Do Environmental Provisions in Trade Agreements Make Exports from Developing Countries Greener?

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1. Introduction

One of the key impediments for the promotion of a green transformation is the alleged trade-off between growing versus greening the economy.[1] This trade-off is acute for developing countries, which face the immediate challenge of fostering economic growth to combat poverty, while their ecological footprints are typically much smaller compared to developed countries. This alleged trade-off is especially evident in debates about trade policy: although preferential trade agreements (PTAs) are typically signed with the objective to boost trade between contracting parties, environmental provisions are increasingly being incorporated into them (Morin et al., 2018). These provisions are becoming more far-reaching and cover such issues as the regulation of hazardous waste, deforestation and the protection of fish stock.

Recent research shows that environmental provisions in PTAs have the potential to contribute towards environmental sustainability by promoting domestic environmental legislation and reducing air pollution and carbon dioxide (CO_2) emissions (Baghdadi et al., 2013; Bastiaens & Postnikov, 2017; Brandi et al., 2019; Martínez-Zarzoso & Oueslati, 2016; Zhou et al., 2017; Kolcava et al., 2019). At the same time, there are concerns that environmental provisions can run counter to the core objective of PTAs, resulting in a reduction of trade flows. Research also shows that environmental provisions in PTAs and other non-trade issues are partly motivated by protectionist interests (Lechner, 2016). However, while environmental provisions in PTAs are more prominent than ever, very few studies have investigated their economic consequences. Accordingly, the question arises whether the recent trend of incorporating environmental provisions into PTAs exacerbates the alleged trade-off between protecting the environment and generating economic development, particularly in developing countries. Despite the high political relevance of the trade and environment interface, the actual effects of environmental provisions on trade flows remain under-researched.

This article focuses on the effect of environmental provisions incorporated into PTAs on (the composition of) exports, with a particular emphasis on developing countries facing the above-mentioned trade-off between economic development and environmental protection. This research focus is particularly relevant as developing countries want to use PTAs to increase trade while facing increasing demands from their negotiation partners, in particular high-income countries, such as the United States and the European Union, to incorporate ever more environmental provisions.

One key question is whether environmental provisions in PTAs can promote environmental-friendly trade relations. Can they contribute to limiting trade in "dirty", i.e.

[1]The term "green transformation" refers to the radical shift towards a green economy in light of today's environmental challenges "to achieve a transformation similar in scope to the Neolithic and industrial revolutions" (WBGU, 2011, p.1). For a discussion of the term "green economy" and related concepts, see Loiseau et al. (2016).

polluting goods, and can they promote trade in "green" goods, i.e. goods that reduce or remedy environmental damage? As it appears that no study has yet been conducted to investigate the trade effect of environmental provisions in PTAs at the sectoral level, this article is the first to address this important gap in the literature.

We analyse sectoral bilateral trade data and fine-grained data on environmental provisions included in PTAs to inspect whether these provisions affect the sectoral composition of trade flows. We find that including environmental provisions in PTAs, and particularly markedly trade-restrictive provisions, contribute to reducing the share of environmentally harmful dirty goods in exports. On the other hand, explicitly liberal environmental provisions are associated with an increased share of environmentally beneficial green goods exports.

By asking how environmental provisions in PTAs affect sectoral trade flows, this study contributes to the literature on economic impacts of deep trade agreements, which increasingly cover non-trade issues, and the consequences of their specific design features. Moreover, by providing new evidence on the trade effects of environmental provisions in PTAs, this study contributes to the debate on trade and environment and the links between greening the economy and the implications for competitiveness. Last but not least, by providing evidence that the trade effects of environmental provisions depend on their design, the study offers policy recommendations for shaping PTAs in ways that help to create synergies and manage trade-offs between the green transformation and competitiveness.

The remainder of this article is organized as follows: Section 2 provides a review of the relevant strands of literature and contains our hypotheses; Section 3 includes a description of the data and methodology used for the empirical analysis; Section 4 presents and discusses the empirical findings; Section 5 includes the robustness checks; and Section 6 concludes with a discussion of the contributions of study.

