Do greener trade agreements call for side-payments?

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Abstract:

Preferential trade agreements (PTAs) increasingly include environmental provisions. While the existing literature documents these provisions' environmental impacts, this paper sheds light on their relation with aid flows. Using an event-specification and data on bilateral Official Development Assistance (ODA) commitments for a sample of 147 developing country recipients in the period from 2002-2017, we find evidence that the number of environmental provisions in PTAs is positively associated with aid during negotiation phases. With high-income countries typically pre-determining the extent of environmental provisions in their upcoming PTAs, this suggests that aid serves as a side-payment for recipients to sweeten the pot and agree upon already formulated PTA content. While both aggregate ODA and its subcomponent environmental aid a priori qualify as candidates for pre-signature side-payments, we find that only the former fulfills this expectation, presumably reflecting more leeway to exploit aid fungibility.

Keywords: Preferential trade agreements, environmental provisions, trade and environment, trade policy, Official Development Assistance

1. Introduction

Preferential trade agreements (PTAs) are becoming greener. Environmental provisions in PTAs have been proliferating and are increasingly diverse and extensive. Recent PTAs, such as the United States-Mexico-Canada Agreement (USMCA) or the European Union-Vietnam Free Trade Agreement (EVFTA), include far-reaching environmental chapters. Some of these provisions entail so-called environmental exceptions that allow countries to restrict trade to protect biodiversity or conserve natural resources similar to those in the General Agreement on Tariffs and Trade (GATT) of 1947 (article XX(b)). Other environmental provisions are more prescriptive. For example, environmental provisions in PTAs can promote the harmonization of environmental policies, require the ratification of multilateral environmental agreements (MEAs), or call for greater inclusion of civil society organizations in environmental lawmaking. Environmental provisions cover a manifold of environmental issues, such as limiting deforestation, protecting fish stocks, reducing hazardous waste, and mitigating CO_2 emissions.

PTAs offer several benefits over MEAs for the negotiation of environmental obligations. These benefits include the facilitation of trade-offs across diverse issue-areas, and stronger mechanisms to ensure compliance and enforcement. As a result, some PTAs set environmental obligations that are more precise, more stringent, and more enforceable than those contained in MEAs (Jinnah and Lindsay 2016; Jinnah and Morin 2020).

These developments appear to have positive impacts on the environment. Recent studies have found that the signing of PTAs with environmental provisions is related to the adoption of domestic environmental regulation (Brandi et al. 2019), reductions of carbon dioxide emissions (Baghdadi et al. 2013), decreases in suspended particulate matter (Martínez-Zarzoso and Oueslati 2018; Zhou et al. 2017), and improvements in overall environmental performance (Bastiaens and Postnikov 2017).[1] Indeed, while the specific patterns vary across analyses, existing studies provide evidence that some environmental benefits are occurring both in high-income as well as in developing countries.

This paper explores the bargaining process that drives the trend of linking trade and environmental policy. Notably, some developing countries are reluctant to include certain environmental provisions in their PTAs for fear that these provisions might restrict their exports and limit their economic growth (Draper et al. 2017). By contrast, high-income countries, often equipped with higher domestic environmental standards, insist on promoting their own environmental standards in their trade agreements with developing countries (Blümer et al. 2020). Since foreign aid operates as a side-payment in various policy fields (Alesina and Dollar 2000; Baccini and Urpelainen 2012; Dreher et al. 2008; Kuziemko and Werker 2006), we hypothesize that one attractive solution is to raise development assistance to increasing acceptance of environmental provisions in PTAs. Exchanging aid for environmental provisions might benefit both donors seeking to include environmental provision in trade agreements and recipients in need of financial resources.

Such linkage between PTA negotiations and aid commitment is not surprising given substantial coordination between the actors negotiating PTAs and those responsible for providing aid. For example, the Office of the US Trade Representative underlines the importance of linking trade and development and the importance of interagency coordination (Government Accountability Office 2005; see also Congress Research Service 2008). In the European Union (EU), there are regular consultations on trade across different Directorate Generals (DGs) of the EU

[1] Less conclusive is the academic assessment of PTA environmental provisions on trade flows. While Brandi et al. (2020) find support for green PTAs to reduce dirty and increase green exports from developing countries, empirical evidence presented by Kolcava et al. (2019) suggests that environmental provisions have little effect on the environmental footprint of developing countries' exports and imports in the course of trade liberalization through PTAs. See also Ferrari et al. (2021).

Commission, including communication between DG Trade and DG INPAT which are responsible for European trade policy and development cooperation, respectively (interview with EU Commission, 24 November 2021; see also Young and Peterson 2013). More generally, the EU and its member countries have committed to policy coherence for development in the Treaty of Maastricht (1992) and the Treaty of Lisbon (2009), thereby seeking "to take account of development objectives in policies that are likely to have an impact in developing countries", including trade. At the same time, the EU is often seen as a "conflicted trade power", using "market access as a bargaining chip to obtain changes in the domestic arena of its trading partners" (Meunier and Nicolaïdis 2006: 906).

Testing our intuition, we employ an event-specification to compare patterns of aid in donor-recipient relationships over time. Driven by the two largest donors, namely the EU and the United States, we find empirical evidence that the number of environmental provisions in new North-South PTAs is positively associated with bilateral aid commitments during negotiation phases, especially shortly prior to signing the PTA. Since high-income countries typically use PTA templates and grant their developing country partners little say on content (e.g., Allee and Elsig 2019; Peacock et al. 2019), we conclude that aid serves as a side-payment for recipients to agree upon already formulated PTA content. The greener the template is, the more aid will be committed to seal the deal.

While both aggregate Official Development Assistance (ODA) and its subcomponent environmental aid a priori qualify as candidates for pre-signature side-payments for greener PTAs, we find that only the former fulfills this expectation, presumably reflecting more leeway to exploit aid fungibility. Disaggregating environmental provisions into specific types, our estimations also suggest that the relationship is more pronounced in the case of so-called defensive provisions, which generate policy space for environmental regulation and can thus justify certain protectionist measures.

The remainder of this paper is organized as follows. The next section presents the theoretical arguments supporting our hypotheses. We describe our methodological approach and data in section 3. Section 4 presents and discusses our empirical findings while section 5 concludes.

2. Hypotheses

Including environmental provisions in PTAs can serve various purposes. One frequently mentioned motivation is the attempt to level the playing field among economies with dissimilar regulations. By adopting shared standards, trade partners can compete on a more equal footing (Copeland 2000). Less frequently admitted by trade negotiators, environmental provisions could also justify the continuation or expansion of trade distorting regulations (Bhagwati 1988). Studies have found a relationship between the existence of protectionist interests and the inclusion of environmental provisions in PTAs (e.g., Bechtel et al. 2012; Lechner 2016). Another line of explanation is that some governments use the opportunity of trade negotiations to promote their environmental interests beyond what they can achieve in multilateral environmental fora (Jinnah and Lindsay 2016; Johnson 2015). Obviously, these different motivations are not mutually exclusive.

However, not all countries have an equal interest in including environmental provisions in trade deals. Several studies have found that high-income countries are the main proponents of many of these provisions (Bechtel and Tosun 2009; Morin et al. 2018). Notably, high-income countries tend to have more stringent environmental regulation than developing countries, making them particularly interested in leveling the playing field with developing countries (Blümer et al. 2020). By strengthening environmental protection in developing countries, high-income countries can reduce trade competition stemming from there. Also, with PTAs stipulating the gradual removal of tariffs, high-income countries are prone to shielding domestic industries which struggle with increasing international competition by turning to regulatory

measures (Beverelli et al. 2019). By inserting environmental exceptions in their PTAs that justify (at least) some of these regulatory measures, high-income countries can maintain some protection for their domestic industries.[2] In reaction, developing countries' officials tend to criticize some of the environmental provisions promoted by high-income countries as being merely sophisticated non-tariff barriers to trade (Draper et al. 2017).[3] In the context of North-South PTA negotiations, high-income countries thus often face the political challenge of persuading their developing countries partners to agree on a desired set of environmental provisions (Bastiaens and Postnikov 2017).

Development assistance can provide a solution to this bargaining problem. Indeed, the existing literature on aid allocation suggests that foreign aid is given mainly for economic and political considerations rather than altruistic motives or recipient needs. This is true for both aggregate ODA (e.g., Hoeffler and Outram 2011; Younas 2008) and its subcomponent environmental aid (e.g., Lewis 2003; Weiler et al. 2018). For example, studies have found that foreign aid influences voting behavior in the United Nations (UN) General Assembly and Security Council to the advantage of donors (Dreher et al. 2008; Kuziemko and Werker 2006). Aid might thus conveniently be used to motivate developing countries to sign greener PTAs. Despite controversies over its effectiveness in terms of generating sustainable economic benefits in recipient countries and concerns about fueling dependencies in the Global South, foreign aid is known to provide an important external source of finance for many developing countries (Combes et al. 2016; Mosley et al. 1987).

