deep PTAs could be a quick remedy. However, to the extent that AfT resources remain constant, it seems more effective for donor countries to invest in a careful balancing of the costs of compliance to developing countries against the non-trade benefits from common deep PTAs. To this end, the capacity to implement deep PTA provisions and the financial and technical assistance needs of developing PTA partners involved must be accurately identified. This process would ideally be shaped through continuous mutual dialogue and be based on national development strategies to avoid conflicting goals with regard to supply-side constraints in developing countries. This could also mean further prioritisation of limited financial resources in the short-term.

Given the bird’s eye view of our analysis, further research is needed to evaluate our findings more rigorously. In particular, little is known about the *types* of costs incurred in deep PTA implementation for developing countries. Moreover, it is unclear whether AfT in deep PTAs is actually consumed by related reform requirements on a large scale, beyond the limited anecdotal evidence provided. Finally, it is critical to assess how conceptual differences in donor AfT strategies affect AfT effectiveness in order to design future AfT projects to more meaningfully complement (deep) economic integration.

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Appendix

Table A1: Donor countries in the sample

Australia	Germany	Luxembourg	Spain
Austria	Greece	Netherlands	Sweden
Belgium	Hungary	New Zealand	Switzerland
Canada	Iceland	Norway	United Kingdom
Czech Republic	Ireland	Poland	United States
Denmark	Italy	Portugal	
Finland	Japan	Slovak Republic	
France	Korea, Republic of	Slovenia	

Table A2: Recipient countries in the sample

Afghanistan	Democratic Republic of the Congo	Liberia	Saint Lucia
Albania	Djibouti	Libya	Saint Vincent and the Grenadines
Algeria	Dominica	Madagascar	Samoa
Angola	Dominican Republic	Malawi	Sao Tome and Principe
Antigua and Barbuda	Ecuador	Malaysia	Saudi Arabia
Argentina	Egypt	Maldives	Senegal
Armenia	El Salvador	Mali	Serbia
Azerbaijan	Equatorial Guinea	Marshall Islands	Seychelles
Bahrain	Eritrea	Mauritania	Sierra Leone
Bangladesh	Eswatini	Mauritius	Solomon Islands
Barbados	Ethiopia	Mexico	Somalia
Belarus	Fiji	Micronesia	South Africa
Belize	Gabon	Moldova	Sri Lanka
Benin	Gambia	Mongolia	Suriname
Bhutan	Georgia	Montenegro	Syrian Arab Republic
Bolivia	Ghana	Morocco	Tajikistan
Bosnia and Herzegovina	Grenada	Mozambique	Tanzania
Botswana	Guatemala	Myanmar	Thailand
Brazil	Guinea	Namibia	Timor-Leste
Burkina Faso	Guinea-Bissau	Nauru	Togo
Burundi	Guyana	Nepal	Tonga
Cabo Verde	Haiti	Nicaragua	Trinidad and Tobago
Cambodia	Honduras	Niger	Tunisia
Cameroon	India	Nigeria	Turkey
Central African Republic	Indonesia	Niue	Turkmenistan
Chad	Iran	North Macedonia	Tuvalu
Chile	Iraq	Oman	Uganda
China (People's Republic of)	Jamaica	Pakistan	Ukraine
Colombia	Jordan	Palau	Uruguay
Comoros	Kazakhstan	Panama	Uzbekistan
Congo	Kenya	Papua New Guinea	Vanuatu
Cook Islands	Kiribati	Paraguay	Venezuela
Costa Rica	Kyrgyzstan	Peru	Viet Nam
Cuba	Lao People's Democratic Republic	Philippines	Yemen
Côte d'Ivoire	Lebanon	Rwanda	Zambia
Democratic People's Republic of Korea	Lesotho	Saint Kitts and Nevis	Zimbabwe