2. Literature and hypotheses

To date, there is only limited research on the role of PTAs and their environmental content in the context of debates about the trade and environment interface and little is known about the trade effects of environmental provisions in trade agreements. The literature on the effects of trade agreements is mainly centered on investigating how PTAs in general affect the levels of trade flows between their parties.[2] This literature has traditionally focused on the World Trade Organization (WTO).[3] However, in light of the slow pace of multilateral negotiations and the surge in PTA negotiations, more recent studies have focused on the trade effects of bilateral and regional PTAs. These studies usually indicate that PTAs lead to overall higher trade between their members (Baier & Bergstrand, 2007, 2009; Egger et al., 2008, 2011; Freund & Ornelas, 2010; Fugazza & Nicita, 2013; Magee, 2008). Some studies investigate the effects of trade liberalization at the sectoral level.[4] For example, Baggs and

[2] For a recent review of the literature on the formation of PTAs and their effects, see Baccini (2019).

[3] While the literature finds a positive impact for countries that acceded the WTO (Rose, 2005; Subramanian & Wei, 2007; Tang & Wei, 2009), the findings about a more general trade effect of WTO membership is less clear. In the well-known study by Rose (2004), a positive impact is indicated, while, Subramanian and Wei (2007) find that WTO membership increases trade but only for the members that are participating in reciprocal tariff reductions.

[4] Only recently has research been conducted to assess the trade effects of PTAs across sectors and firms. The empirical insight that not all firms benefit equally when trade barriers are reduced (e.g. Bernard et al., 2003; Bernard & Jensen, 1999; Eaton et al., 2004) is mirrored in models of new trade theory (Melitz, 2003). These models show that trade liberalization generates gains for those, typically large, firms that are very productive, while less productive firms are frequently not sufficiently competitive in foreign markets and accordingly cannot benefit from reduced trade barriers.

Brander (2006) find that reduced domestic tariffs are associated with lower profits for import-competing firms, while reduced foreign tariffs are associated with higher profits for exporting firms. Baier et al. (2014) find that the intensive margin effects (goods that were already previously exported) of PTAs are larger than extensive margin effects (goods that were not previously traded). Baccini et al. (2017) find that the distribution of the gains from trade is highly uneven, with more competitive firms benefiting disproportionally more. Spilker et al. (2018) find that firms exporting heterogeneous products, such as textiles, benefit from PTAs, as they can export more varieties of their products, but that their trade volume decreases; they find the opposite pattern for firms exporting homogenous products.

Newly available data on the design of PTAs (Dür et al., 2014) make it possible to study how the effects of PTAs vary in light of their design. While PTAs used to focus mainly on reducing at-the-border measures, such as tariffs and quotas, negotiating parties are now tending to focus more on behind-the-border measures in trade agreements. The latest PTAs incorporate a wide array of behind-the-border issues, including, among them, investment, services, intellectual property and regulatory cooperation. Existing studies indicate that such deep PTAs tend to generate more trade than shallower agreements (Baier et al., 2014; Dür et al., 2014; Mattoo et al., 2017).

In recent years, environmental provisions are more than ever being incorporated in PTAs.[5] Figure 1 shows that the average number of environmental provisions per PTA has increased sharply since the end of the 1990s. In 2016, each new PTA contained, on average, approximately 100 different environmental provisions (Morin et al., 2018). Environmental provisions are becoming more and more diverse and extensive. Multiple environmental provisions are relevant for the trade flows between PTA partner countries. Some provisions, for example, aim at reducing trade barriers for environmental goods or justify trade barriers for hazardous waste; other provisions prescribe environmental regulations which in turn are likely to affect trade flows by impacting firm's competitiveness (see also the discussion below).

[5] For an overview of the uptake of environmental provisions, see www.trendanalytics.info.