While aid can play an important role, we do not suggest that the supply of aid has a causal effect on the environmental provisions being included in a PTA. This is because of the well-researched practice of high-income countries entering negotiations with developing countries with a pre-defined template of PTA provisions (e.g., Allee et al. 2017; Alschner et al. 2018; Baccini et al. 2015). Recent works by Allee and Elsig (2019) and Peacock et al. (2019), for example, point to the fact that most PTA provisions are simply copy-pasted by high-income countries from their previous PTAs. In more than 100 PTAs, 80 percent or more of the contents is copied from previous agreements, with many PTAs copying 95 percent or more word-for-word (Allee and Elsig 2019). The standard Trade and Sustainable Development (TSD) chapters in EU PTAs include almost the same language, and US PTAs also heavily rely on copy-pasting (Peacock et al. 2019). Hollway et al. (2020) find that 87 percent of trade agreements include only provisions that were copy-pasted from earlier agreements. Most high-income countries use PTA templates and they are highly reluctant to deviate from them. These models typically evolve incrementally, following domestic political changes in high-income countries (Morin and Rochette 2017). Based on these observations, the margin for developing countries to have a voice in the drafting of both content and number of PTA environmental provisions is low. In

[2] High-income countries might have additional reasons to promote certain types of environmental provisions as they are typically characterized by capital-intensive sectors that tend to be more pollution-intensive than labor-intensive sectors (Antweiler et al. 2001; Cole 2004; Cole and Elliot 2003). For example, green PTAs can alleviate local environmental problems by facilitating environmental legislation on air pollution (Brandi et al. 2019) and reducing suspended particulate matter (Martínez-Zarzoso and Oueslati 2018; Zhou et al. 2017).

[3] Contrary to the prevailing assumptions, Bernauer and Nguyen (2015) find a positive attitude towards environmental clauses in trade agreements for developing countries' citizens. Moreover, recent research shows that a majority of South-South PTAs now includes environmental provisions and that this development tends to signal real environmental concern (Lechner and Spilker 2021). For example, several South-South PTAs include ambitious provisions on genetic resources, an environmental priority for several developing countries. We do not question that developing countries are increasingly interested in inserting certain environmental provisions in South-South PTAs. Still, North-South trade agreements include on average four times more environmental provisions than their South-South counterparts (Morin et al. 2008). In this paper, we focus on the specific negotiation dynamics in North-South PTAs.

other words, the environmental content in North-South PTAs is exogenously given for developing countries.

Instead, we expect causality to operate in the opposite direction: anticipated environmental provisions can drive the allocation of aid during the negotiation stage. With high-income countries typically pre-determining the extent of environmental provisions in their upcoming PTAs, aid may serve as a side-payment for recipients to agree upon already formulated PTA content. Then, in contrast to the number of environmental provisions, such aid commitments could well be the subject of negotiations. Therefore, our first hypothesis is the following:

> H_1: *Trade agreements with more environmental provisions are associated with higher levels of aid commitments during their negotiation phase than trade agreements with fewer environmental provisions.*

Our expectation is that only aggregate ODA (rather than its small-scaled subcomponent environmental aid) is sufficient to provide for an effective side-payment to compensate for the inclusion of environmental provisions in a PTA. This assumption rests on the observation that aggregate ODA by definition comes with a broader and more diverse portfolio of purposes compared to aid dedicated specifically to environmental purposes only, and thus offers a larger margin for the exploitation of aid fungibility. If aid is offered as a side-payment for environmental provisions, then aggregate ODA is a more attractive compensation for developing countries than environmental aid. We hence hypothesize that:

> H_2: *The number of environmental provisions has a more pronounced effect on pre-signature aggregate ODA commitments than on environmental aid commitments.*

PTA environmental provisions are far from being homogenous. In fact, certain types of environmental provisions could be more important to high-income countries and met with stronger resistance from developing countries. Some of these highly contentious provisions are "defensive environmental provisions" (Blümer et al. 2020). Defensive provisions are those that are used to safeguard a country's policy space for environmental regulations. They include the above-mentioned environmental exceptions allowing countries to restrict trade for environmental purposes to protect the environment or conserve natural resources. Defensive environmental provisions can thereby justify some form of trade protectionism. This argument is in line with studies suggesting that environmental provisions are driven by protectionist interests (Bechtel et al. 2012; Lechner 2016), although defensive provisions can also contribute to environmental protection (Morin et al. 2018). Defensive provisions are particularly attractive for high-income countries as they can use regulations, subsidies and other restrictions to protect their domestic industries despite tariffs not being available anymore.

In contrast, developing countries are much less likely than high-income countries to use defensive provisions as protectionism. Due to special and differential treatment principles for developing countries in the multilateral trade system, they tend to have more leeway to still use tariffs and are thus less in need to use other types of protectionist measures. Moreover, using environmental regulation as a form of protectionism could undermine their comparative advantage in the extraction and export of natural resources. As a result, developing countries are particularly skeptical of the motivations supporting defensive provisions, as environmental measures in high-income countries can restrict their access to these markets. In this context, aid can compensate developing countries for accepting this form of "green protectionism". We hence hypothesize that:

> H_3: *Defensive environmental provisions have a more pronounced effect on pre-signature aid than other types of environmental provisions.*

3. Empirical strategy

3.1 Estimation model

Our empirical model specifies foreign aid as a function of PTAs and the environmental provisions contained therein. We subdivide the effects of both measures into negotiation and post-signature phases. Because we aim to identify year-specific effects, we use the Poisson Pseudo Maximum Likelihood (PPML) estimator proposed by Santos Silva and Tenreyro (2006) to account for zero-aid observations.[4] The estimation equation reads as follows:

$$aid_{d,r,t} = \exp\left(\beta' \mathbf{A}_{d,r,t} + \gamma' \mathbf{\Omega}_{d,r,t} + \pi_{d,r} + \eta_{d,t} + \mu_{r,t}\right) + \epsilon_{d,r,t} \quad (1)$$

where aid is either levels of environmental aid or aggregate ODA (both commitments) of donor d towards recipient r in year t expressed in current US dollars. On the right-hand side, $\mathbf{A}$ is a vector of three explanatory variables: (1) a dummy signaling future common PTA membership between r and d, zero otherwise; (2) the total count of environmental provisions in the respective PTA, zero otherwise; and (3) the overall depth of that PTA, zero otherwise. All three variables are conditioned to a two-year time window prior to signing the PTA. The length of the time window is based on the median duration of PTA negotiations (Lechner and Wüthrich 2018). By contrast, $\mathbf{\Omega}$ represents a vector of the above three variables, yet conditioned to all years from PTA signature onwards, zero otherwise.

We fully acknowledge that the actual length of negotiations varies substantially across PTAs. However, three points speak against accounting for the individual length of negotiations of each PTA. First, information on negotiation lengths is not publicly available for most trade agreements. While governments sometimes issue press releases to announce the launch of exploratory trade discussions, such as the organization of a first negotiation round or inaugural trade talks between heads of governments, this is rarely the case and the actual start of trade negotiations is seldom communicated in public domain (Lechner and Wüthrich 2018). Second, trade negotiations are often irregular and punctuated processes. Take the EU-Mercosur agreement as an example: While negotiations for this agreement started in 1999, they were characterized by continuous on-off talks for a period of 20 years. Considering this entire on-off negotiation period would probably lead to misleading conclusions about the relationship between the content of the trade agreement and pre-signature side-payment as there have been many years without any meaningful talks, let alone concrete progress. Third, irrespective of the actual length of negotiations, we focus intentionally on the *hot* negotiation phase that is particularly relevant for carrying recipient countries "over the doorstep". Seen from this angle, a two-year time window prior to PTA signature captures the potentially most decisive negotiations phase. To address suspicion of arbitrariness in the specification of the pre-signature time window, however, we also test our model specification using shorter and longer negotiation time windows in a later extension, which provide full support for our baseline specification.