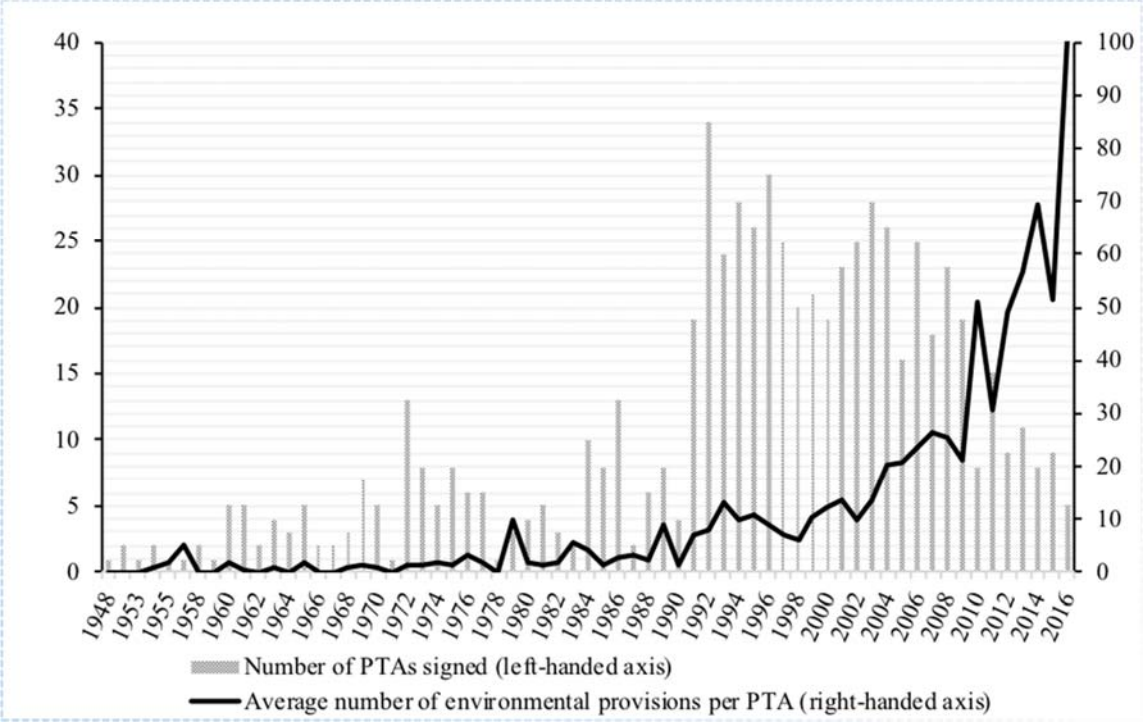

Figure 1: Average number of environmental provisions per PTA

The literature points to political and economic explanations for the growing number of environmental provisions per PTA (Lechner, 2016; Milewicz et al., 2016; Morin et al., 2018; Blümer et al., 2019; Morin et al., 2019). A first strand of political reasoning makes the case that the inclusion of environmental provisions in PTAs is used as a strategy to get the backing of political parties and non-state actors, which are critical for implementing trade liberalization and would otherwise block the adoption of trade agreements (Gallagher, 2004; Hufbauer et al., 2000). The inclusion of environmental provisions in trade agreements enjoys strong public support; a majority of citizens in many countries are in favor of "greening" PTAs (Esty, 2001; Bernauer & Nguyen, 2015). A second political explanation is that countries use PTAs as an instrument of environmental diplomacy in order to set higher environmental standards (Johnson, 2015; Jinnah & Lindsay, 2016). As PTAs enable trade-offs across different issue areas and can include stringent dispute settlement clauses, they might be regarded as being more effective for environmental diplomacy than multilateral, regional or bilateral negotiations that focus solely on environmental issues. A third potential driver for the inclusion of environmental provisions in PTAs is motivated by economic considerations (Bechtel et al., 2012; Bhagwati & Hudec, 1996; Krugman, 1997). Countries with higher environmental standards might want to level the playing field with competitors by reducing differences in regulatory environments across countries (George, 2014). Moreover, a number of studies suggest that there might be a link between protectionist interests and environmental provisions in PTAs (Ederington & Minier, 2003; Lechner, 2016; Runge, 1990; Subramanian, 1992).

While existing research sheds light on the motivations for including environmental provision in PTAs, their actual economic effects remain largely unclear. One exception is a recent study by Lechner (2018) which analyzes how non-trade issues, such as environmental and labor provisions, affect the behavior of US investors. Lechner finds that their effects vary across sectors: environmental provisions in PTAs reduce FDI in polluting industries while they have a promoting effect in environmentally clean industries. Yet, it remains

unknown whether and how the trade effects of environmental provisions vary across different parts of the economy, how environmental provisions in PTAs affect trade flows at the sectoral level, and to what extent their sectoral implications generate synergies or rather trade-offs between trade and the environment.

Several studies show that environmental regulations can affect the composition of exports and investment. Levinson and Taylor (2008) study the effect of US environmental regulations on bilateral trade flows with Canada and Mexico and find that they lead to an increase in imports from these countries. Hanna (2010) assesses the U.S. Clean Air Act and finds that more stringent US regulation leads to a shift of production out of the country. A recent review of the literature (Cherniwchan et al., 2017) furthermore indicates that there is a link between more stringent environmental regulations and reduced exports in polluting sectors. International environmental regulation can also affect trade flows. Aichele and Felbermayr (2015) investigate the impact of the Kyoto Protocol on the carbon content of trade for 15 industries in 40 countries and find that the Kyoto Protocol generated a significant increase in the carbon content of imports.

Moreover, the literature has typically investigated the relation between trade liberalization and environmental protection from the perspective of the comparative advantage that results from varying levels of national environmental regulation. One key concern is the potential rise of pollution havens in developing countries. According to the pollution haven hypothesis, formulated for the first time by Copeland and Taylor (1994), the removal of barriers to trade and investment leads to a relocation of environmental harmful production stages from (high-income) countries with stringent environmental regulation to (developing) countries with less stringent environmental regulation. Empirical evidence remains ambiguous, but several studies provide some support for the pollution haven hypothesis (e.g. Li & Zhou, 2016; Cherniwchan, 2017). One of these studies was recently conducted by Kolcava et al. (2019). In this study, the authors find that trade liberalization via PTAs is associated with an increase in the ecological footprint of developing countries' exports. According to their results, environmental provisions in PTAs even increase this effect.

In this article, we analyze the effect of different environmental provisions on the overall level of exports and a shift in its sectoral composition. In contrast to Kolcava et al. (2019), we investigate sectoral trade flows instead of ecological footprint exports as the dependent variable. Also, we use bilateral panel data, which allows us to focus on exports *between the contracting partner countries* and control for country specific fixed effects in our estimation whereas Kolcava et al. (2019) use country-level observations. Moreover, while Kolcava et al. (2019) use a proxy for the strength of environmental provisions (ranging from 1 to 6) as explanatory variable for their model extension, our measure of environmental provisions is not only more fine-grained (see the description in Section 3) but also directly refers to the affected bilateral trade flows in order to illuminate the trade effects of trade-restrictive and liberal environmental provisions in PTAs.

In our analysis of sectoral trade flows, we disentangle the effect of different environmental provisions on dirty and green goods. We refer to goods as "dirty" when they incur high levels of pollution abatement costs and as "green" when they reduce or remedy environmental damage (for more details, see Section 3). There are also environmentally 'neutral' goods (constituting the majority of traded goods), which are neither particularly harmful nor beneficial for the environment.

Based on existing research on the protectionist motivations for introducing environmental provisions in PTAs and on the trade restrictive effects of environmental regulation, we expect that these provisions will decrease exports in dirty sectors. Echoing the view of their environmental non-governmental organizations (NGOs) and businesses,

high-income countries are expected to promote environmental provisions in PTAs that restrict the exports of developing countries' polluting industries. High-income countries' businesses prefer to avoid this competition and environmental NGOs want to avoid the creation of pollution havens in developing countries. In this political context, developed countries have strong political incentives to design environmental provisions that restrict developing countries' dirty exports. If entering into a PTA increases the relative importance of dirty sectors in developing countries, we expect that the inclusion of environmental provisions in this PTA will counterbalance this effect. We thus hypothesize:

H1a: Environmental provisions in PTAs reduce exports in dirty goods (from developing countries).