The variable expressing the count of environmental provisions varies across PTAs but it remains constant for a given PTA upon its signature. Whereas PTA environmental provisions differ in terms of scope and depth, their aggregation is a good proxy for the concerns related to environmental issues in the PTA, or bluntly the overall level of greenness of PTAs (Morin et al. 2018). While our main interest is on the effect of environmental provisions, avoiding an

[4] In our baseline sample, zero-aid flows make up about one third of all aggregate ODA observations, and even two thirds in the case of environmental aid. In addition to allowing the inclusion of zero-aid observations in regression analysis, PPML also avoids Jensen's inequality – the discrepancy between the expected value of the logarithmized random variable and the logarithm of its expected value – because it does not request the log-transformation of continuous dependent variables, and is known to better address heteroscedasticity of error terms than linear regression techniques such as Ordinary Least Squares (OLS). For these reasons, PPML is widely accepted as the best-practice estimator of gravity-type panel data models (Yotov et al. 2016).

omitted variables bias requires joint estimation with the PTA dummy because a positive observation for environmental provisions in country pairs underlies the necessary condition of a common PTA. Also, note that controlling for the overall PTA effect by means of the PTA dummy alongside explicitly incorporating the number of PTA environmental provisions allows the identification of the relationship between PTA *content* and aid.

For similar reasons, we include PTA depth as a control variable. PTA depth is a synthetic categorical indicator on the design of PTAs. It ranges between 1 and 7, and is measured as the degree of tariff liberalization and cooperation in the areas of services trade, investments, standards, public procurement, competition, and intellectual property rights (Dür et al. 2014). Lower scores of PTA depth indicate shallower agreements. While the indicator does not capture the extent of environmental provisions, it is highly correlated with it (with a correlation coefficient of roughly 0.9). Despite the absence of environmental aspects, however, the level of bilateral environmental aid could be influenced by depth if donors rededicated aid purposes in view of PTA content.[5]

Lastly, π_{dr}, η_{dt}, and μ_{rt} are country-pair and country-year fixed effects, respectively, to control for heterogeneity across panel dimensions. In particular, π_{dr} captures time-invariant ties between donors and recipients, such as their mutual distance or historical aid and trade relationships, that may be correlated not only with current bilateral aid, but more specifically the formation of a common PTA and the extent of environmental provisions contained therein. Similarly, all three items could be determined by time-varying individual donor and recipient characteristics. For example, donor-year effects capture both the temporal evolution and idiosyncrasies of PTA templates as well as the behavior in aid allocation.[6]

3.2 Data

For empirical implementation, we utilize OECD Development Assistance Committee (DAC) (2020) data and construct a bilateral panel of annual environmental aid and aggregate ODA commitments of the 10 DAC donors towards all 147 recipients that have received environmental aid for at least one year in the period from 2002-2017.[7] Sample donor and recipient countries are listed in Appendix Tables A1 and A2, respectively. The OECD's Credit Reporting System (CRS) allows for a distinction of specific purposes attached to aid. For aid targeting global environmental objectives, we rely on the "Rio marker" and use commitments with a designated principal objective to support environmental sustainability. Data on environmental aid is available only from 2002 and onwards. Given its common trade policy,

[5] Extending our baseline model specification, we incorporate other types of PTA provisions – namely those capturing civil and political rights, and economic and social rights – more explicitly as further control variables in an extension below. As deeper PTAs typically include more trade and non-trade related provisions, different types of PTA provisions are naturally highly correlated with each other. Estimation results that jointly include larger sets of different PTA provisions may thus give rise to the concern of a multicollinearity bias and have thus to be taken with caution.

[6] Several studies document the positive effects of (existing or future) PTAs on the level of bilateral trade between trade partners (e.g., Baier and Bergstrand 2007; Carrère 2006; Magee 2008). Other studies point towards the positive relationship between foreign aid and bilateral trade (e.g., Martínez-Zarzoso et al. 2014; Pettersson and Johansson 2013; Silva and Nelson 2012). Thus, a potential source of omitted variables bias in equation (1) could stem from a correlation of time-varying bilateral trade flows and aid. We have therefore tested different specifications of annual donor-recipient trade flows, i.e., (lagged) donors' imports and exports, and the sum of both, as additional regressor in equation (1). Estimation results are, however, qualitatively unchanged to those reported below (results are available upon request).

[7] The selection of sample countries is based on data availability. We use annual data because information on high-frequency aid flows (for instance on a monthly or quarterly basis) is publically not available for a larger set of donor-recipient pairs.

the EU is treated as a single entity. To this end, we sum up annual aid by individual DAC EU members (taking into account individual accession years) and the EU Commission.[8]

Due to data availability of environmental aid, we rely on commitments instead of disbursements for both dependent variables to allow for direct comparison. While acknowledging that commitments are usually subject to multi-annual strategic plans so that single years are not necessarily independent from each other (Davies and Klasen 2019), disbursements are based on donors' decisions in the past, and thus not necessarily linked to current events such as PTA negotiations. By contrast, commitments provide a sufficient degree of incentive in the year of announcement because of formalized future support. What is more, according to Berthélemy and Tichit (2004), donors have full control only over commitments while disbursements also depend on the willingness of recipients to accept financial support and the managing capacities to handle it. Commitments are thus the only aid measure in the hands of donors that qualifies directly for strategic considerations.

Bilateral aid data are matched with PTA membership information, based on the Design on Trade Agreements (DESTA) database (Dür et al. 2014), and the environmental provisions included in these PTAs, taken from the Trade and Environment Database (TREND) (Morin et al. 2018). TREND records nearly 300 different types of environmental provisions identified in more than 730 PTAs. Created by manual coding, it is the most fine-grained and wide-ranging data on environmental provisions in PTAs. To probe our third hypothesis, we follow Blümer et al. (2020) and categorize environmental provisions by type and take account of defensive (67 in TREND) and development-related (17 in TREND) provisions. Counting 32 defensive provisions, the EVFTA is the most defensive PTA in our sample.[9]

We exclude country pairs with more than one newly signed PTA in our time series, as implementation effects of the former could not be disentangled from the run-up effects of the latter. Also, because aid commitments are highly volatile over time, we allow for a reference period of at least two years (within country pairs), which is neither affected by the in-force period of a PTA nor by the two years prior to its signature, by disregarding country pairs with a PTA signed before 2006.[10]

Table 1 illustrates the PTAs considered for empirical analysis by donors. A complete list can be found in Table A3 in the Appendix. Notably, the extent of environmental provisions in PTAs substantially varies by donor.

Moreover, we would like to refer to the variation in the number of environmental provisions even within donor-PTAs, and thus across time. While the core of PTA templates is generally stable, specific content is regularly adjusted and thus not identical over longer periods of time (Morin and Rochette 2017). In the case of the EU, for example, the bloc used different templates for neighbors and accession candidates compared to remaining countries. In the US, the original template (modeled after NAFTA) was changed in 2007 for the US-Peru agreement, when the Democrats gained control of both the House of Representatives and the Senate.

[8] Empirical results do not hinge on this aggregation. See below for details.

[9] Please note that the EVFTA was signed in 2019 when the negotiation process between the EU and Vietnam had been officially concluded already in December 2015. While legal review and translation into EU languages were still outstanding, the text of the EVFTA had been published by the EU Commission shortly after the conclusion of negotiations. For this reason, we treat 2016 as the de facto *signature* year of the EVFTA. Estimation results are robust to disregarding the EVFTA and removing corresponding country pairs from the data.

[10] The editing removes several PTAs, in particular from the US, including the 2003 US-Chile agreement, the 2003 US-Laos agreement, the 2004 US-Bahrain agreement, and the 2004 US-Morocco agreement. While affecting the number of sample PTAs, our findings are unchanged for shorter or longer reference periods. See below and Appendix Table A5 for details.