The Porter hypothesis paints a very different picture than the pollution haven perspective. According to the Porter hypothesis, environmental regulation does not undermine competitiveness but acts as an incentive for companies to innovate, which, in turn, enhances productivity (Porter, 1991; Porter & van de Linde, 1995). In light of the Porter Hypothesis, environmental provisions can be expected to promote (at least certain types of) trade flows. Environmental provisions lead to more domestic environmental regulations (Brandi et al., 2019). These environmental regulations in turn are expected to push firms to develop more environmentally-friendly technologies, thereby prompting innovations that compensate or even surpass the costs of complying with new regulations (Porter 1991; Porter & van der Linde 1995).

While the so-called "weak" Porter Hypothesis posits that innovations induced by regulation offset the compliance costs, the "strong" Porter hypothesis goes beyond this by arguing that stringent regulations can lead to changed patterns of competitive specialization (Lanoie, 2008; Ambec et al., 2013). According to this latter variant, strict regulations lead to technological learning and trigger innovations that generate new areas of specialization. In light of stringent regulations, companies are expected to develop green innovations that become an early mover advantage once other countries enforce comparable environmental regulations at a later point in time; the strong Porter Hypothesis is thus be mirrored, for instance, by increasing competitiveness, market shares and exports in green sectors (Pegels & Altenburg 2019).

There is inconclusive evidence regarding the Porter Hypothesis. Whereas several studies find that regulation tends to promote innovation (Johnstone et al., 2012), it is unclear how environmental regulation affects competitiveness (Palmer et al., 1995; Berman & Bui, 2001; Lanoie et al., 2008; Dechezleprêtre & Sato, 2017). A recent meta-analysis suggests that a positive effect of regulation is more likely at the state, regional or country levels than at the firm or industry levels (Cohen & Tubb, 2018). Mealy and Teytelboym (2019) find that countries with stricter environmental policies do indeed export a larger number and more sophisticated green goods. Environmental provisions in PTAs can either directly function as environmental regulation of exports or demand such regulation more generally at the domestic level. In either case, they regulate exports and their effects on exports can thus be analyzed in view of the Porter hypothesis.

In light of these links between environmental provisions in PTAs as proxy for environmental regulation and their expected effects for the competitiveness of green sectors, we expect the following:

H1b: Environmental provisions in PTAs increase exports in green goods (from developing countries).

While it is important to investigate the effect of environmental provisions more generally, environmental provisions in PTAs are very diverse and might thus have

heterogeneous effects on trade across sectors. To the best of our knowledge, this varying nature of environmental provisions concerning expected trade effects has not been assessed yet. Whereas some environmental provisions are likely to limit trade, due to their very nature, others have the potential to foster trade flows. We, therefore, distinguish between trade-restrictive and liberal environmental provisions and assess their effects at the sectoral level. On the one hand, trade-restrictive provisions are intended to limit environmentally unsustainable trade flows. These restrictive environmental provisions can affect trade flows in two different ways. First, countries with stringent environmental regulations can use environmental provisions in PTAs to "level the playing field" with countries that have weak environmental regulations (Bhagwati, 1995). Indeed, for example, some environmental provisions require parties to enhance the level of environmental protection and implement a list of environmental agreements (Bluemer et al., 2019). These types of environmental provisions can be used to diminish the competitive advantage of countries with previously less stringent environmental regulations. This is likely to be of special relevance to developing countries who tend to have a comparative advantage in dirty sectors and fewer and less stringent environmental regulations. Second, other trade-restrictive environmental provisions aim at directly restricting environmentally harmful trade flows. For instance, the members of the Caribbean Community agreed "to protect the Region from the harmful effects of hazardous materials transported, generated, disposed of or shipped through or within the Community" (CARICOM, 2001).