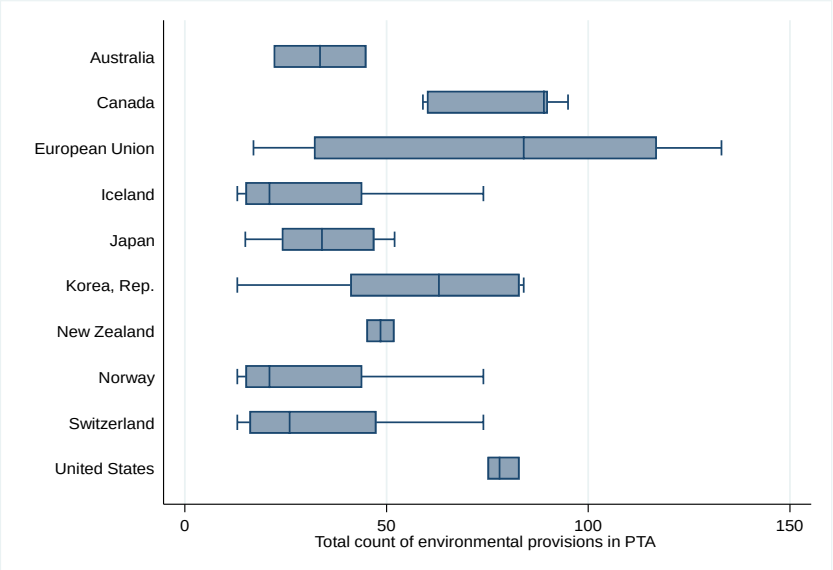
Table 1. Preferential trade agreements considered for empirical analysis by donors

Donor	Number of PTAs	Average number of environmental provisions
Australia	2	33.5
Canada	5	78.6
European Union	13	72.7
Iceland	11	33
Japan	6	37.3
Korea, Rep.	6	57.8
New Zealand	2	48.5
Norway	11	33
Switzerland	12	34.5
United States	3	78.7
Total	48	55.4

Notes: Some sample donors share the same PTAs. For example, while Switzerland has signed an additional individual PTA, the three EFTA members in our sample (Iceland, Norway and Switzerland) share 11 PTAs. Similarly, Australia and New Zealand both signed the same PTA with the Association with Southeast Asian Nations (ASEAN). *Total* excludes these double counts of preferential trade agreements across donors.

Figure 1 displays the distribution of the total count of environmental provisions in the PTAs considered for empirical analysis by donors. As can be seen, the count of environmental provisions in the PTAs signed by the EU, for example, ranges between 17 (for the 2006 EU-Albania Stabilization and Association Agreement) and 133 (for the 2012 Association Agreement between the EU and Central America). These two agreements are representative for the evolutionary trend that is visible in particular for the EU PTAs, when the bloc gradually updated its PTA template from an average of 36 PTA environmental provisions before 2010 to the one that includes more than 100 after 2010.

Figure 1. Box-and-whisker plot of environmental provisions by donor-PTAs



Notes: Own computation based on data of PTAs considered for empirical analysis (see text for details). Upper and lower boundaries of the box display 75th and 25th percentiles and the vertical line in the box represents the median.

4. Estimation results and discussion

4.1 Baseline results

Estimation results for the full sample are shown in Table 2. For both dependent variables (environmental aid and aggregate ODA), we initially exclude PTA depth to address multicollinearity concerns, and run a reduced model including only the chronologically subdivided variables for PTA membership and environmental provisions. Focusing on the negotiation phase of PTAs, there is no indication of a general PTA-specific or environmental-provisions-specific relationship with environmental aid at any of the standard significance levels in their joint estimation in column (1) and when using PTA depth as additional control in column (2).

Table 2. Baseline estimation results

	Environ aid		Aggregate ODA	
VARIABLES	(1)	(2)	(3)	(4)
Negotiation phase				
PTA	-0.129	-0.723	-0.376**	-0.134
	(0.729)	(1.025)	(0.191)	(0.305)
Environmental provisions	-0.00622	-0.0102	**0.0118*** **	**0.0140*** **
	(0.00780)	(0.0108)	**(0.00285)**	**(0.00382)**
Depth		0.154		-0.0683
		(0.229)		(0.0743)
Post-signature phase				
PTA	0.596	0.576	0.0247	-0.0499
	(0.779)	(1.106)	(0.276)	(0.234)
Environmental provisions	-0.0186**	-0.0185	0.00250	0.00190
	(0.00917)	(0.0115)	(0.00389)	(0.00513)
Depth		0.00195		0.0212
		(0.233)		(0.0596)
Observations	12,678	12,673	18,588	18,583
Country pairs	862	862	1,208	1,208
Pseudo-R^2	0.884	0.884	0.937	0.937

Notes: Estimations performed with PPML. Dependent variables defined in levels of environmental aid and aggregate ODA, respectively. Robust, clustered (at 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.

This is in contrast to aggregate ODA. In accordance with H_1, both columns (3) and (4) suggest that the more environmental provisions PTAs contain, the more ODA is provided during previous negotiations. Lending support to H_2, we thus find pre-signature side-payments only in

the form of aggregate ODA, but not through environmental aid.[11] Interestingly, the statistical insignificance of the coefficient for depth in column (4) indicates that the degree of tariff liberalization under a PTA or the level of cooperation in the areas of services trade, investments, standards, public procurement, competition, and intellectual property rights do not provoke a similar effect, at least not when considered together.

Arguably, another interpretation of our findings on the relationship between PTA environmental provisions and pre-signature ODA is possible. Under this alternative interpretation, PTA environmental provisions are the endogenous result of negotiations with PTA partners. More specifically, high-income countries could use aid proactively during negotiations to increase the number of environmental provisions in their PTAs with developing countries. From an econometric point of view, our estimates could be biased in case of reverse causality or the reciprocal determination of environmental provisions and ODA during PTA negotiations.

Two lines of argumentation, however, support our argument that causality operates from anticipated environmental provisions to aid. First and foremost, as discussed in section 2, high-income countries typically use pre-defined template agreements when entering into negotiations for a new PTA, thus leaving no de facto scope for developing countries to influence the extent of non-tariff provisions.

Second, we complement this anecdotal evidence econometrically by a two-stage control function approach to address and test for potential endogeneity of environmental provisions in equation (1). The control function approach relies on the same identification conditions as instrumental variables estimation but typically comes with greater computational flexibility, especially in the context of high-dimensional three-way fixed effects, and is applicable also in non-linear model settings such as PPML. To this end, we first estimate a linear regression model of environmental provisions (upon PTA formation) on standard gravity variables retrieved from the CEPII gravity dataset (Head et al. 2010), including time-varying donor and recipient gross domestic products and population sizes, time-invariant bilateral distance, language commonality and colonial ties, and the time-varying product of donor and recipient scores on the Yale Environmental Performance Index (EPI) (Wendling et al. 2020) as exclusion variable. The EPI is composed of several performance indicators and ranks countries according to their environmental health and ecosystem vitality, which could be indicative of a country's interest and willingness towards environmental regulation (in trade agreements).[12] We then use the residuals obtained from this reduced form regression as an additional control variable in equation (1) which is estimated with PPML.

Results of the second-stage estimation are shown in Table (3). Please note that the observation size is reduced in comparison to our baseline estimation results, partly owing to data gaps in the EPI. Notably, the EPI does not track all countries across survey waves, and especially developing countries are recorded only for later years. While column (1) uses only available data, column (2) reports estimation results when missing data points of EPI scores for the years

[11] Besides differences related the mere scale of aid earmarked for environmental purposes versus aggregate ODA, one could assume differences also more generally between project-related and program aid, the latter including general budget support and debt relief. In this context, according to Dreher et al. (2008), recipients tend to favor program aid because it allows greater scope and flexibility in terms of its utilization. It would thus not be surprising to find pre-signature side-payments in the form of program rather than project aid. An unreported robustness check, however, reveals little difference when using either project or program aid as dependent variables compared to our baseline estimations (results are available upon request).

[12] Although methodology of the EPI is not consistent across survey waves, we merge data across waves in order to construct a time-varying measure used as exclusion restriction. To increase data points, we fill non-survey years with those of the last survey.

prior to the initial survey are filled with the earliest available observations. In both columns, a simple t-test for the reduced form residuals indicates that the exogeneity assumption of environmental provisions cannot be rejected at any of the standard significance levels. Although statistical significance is reduced in comparison to Table (2), results confirm our above interpretation about the relationship between the number of environmental provisions in upcoming PTAs and ODA provided during negotiations. While a difference in coefficients between our baseline estimations and those relying on the control function approach could generally point towards an invalid exclusion restriction for the latter, we obtain nearly identical coefficients when restricting observations of our baseline estimations to those used in Table 3.[13]

Table 3. Aggregate ODA estimation results using control function approach

VARIABLES	(1)	(2)
Negotiation phase		
PTA	-0.536	-0.486
	(0.881)	(0.733)
Environmental provisions	**0.0251***	**0.0242***
	(0.0145)	**(0.0135)**
Depth	-0.0749	-0.0784
	(0.150)	(0.138)
Post-signature phase		
PTA	0.0939	0.0228
	(0.901)	(0.773)
Environmental provisions	1.081	0.599
	(1.055)	(1.283)
Depth	-0.0766	-0.0766
	(0.128)	(0.117)
Reduced form residuals	-1.066	-0.584
	(1.050)	(1.280)
Observations	10,191	14,766
Country pairs	897	964
Pseudo-R^2	0.927	0.931

Notes: Table shows the second stage PPML estimation results of a two-stage control function approach. See section 4 for details. Bootstrapped standard errors in parentheses (1000 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.

Similarly, the probability that countries come to agree on a joint PTA at all could be affected by side-payments during negotiations. Previous literature, however, provides no indication of

[13] Estimation results are nearly identical when using country fixed effects alongside the standard gravity variables in the reduced form equation or a Poisson model for the reduced form regression. As a constraint, however, note that the control function approach is recommended mainly for continuous (potentially) endogenous variables; yet, while the number of environmental provisions varies across PTAs, it is discrete within country pairs and conditional on a PTA. The reduced form regression thus suffers from zero-inflated observations for environmental provisions because it uses the full sample, including also those country pairs without a PTA.

the validity of this line of argumentation and has instead identified economic, geographical and socio-political characteristics (e.g., Baier and Bergstrand 2004; Márquez-Ramos et al. 2011), or domino and contagion effects (e.g, Baier et al. 2014; Baldwin and Jaimovich 2012) as the main determinants of PTA formation. Based on this evidence, we believe that it is reasonable to argue that the overall agreement on PTA formation is shaped by a number of *structural* variables rather than by ad-hoc aid flows shortly prior to the signature of a PTA. In line with common practice across literature (Head and Mayer 2014; Yotov et al. 2016), all of these structural factors are controlled for by means of time-invariant country-pair- and time-varying country-year fixed effects.

Assessing the findings for the post-signature period reveals that all post-signature coefficients of the explanatory variables are consistently statistically insignificant across ODA regressions. For environmental aid, we find evidence for an inverse relationship with environmental provisions in column (1) but statistical significance disappears when controlling for PTA depth in column (2). While contrary to expectation with regard to the idea that environmental aid might be provided to promote the implementation of PTAs' environmental provisions, these findings could be due to our aggregation of provisions and differ with respect to their type and purpose and can also be explained by policy substitution. The non-effect of PTAs on aggregate ODA is consistent with Baccini and Urpelainen (2012), who find that post-signature side-payments are conditional on recipient countries being democracies and particularly short-lived.

In Appendix Table A5, we provide estimation results when allowing for shorter reference periods (within country pairs), and variation in the length of the time window prior to signing the PTA. While these amendments also have an effect on the composition of both sample countries and PTAs, an interesting finding across columns is that the number of environmental provisions is associated with pre-signature aid only shortly prior to the signature of a PTA, i.e., in the potentially most decisive phase of negotiations. Adjusting the negotiation phase time window to more than three years, however, does not reveal a statistically significant relationship, advocating for the length and rigor of the pre-signature time window in our baseline model specification.

A simple placebo test provides additional support to our inference. More specifically, we replicate our baseline analysis by modelling time windows around the year of a PTA's entry into force, instead of using signature years. Following our baseline specification, we use a two-year time window prior to entry into force. As for the sample PTAs, the average time between signature and entry into force is roughly two years. While for some PTAs we observe immediate (provisional) implementation upon signature (e.g., the 2008 China-New Zealand agreement or the 2008 CARIFORUM-EU Economic Partnership Agreement) or extreme lags of seven years (the 2008 Bosnia and Herzegovina-EU Stabilization and Association Agreement), EVFTA and the 2016 EFTA-Philippines agreement had not entered into force within our period of analysis. Estimation results are shown in Appendix Table A6, and reveal no indication of side-payments before a PTA's entry into force. This non-finding makes intuitively sense: Once the PTA is signed, potentially controversial content does not require side-payments any more.

4.2 Extensions

We apply a number of sensitivity checks to our above findings related to pre-signature aggregate ODA. To begin with, we account for the heterogeneity of environmental provisions. Shedding light on H_3, Table 4 displays the estimation results for defensive environmental provisions in comparison with development-related provisions, the latter seeking to promote financial assistance for and environmental capacity-building in developing countries. We first consider defensive and development provisions separately alongside the total count of environmental provisions in columns (1) and (2), respectively, and estimate their joint effects in column (3). While pre-signature estimation results confirm our previous findings to the effect

that the total number of environmental provisions is still significant throughout, the coefficient estimates for the two types of environmental provisions signal a deviation from the overall effect in column (3). More specifically, in line with H_3, we find defensive provisions to have a more pronounced relationship with pre-signature ODA. As expected and following our interpretation put forth above, high-income countries thus seem to put comparatively more money on the table to compensate developing countries for accepting defensive environmental provisions. Development-related provisions, on the other hand, intuitively reduce the need for financial side-payments. This is not surprising as developing countries can expect more assistance during the implementation phase of the PTA when development-related provisions are included in the agreement. It thus appears reasonable that acceptance of these types of provisions does not warrant pre-signature compensation.

Table 4. Aggregate ODA sensitivity analysis I (different types of environmental provisions)

VARIABLES	(2)	(3)	(7)
Negotiation phase			
PTA	-0.300	-0.181	-0.485
	(0.340)	(0.324)	(0.329)
Environmental provisions	**0.0111*** **	**0.0153*** **	**0.0129*** **
	(0.00398)	**(0.00345)**	**(0.00364)**
Defensive	0.0215		**0.0398*** **
	(0.0143)		**(0.0128)**
Development		-0.0315	**-0.0864** **
		(0.0367)	**(0.0409)**
Depth	-0.0547	-0.0538	-0.0277
	(0.0732)	(0.0821)	(0.0760)
Post-signature phase			
PTA	-0.190	-0.0328	-0.267
	(0.288)	(0.230)	(0.307)
Environmental provisions	-0.000388	0.00153	0.000457
	(0.00550)	(0.00576)	(0.00573)
Defensive	0.0202		0.0278
	(0.0194)		(0.0209)
Development		0.00926	-0.0305
		(0.0582)	(0.0653)
Depth	0.0293	0.0168	0.0360
	(0.0600)	(0.0582)	(0.0586)
Observations	18,583	18,583	18,583
Country pairs	1,208	1,208	1,208
Pseudo-R^2	0.937	0.937	0.937

Notes: Estimations performed with PPML. Dependent variables defined in levels of aggregate ODA. Robust, clustered (at 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.

Second, we add other types of PTA provisions to equation (1). More specifically, un-controlled features of trade agreements which are not captured by the different components of PTA depth, such as labor standards or clauses on human rights, could plausibly be correlated to both the level of greenness of PTAs and ODA. In order to allay corresponding endogeneity concerns, we use data from Lechner (2016) and incorporate multi-dimensional indices that capture the extent of PTA provisions addressing civil and political rights as well as economic and social rights.[14] Higher scores in the indices indicate more stringent legalization in both fields. As with environmental provisions, both variables are continuous across PTAs but remain constant for a given PTA. In line with our baseline explanatory variables, the effects of both types of PTA provisions are differentiated between negotiation and post-signature phases.

Table 5. Aggregate ODA sensitivity analysis II (controlling for other PTA provisions)

VARIABLES	(1)	(2)	(3)
Negotiation phase			
PTA	-0.255	-0.492	-0.446
	(0.391)	(0.522)	(0.526)
Environmental provisions	**0.0135*** **	**0.00972***	**0.0107****
	(0.00435)	**(0.00525)**	**(0.00532)**
Depth	-0.104	-0.206**	-0.238**
	(0.0864)	(0.0878)	(0.0988)
Civil and political rights provisions	0.104*		-0.0168
	(0.0607)		(0.0771)
Economic and social rights provisions		0.334**	0.352**
		(0.132)	(0.155)
Post-signature phase			
PTA	-0.879**	-1.040*	-1.258**
	(0.390)	(0.586)	(0.601)
Environmental provisions	-0.00683	-0.00928*	-0.0113**
	(0.00443)	(0.00531)	(0.00493)
Depth	0.103*	-0.0185	0.0585
	(0.0609)	(0.0679)	(0.0598)
Civil and political rights provisions	0.287***		0.215***
	(0.0735)		(0.0742)
Economic and social rights provisions		0.455***	0.270*
		(0.167)	(0.157)
Observations	18,575	18,575	18,575
Country pairs	1,208	1,208	1,208

[14] Civil and political rights provisions capture aspects related to human dignity, the right to political participation, the right to free movement, women's and children's rights, minority protection, and the rule of law. In comparison, economic and social rights include the right to work, rights at work, and the rights to education, development, and health.

Pseudo-R^2	0.937	0.937	0.937

Notes: Estimations performed with PPML. Dependent variables defined in levels of aggregate ODA. Robust, clustered (at 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.