Liberal provisions, on the other hand, intend to strengthen "green" trade. They include requirements to reduce trade barriers specifically for environmental goods and services. For instance, the PTA between New Zealand and Taiwan from 2013 requires the elimination of all tariffs on environmental goods. The EU-Georgia PTA (2014) demands the parties "to facilitate the removal of obstacles to trade or investment concerning goods and services of particular relevance to climate change mitigation, such as sustainable renewable energy and energy efficient products and services." Liberal environmental provisions also include clauses that promote international standards, harmonize domestic measures and indicate the prevalence of trade in cases of inconsistencies with other issue areas. Liberal environmental provisions that promote economic openness can facilitate the diffusion of more advanced technologies and environmentally friendly innovations (Prakash & Potoski, 2006), thereby further promoting the competitiveness of the green sectors of the economy.

Overall, environmental provisions can be expected to reduce "dirty" trade flows and to promote "green" trade flows due to their very nature in terms of aiming at liberalizing environmentally sustainable and restricting unsustainable trade. In light of the liberalizing and trade-restricting character of environmental provisions, we expect the following:

H2a: Trade-restrictive environmental provisions in PTAs reduce exports in dirty goods (in developing countries).

H2b: Liberal environmental provisions in PTAs promote exports in environmental goods (in developing countries).

3. Data and methodology

We base our analysis of the effects of environmental provisions on exports on a panel dataset of sectoral bilateral merchandise exports from 1984 to 2016 (UN Comtrade).[6] We

[6] Although it would also be interesting to analyze the effect on services trade, due to limited data availability we remain in line with the majority of studies on the trade effects of PTAs, which restrict the analysis to merchandise trade.

combine these data with information on trade agreements between the trading partners and the environmental provisions contained therein.

Information on environmental provisions in PTAs is obtained from the Trade and Environment Database (TREND). TREND, introduced by Morin et al. (2018), is the most comprehensive and fine-grained dataset of environmental provisions in PTAs. This list of PTAs is based on the Design of Trade Agreements (DESTA) dataset, which is by far the most comprehensive collection of PTAs (Dür et al., 2014). TREND identifies a variation of 286 different types of environmental provisions in 568 PTAs, which have entered into force and for which complete data are available. These PTAs include 505 agreements in which at least one partner is a developing country.[7] We use the overall number of environmental provisions included in a PTA as the main dependent variable. The number of environmental provisions should be a good proxy for the concern of partnering countries to environmental issues in the PTA, and thus also the breadth and stringency of environmental regulations in the PTA. PTAs include 14.4 environmental provisions on average (14.7 in PTAs in which developing countries are involved). However, this number varies widely, with a maximum of 120 provisions (the 2014 agreement between the EU countries and Moldova) and a median number of five provisions. More recently signed PTAs tend to include more environmental provisions (see also Figure 1).

We assess the number of environmental provisions in general and also identify those environmental provisions that are likely to restrict trade and those that are likely to liberalize trade and investigate their different effects. Table A2 in the Annex includes a list of the respective trade-restrictive (e.g. concerning specific restrictions of environmentally harmful trade) and liberal provisions (e.g. concerning the reduction of trade barriers for environmental goods) (see also the examples mentioned in Section 2). On average, each PTA includes 1.58 restrictive and 0.41 liberal environmental provisions.

Given that WTO agreements concern almost every country in the trade flow sample, they are not included in our analysis. We assume that external EC/EU treaties involve all members and the respective partner country.

We combine these data with the data on bilateral exports and obtain a sample of 476,152 exporter-importer relationships over 33 years, of which 140,457 are under a PTA. Between some trading partners, there is more than one PTA in place at a given point in time. If this is the case, we assume that the environmental provisions in the PTA that contains the most of them have a stronger effect on trade flows and that provisions in a PTA with less provisions accordingly do not have any additional effects. We thus take the maximum number of a respective type of environmental norms (overall, trade-restrictive, liberal) in place between two countries in a given year as our main independent variable. The results are robust to this choice.