Estimation results are displayed in Table 5 and confirm the previously identified positive relationship between the number of environmental provisions in upcoming PTAs and aggregate ODA commitments during negotiations throughout. While columns (1) and (2) consider separately civil and political rights and economics and social rights, respectively, column (3) shows results for their joint estimation and hints at pre-signature side-payments for economic and social rights provisions alongside environmental provisions in the form of ODA. This does not come as a surprise given that economic and social rights provisions and environmental provisions often share similar purposes, namely protecting domestic industries in high-income countries. Developing country exporters, by contrast, fear non-compliance with the environmental and social regulation demanded by high-income countries. As for the concerns of curtailed export potentials associated with increased environmental regulatory demands, there is a long-held controversial debate on labor standards in international trade policy, led by the suspicion of developing countries that stricter standards might compromise their comparative advantage in labor-intensive industries (e.g., Busse 2002; Salem and Rozental 2012).

Note that, in contrast to our baseline estimation results, PTA depth is now negatively associated with pre-signature ODA. Recalling that higher scores of PTA depth relate to often more complex and comprehensive trade agreements that are typically signed by the more advanced developing countries and emerging market economies instead of lower income and least-developed countries, this could be interpreted as a hint to the comparatively lower need of financial persuasiveness in regard to trade policy changes for this group of countries.[15]

Third, estimation results in Table 6 show that our above findings on the relationship between PTA environmental provisions and aggregate ODA are not compromised either by dropping the five upper- and lower tail PTAs in terms of environmental provisions from the sample (column 4), taking into account only aid provided by the EU Commission (column 5) or using data for individual DAC EU members instead of treating the EU as a bloc (column 6).[16] Furthermore, while our baseline findings still hold when dropping either the EU (column 1) or the US (column 2) as donors individually, their joint exclusion in column (3) leaves behind a statistically insignificant coefficient of environmental provisions during PTA negotiations. In other words, pre-signature aid commitments relating to the count of environmental provisions seem to be specific to the two economic heavyweights.

[15] For the post-signature period, we find a positive relationship between the number of civil and political as well as economic and social provisions and ODA commitments, pointing towards continuous support in both fields during the implementation of PTAs. By contrast, we find statistically significant negative effects of both the extent of PTA environmental provisions and membership on ODA. As for environmental provisions, note that the finding does not contradict our H_1. Instead, in this paper, we provide ample evidence that environmental provisions in upcoming PTAs are positively associated with pre-signature ODA commitments. We would thus expect to find a rise in post-signature ODA disbursements in fulfillment of the formalized future support, but not necessarily a continuation of increased commitments that were used previously as a side-payment during negotiations. While the negative coefficient of the PTA dummy appears counterintuitive, depending on the design of individual PTAs, the negative membership effect could well be offset by the positive effects of individual PTA provisions.

[16] We have also dropped the ten largest oil exporting recipients from estimations, given their distinctions with remaining sample recipients in terms of economic structure and potential attitudes towards environmental policy. The estimation results of this exercise are, however, very similar to our baseline estimations (results are available upon request).

There are several explanatory lines for these results. Our findings might reflect the fact that only the EU and the US have the ambition to export their regulatory models globally. In addition, only these heavyweights might offer sufficient ODA in absolute term to have an effect on foreign attitude. At the same time, although its share in aggregate ODA has fallen to some 20 percent averaged across all DAC donors in recent years, tied-aid practice notoriously constitutes a larger fraction of EU and US foreign aid (OECD 2021). Tying aid comes with the condition that recipients have to (at least partly) spend aid in the donor's market and is therefore known to reduce the benefits of aid for recipients (Roodman 2006).

By contrast, estimation results in column (3) reveal that other sample donors give ODA to PTA partners during post-signature phases depending on the number of environmental provisions contained in common PTAs. While the effect is estimated to be only slightly statistically significant and, at the same time, found as a rough average over the entire group of remaining DAC donors with potentially large differences among them, this insight does not hide an obvious strategic difference in the use of financial support related to PTA environmental provisions between the EU and the US on the one side, and remaining DAC donors on the other.

Table 6. Aggregate ODA sensitivity analysis III (sample and data variation)

	Sample variation				Data variation	
	w/o EU	w/o US	w/o EU & US	w/o bottom/top 5 PTAs	EU Commission aid	EU members data
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Negotiation phase						
PTA	-0.246	0.0765	-0.605*	-0.202	0.0910	0.0381
	(0.398)	(0.245)	(0.344)	(0.380)	(0.300)	(0.351)
Environmental provisions	**0.0214*** **	**0.00719** **	0.00922	**0.0191*** **	**0.0161*** **	**0.00947** **
	(0.00757)	**(0.00331)**	(0.00730)	**(0.00377)**	**(0.00386)**	**(0.00395)**
Depth	-0.0994	-0.0653	0.0774	-0.112	-0.115*	-0.0731
	(0.0824)	(0.0607)	(0.0707)	(0.0853)	(0.0696)	(0.0805)
Post-signature phase						
PTA	0.0801	0.238	-0.0751	-0.117	0.271	0.0568
	(0.416)	(0.241)	(0.384)	(0.287)	(0.284)	(0.257)
Environmental provisions	0.0143	-0.00517	0.0116*	0.00257	0.00202	0.00244
	(0.00937)	(0.00455)	(0.00662)	(0.00729)	(0.00513)	(0.00490)
Depth	-0.0842	-0.00112	-0.0454	0.0158	-0.00721	-0.0180
	(0.0644)	(0.0636)	(0.0640)	(0.0758)	(0.0614)	(0.0589)
Observations	16,722	16,527	14,666	18,161	18,583	44,328
Country pairs	1,089	1,076	957	1,180	1,208	3,060
Pseudo-R^2	0.931	0.945	0.926	0.939	0.915	0.907

Notes: Estimations performed with PPML. Dependent variables defined in levels aggregate ODA. Robust, clustered (at 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.

Lastly, we run separate regressions for recipients, based on their EPI scores in 2018. Among the 147 sample recipients, the median index score is 52.05. We categorize recipients below this threshold as countries exhibiting "low greenness", those with higher values as "high greenness" countries. For 15 recipients, however, assignment is not possible due to missing EPI data. While EPI scores are positively correlated with GDP per capita, there is still a high degree of variation in EPI scores among the different income groups. Our classification nevertheless has to be interpreted as an indication of differing results by EPI groups rather than ultimate evidence for a causal relationship.

Table 7. Aggregate ODA sensitivity analysis IV (level of greenness of recipient)

	Low	High
VARIABLES	(1)	(2)
Negotiation phase		
PTA	0.280	-0.0608
	(0.298)	(0.344)
Environmental provisions	**0.0191****	**0.00956****
	(0.00816)	**(0.00412)**
Depth	-0.173	-0.0613
	(0.113)	(0.0680)
Post-signature phase		
PTA	0.631*	0.0939
	(0.361)	(0.434)
Environmental provisions	0.0235**	-0.00648
	(0.00924)	(0.00447)
Depth	-0.279**	0.0524
	(0.110)	(0.0740)
Observations	9,167	7,629
Country pairs	588	495
Pseudo-R^2	0.921	0.890

Notes: Estimations performed with PPML. Dependent variables defined in levels of aggregate ODA. Robust, clustered (at 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 expectation is that greener developing countries are generally more likely to comply with the environmental regulations by high-income countries that are backed by defensive environmental provisions and used to protect their domestic industries. We therefore expect greener developing countries to be less reliant on pre-signature aid compensation. At the same time, in contrast to green developing countries, lower capability or political willingness to comply with environmental regulations and other restrictions justified by green PTAs on the side of low performers could call for aid side-payments even upon PTA signature.

Estimation results are presented in Table 7 and largely in accordance with our above expectations. More specifically, we find a two times larger magnitude for the coefficient of environmental provisions during PTA negotiations for developing countries with lower scores on the EPI compared with high-score recipients. While this suggests that low environmental performers are on average more responsive to aid commitments to agree on environmental

provisions in new PTAs, our results also point towards a positive relationship between the number of environmental provisions and continued support upon PTA implementation for this group of countries. Since aid in the post-signature phase can serve as a means of compensation but also provide support for the implementation of environmental provisions, many of demand compliance with environmental regulation, aid may serve as an effective means to facilitate their transformation to greener economies.

5. Concluding remarks

While previous literature documents the impacts of PTA environmental provisions on environmental regulation, emissions levels, and overall environmental performance, this paper investigated the bargaining process behind reinforcing the synergies between trade and environmental policy.

Given the tension between the aspiration of high-income countries to include ever more environmental provisions in their PTAs and many developing countries' fears associated with this trend, finding a compromise between both positions can be challenging. Driven by the two largest donors, namely the EU and the United States, we find that the number of environmental provisions in upcoming PTAs and the level of aid that high-income donors commit during the negotiations of PTAs are positively correlated. Considering that high-income countries typically pre-determine the extent of environmental provisions in their upcoming PTAs, we conclude that accepting a high number of environmental provisions in North-South PTAs is remunerated with aid offered by high-income countries during negotiations. This bargain potentially benefits both donor countries wishing their green PTA template to be adopted, and recipient countries in need of finance. Our interpretation is further supported econometrically by addressing potential endogeneity of PTA environmental provisions employing a two-stage control function approach.

In light of a greater potential to exploit aid fungibility in the case of aggregate ODA rather than for its subcomponent environmental aid, we found aid commitments to matter in the context of the former rather than the latter. Accounting for the heterogeneity of different types of environmental provisions, our estimations also suggest the relationship to be more pronounced in the case of so-called defensive provisions that safeguard policy space for environmental regulation and can thus justify forms of protectionism.

Our quantitative findings are in line with several qualitative case studies and other pieces of anecdotal evidence, including background interviews conducted for this study, which indicate that aid can play the role of a side-payment in trade negotiations. For example, the US government views aid as a way to gain the cooperation of developing countries in trade negotiations and increasing the likelihood "to complete negotiations" (Congress Research Service 2008: 26). In the case of the agreement between the US and the Central American countries of Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua (CAFTA), a "USTDA official said that the process [of providing foreign aid] had helped negotiators 'sell' CAFTA to CAFTA countries" (Government Accountability Office. 2005: 28). The EU too uses aid as a carrot to realize its negotiation goals: According to an official at the EU Commission, if the EU wants to include ambitious TSD chapters, it often has to pay for it, including by making use of aid; for instance, such bargaining dynamics are relevant in the case of the negotiations for deepening the EU's Economic Partnership Agreement (EPA) with Eastern and Southern Africa (ESA) (interview with EU Commission, 24 November 2021).

Our findings on the positive relationship between PTA environmental provisions and pre-signature aid generate important policy-relevant insights and could also point to new avenues for future research. Not only do we find the link most pronounced for recipients with relatively poor environmental performance, but for this group of countries we also find the number of environmental provisions in PTAs to be positively associated with aggregate ODA after the

signing new PTAs. This suggests that aid may serve as an effective means to facilitate the transformation into greener economies for this group of countries. Despite controversies over the effectiveness of aid to promote economic growth, our findings thus signal the positive developmental effects of aid through a previously undetected channel.

Future research could shed more light on the role of aid for environmental protection in the contexts of other international institutions beyond trade agreements, including in international environmental agreements. Also, an interesting field of policy assessment would be to monitor the adherence of pre-signature aid commitments with regard to post-signature disbursements.

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Appendix

Table A1. Donor countries in the sample

Australia	Japan	Switzerland
Canada	Korea, Rep.	United States
European Union	New Zealand	
Iceland	Norway	

Table A2. Recipient countries in the sample

Afghanistan	Ghana	Palau
Albania	Grenada	Panama
Algeria	Guatemala	Papua New Guinea
Angola	Guinea	Paraguay
Antigua and Barbuda	Guinea-Bissau	Peru
Argentina	Guyana	Philippines
Armenia	Haiti	Rwanda
Azerbaijan	Honduras	Saint Kitts and Nevis
Bahrain	India	Saint Lucia
Bangladesh	Indonesia	Saint Vincent and the Grenadines
Barbados	Iran	Samoa
Belarus	Iraq	Sao Tome and Principe
Belize	Jamaica	Saudi Arabia
Benin	Jordan	Senegal
Bhutan	Kazakhstan	Serbia
Bolivia	Kenya	Seychelles
Bosnia and Herzegovina	Kiribati	Sierra Leone
Botswana	Kosovo	Solomon Islands
Brazil	Kyrgyzstan	Somalia
Burkina Faso	Lao People's Democratic Republic	South Africa
Burundi	Lebanon	South Sudan
Cabo Verde	Lesotho	Sri Lanka
Cambodia	Liberia	Sudan
Cameroon	Libya	Suriname
Central African Republic	Madagascar	Syrian Arab Republic
Chad	Malawi	Tajikistan

China	Malaysia	Tanzania
Colombia	Maldives	Thailand
Comoros	Mali	Timor-Leste
Congo	Marshall Islands	Togo
Cook Islands	Mauritania	Tonga
Costa Rica	Mauritius	Trinidad and Tobago
Cuba	Mexico	Tunisia
Côte d'Ivoire	Micronesia	Turkey
Democratic People's Republic of Korea	Moldova	Turkmenistan
Democratic Republic of the Congo	Mongolia	Tuvalu
Djibouti	Montenegro	Uganda
Dominica	Morocco	Ukraine
Dominican Republic	Mozambique	Uruguay
Ecuador	Myanmar	Uzbekistan
Egypt	Namibia	Vanuatu
El Salvador	Nauru	Venezuela
Equatorial Guinea	Nepal	Vietnam
Eritrea	Nicaragua	West Bank and Gaza Strip
Eswatini	Niger	Yemen
Ethiopia	Nigeria	Zambia
Fiji	Niue	Zimbabwe
Gabon	North Macedonia	
Gambia	Oman	
Georgia	Pakistan	

Table A3. List of defensive and development environmental provisions in PTAs

Defensive provisions
Precautionary principle
Sovereignty over natural resources in general
Sovereignty over hydrobiological and fishery resources
Sovereignty over other specific resources
Sovereignty in determining level of protection according to State priorities
Sovereignty in the enforcement of environmental measures
Sovereignty or independence of national tribunals in the application of environmental measures
Other norms on regulatory sovereignty
No extraterritorial enforcement activities
No right of action under a Party's domestic law
Exclusion of water from the agreement
Environmental experts for State-State dispute over failure to enforce environmental measures or other environmental provisions of the trade agreement

Environmental experts in State-State dispute over trade provisions of the trade agreement

Environmental report in State-State dispute over failure to enforce environmental measures or other environmental provisions of the trade agreement

Environmental report in State-State dispute over trade provisions of the trade agreement

Environmental report in investor state dispute

Consent to use the DSM of a multilateral environmental agreements

Panel shall consult or defer to any relevant entity the interpretation of a Party s obligation under a multilateral environmental agreement

Prevalence of environmental agreements in case of inconsistency: Prevalence CITES

Prevalence of environmental agreements in case of inconsistency: Prevalence Montreal Protocol

Prevalence of environmental agreements in case of inconsistency: Prevalence Basel Convention

Prevalence of environmental agreements in case of inconsistency: Prevalence MARPOL

Prevalence of environmental agreements in case of inconsistency: Prevalence Rotterdam Convention

Prevalence of environmental agreements in case of inconsistency: Prevalence Stockholm Convention

Prevalence of environmental agreements in case of inconsistency: Prevalence Ramsar Convention

Prevalence of environmental agreements in case of inconsistency: Prevalence CCAMLR

Prevalence of environmental agreements in case of inconsistency: Prevalence International Convention for the Regulation of Whaling

Prevalence of environmental agreements in case of inconsistency: Prevalence Kyoto Protocol

Prevalence of environmental agreements in case of inconsistency: Prevalence CBD

Prevalence of environmental agreements in case of inconsistency: Prevalence Cartagena Protocol

Prevalence other agreements related to the environment

International standards are presumed to be in conformity with the trade agreement's obligations

Right to adopt stringer standards than international ones

Possibility to opt out of harmonized environmental norms

Not the Party s intentions to harmonize their environmental standards

Life (or health) of animal and/or plant: References to GATT art XX b) or the complete art XX

Life (or health) of animal and/or plant: Includes references to Article 30 of the EC Treaty and Article 50 of the Montevideo Treaty

X8 01 01 Animal plant life or health

Conservation of natural resources

Protection of the environment

Right to conduct a risk assessment

Right to prepare, elaborate, adopt or apply TBT measures related to the environment

Right to derogate from the regular adoption procedure of a TBT measure in case of emergency

Investment: General on investment

Investment: Specific on establishment

Investment: Specific on performance requirements

Investment: Specific on expropriation

Foreign investment ban from specific sectors related to the environment

Right to maintain or adopt any measures in regards of investment in a specific sector

Exclusion of ISDS

Exclusion of environmentally harmful inventions from patentability

Use of geographical indications to protect the environment

Other norms on intellectual property and the environment

Procurement and the environment: General exceptions

Technical specification or restriction in tender procedure

Exclusion of specific sectors from procurement liberalization

Cooperation on green public procurement

Exceptions allowing agricultural subsidies

Other norms allowing subsidies

Prevention of subsidies harmful to the environment

Safeguard measures on environmental grounds

Services on Life or health of animal or plant

Services on conservation of natural resources

Services on protection of the environment

Norms on environmental services

Exclusion of environmental sectors from the liberalization of services

Right to maintain or adopt any measures in regards of a specific sector of services

SPS measures and the environment

Exception to the free movement of persons

Development provisions

Common but differentiated responsibilities principle

Sovereignty over natural resources in general

Sovereignty over genetic resources

Sovereignty over hydrobiological and fishery resources

Sovereignty over other specific resources

Recognition of a development gap or of different capabilities

Disclosure of the source of genetic material

Prior informed consent from the appropriate authority when accessing genetic resources

Equitable sharing of benefits arising from use of genetic resources

Other norms on genetic resources

Technical assistance, training or capacity building provided to another Party

Technical assistance, training or capacity building provided to non-State actors

Technology transfer in the field of environment

Funding of capacity-building, training, technical assistance and technological transfer

Funding provided to non-State actors

Emergency assistance in case of natural disaster

Capacity-building, training, technology transfer, technical, financial and emergency assistance to third countries

Notes: Details on individual environmental provisions are available in the TREND codebook at http://www.chaire-epi.ulaval.ca/en/Trend.

Table A3. List of preferential trade agreements considered in baseline analysis

ASEAN-Australia-New Zealand FTA (2009)	China-Switzerland FTA (2013)	EFTA-Montenegro FTA (2011)
ASEAN-Japan FTA (2008)	China-New Zealand FTA (2008)	EFTA-Peru FTA (2010)
ASEAN-Korea FTA (2006)	Colombia-EFTA FTA (2008)	EFTA-Philippines FTA (2016)
Albania-EU SAA (2006)	Colombia-Korea FTA (2013)	EFTA-Serbia FTA (2009)
Albania-EFTA FTA (2009)	Colombia-Peru-EU FTA (2012) + accession of Ecuador (2016)	EFTA-SACU FTA (2006)
Australia-China FTA (2015)	Colombia-US FTA (2006)	EFTA-Ukraine FTA (2010)
Bosnia and Herzegovina-EU SAA (2008)	Côte d'Ivoire-EU EPA (2009)	India-Japan FTA (2011)
Canada-Colombia FTA (2008)	EU-Georgia FTA (2014)	India-Korea FTA (2009)
Canada-Honduras FTA (2013)	EU-Kosovo SAA (2015)	Indonesia-Japan FTA (2007)
Canada-Jordan FTA (2009)	EU-Moldova FTA (2014)	Japan-Mongolia EPA (2015)
Canada-Panama FTA (2010)	EU-Montenegro SAA (2007)	Japan-Philippines FTA (2006)
Canada-Ukraine FTA (2016)	EU-Serbia SAA (2008)	Japan-Thailand FTA (2007)
CARIFORUM-EU EPA (2008)	EU-Ukraine SAA (2014)	Korea-Peru FTA (2011)
Central America-EU AA (2012)	EU-Vietnam FTA (2016)	Korea-Turkey FTA (2012)
Central America-EFTA FTA (2013)	EFTA-Egypt FTA (2007)	Oman-US FTA (2006)
China-Korea FTA (2014)	EFTA-GCC FTA (2009)	Panama-US FTA (2007)

Notes: Parentheses indicate signature years. While the EVFTA was signed in 2019 we treat 2016 as the de facto signature year of the EVFTA because when the negotiation process between the EU and Vietnam had been officially concluded already in December 2015. The European Union has additionally signed Economic Partnership Agreements with a number of countries in the period under investigation but coding of their environmental provisions is not provided in the current version of the TREND database. The data limitation applies also to the EFTA-Georgia FTA signed in 2016. For this reason, respective country pairs are removed from the data. The Trans-Pacific Partnership (TPP) is not considered because the original agreement was not pursued further upon the withdrawal of the United States. Its successor, the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), was signed only in 2018. Corresponding country pairs are removed from the data.

Table A4. Summary statistics

VARIABLES	Observations	Mean	Std. Dev.	Min	Max
Environ aid	22,192	4.048993	36.27812	0	2,254.387
Aggregate ODA	22,192	49.56642	231.9438	0	9,762.62

Negotiation phase					
PTA	22,192	0.0113554	0.1059576	0	1
Environmental provisions	22,192	0.5675018	6.480674	0	133
Defensive	22,192	0.1438356	1.506642	0	32
Development	22,192	0.0428983	0.5569363	0	11
Depth	22,192	0.0547093	0.5592395	0	7
Civil and political rights provisions	22,192	0.0371845	0.3674968	0	5.590395
Economic and social rights provisions	22,192	0.0461794	0.4543152	0	6.400174
Post-signature phase					
PTA	22,192	0.0489366	0.2157403	0	1
Environmental provisions	22,192	2.135184	11.85554	0	133
Defensive	22,192	1.150685	4.123243	0	32
Development	22,192	0.3431867	1.542195	0	11
Depth	22,192	0.2276804	1.101766	0	7

Notes: Values for environmental aid and aggregate ODA are expressed in current US dollars (millions).

Table A5. Aggregate ODA estimation results with different reference and negotiation phase time windows

	1-year reference period					2-years reference period				
	1 year neg	2 years neg	3 years neg	4 years neg	5 years neg	1 year neg	2 years neg **(baseline)**	3 years neg	4 years neg	5 years neg
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Negotiation phase										
PTA	-0.489	-0.134	-0.00105	0.323	0.0863	-0.571*	-0.134	0.0656	0.184	0.511*
	(0.319)	(0.305)	(0.246)	(0.257)	(0.267)	(0.306)	(0.305)	(0.258)	(0.251)	(0.298)
Environmental provisions	0.00634	**0.0140*** **	**0.0116*** **	0.000519	0.00213	**0.0103** **	**0.0140*** **	**0.00831** **	0.00412	-0.000216
	(0.00403)	**(0.00382)**	**(0.00349)**	(0.00370)	(0.00416)	**(0.00422)**	**(0.00382)**	**(0.00358)**	(0.00405)	(0.00469)
Depth	0.0755	-0.0683	-0.0651	0.0364	0.0355	0.0640	-0.0683	-0.0456	0.00554	0.0130
	(0.0776)	(0.0743)	(0.0611)	(0.0661)	(0.0681)	(0.0727)	(0.0743)	(0.0632)	(0.0661)	(0.0599)
Post-signature phase										
PTA	-0.0575	-0.0500	-0.0183	0.350	0.262	-0.103	-0.0499	0.194	0.295	0.417
	(0.212)	(0.234)	(0.253)	(0.269)	(0.301)	(0.220)	(0.234)	(0.259)	(0.283)	(0.491)
Environmental provisions	-0.00202	0.00190	0.00212	-0.00498	-0.00671	-0.000801	0.00190	5.24e-06	-0.00595	-0.00714
	(0.00431)	(0.00513)	(0.00541)	(0.00507)	(0.00560)	(0.00480)	(0.00513)	(0.00549)	(0.00517)	(0.00620)
Depth	0.0575	0.0212	0.0226	0.0581	0.0984	0.0537	0.0212	-0.00698	0.0816	0.0842
	(0.0537)	(0.0596)	(0.0632)	(0.0616)	(0.0688)	(0.0564)	(0.0596)	(0.0692)	(0.0651)	(0.0895)
Observations	18,785	18,599	18,583	18,265	18,166	18,599	18,583	18,265	18,166	17,816
Country pairs	1,222	1,209	1,208	1,186	1,179	1,209	1,208	1,186	1,179	1,156
Pseudo-R^2	0.936	0.937	0.937	0.938	0.938	0.937	0.937	0.938	0.938	0.938

Notes: Estimations performed with PPML. Dependent variables defined in levels of aggregate ODA. Robust, clustered (at 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

Table A6. Aggregate ODA estimation results with placebo time window

VARIABLES	(1)
Pre-entry-into-force phase	
PTA	0.0105
	(0.174)
Environmental provisions	-0.000175
	(0.00576)
Depth	0.0246
	(0.0608)
Post-entry-into-force phase	
PTA	0.0692
	(0.245)
Environmental provisions	0.000648
	(0.00551)
Depth	-0.00501
	(0.0802)
Observations	18,586
Country pairs	1,208
Pseudo-R^2	0.937

Notes: Estimations performed with PPML. Dependent variables defined in levels of aggregate ODA. Robust, clustered (at 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.