As main dependent variables, we use both the shares of dirty and green goods in overall exports. To this end, we sum all sectoral flows in sectors that are either classified as dirty or green and relate them to overall exports. This is simply the sum of all sectoral exports. For the goods classifications, we build on the literature that assesses trade in so-called “dirty” goods and “green” or “environmental” goods. While the former are particularly polluting, for example steel, cement or chemicals, the latter can be defined as goods that can be used “to measure, prevent, limit, minimize or correct environmental damage” (OECD & Eurostat, 1999).

[7] The classification of developing countries is based on the country income group classification of the World Bank and includes all countries that are not listed as high-income countries.

For data on environmentally dirty sectors, we make use of Low's and Yeats' (1992) approach, which has been used in several studies. Dirty sectors are identified as those incurring the highest level of pollution abatement and control expenditures (see Annex). On average, across countries, these dirty products comprise 15 percent of all worldwide exports over our sample, and 14 percent of exports of developing countries.

For green goods, many attempts have been made to come up with lists of environmental goods that could be used in trade negotiations. An early list that is frequently used and comprises 132 items covering, issues such as wastewater treatment and air pollution control, was drawn up in the context of the Organisation for Economic Cooperation and Development (OECD) (OECD & Eurostat, 1999). Lists of green goods are not just prepared for negotiations but they are also themselves part of the negotiations. For instance, in the Doha negotiations, the members of the so-called "Friends Group" developed a list of 154 products (WTO, 2009). In plurilateral negotiations, the Asia-Pacific Economic Cooperation (APEC) countries agreed on tariff reductions for environmental goods based on a list of 54 products (APEC, 2012). These lists are generated by negotiators and thus more strongly politically determined than the OECD list, which is compiled by OECD experts. For our classification of green goods, we use a combination of the OECD and APEC lists, which are "the most commonly accepted lists" (Zugravu-Soilita, 2018). The combined list includes goods used directly in the provision of environmental services, such as waste management and air pollution control, and comprises 142 items (see Annex). These green products constitute 2.8 percent of worldwide exports and 2.3 percent of the exports from developing countries. For robustness, we also report the results using the WTO Friends' list, which are very similar.

The classification of dirty products is based on the three-digit Standard International Trade Classification (SITC) level, while the classification of green products is on the six-digit Harmonized System (HS) level. We include only those observations for which countries have reported data in both product classifications, to keep the samples of the estimations on dirty and green goods comparable.

We distinguish countries not only by their level of income, but also by their "greenness", as measured by the Yale Environmental Performance Index (EPI), which ranks countries according to their performance concerning environmental quality based on several indicators of environmental health and ecosystem vitality (Wendling et al., 2018) on a score from 0 to 100. Countries are classified as "brown" when they rank below the median of 58.8 in the EPI, and as "green" if they rank above the median.[8] Since the EPI data is not well covered over time and we use it only in order to split the sample into two groups of countries, we use the data from 2018 for the classification of countries, thereby assuming that it is a good proxy for earlier levels of environmental performance as well. There is little difference in the share of dirty or environmental exports between brown and green countries on average. Furthermore, while the EPI is positively correlated with the level of income, of all export flows from developing countries in the sample, 64 percent of them are considered to have come from a brown developing country, which means that there is variation in the classification.

With these data, we estimate a gravity equation (Baier & Bergstrand, 2007) with the number of (overall, trade-restrictive or liberal) environmental provisions as an explanatory variable for the composition of exports. Our identification strategy is to compare the change in the composition of exports between two countries induced by a PTA that includes more

[8] The results are robust to choosing another cut-off value of the EPI for the classification of brown countries, such as the median EPI score of only developing countries, which is, with a value of 54.2, also very similar to that of all countries.

environmental provisions to the change in the composition of exports between two countries induced by a PTA with less environmental provisions. To this end, in the panel data, we first control for whether there is a PTA in place between the two countries, and second also for the general depth of the PTAs in place between the countries. The information on the depth of the trade agreements is based on the DESTA depth index (Dür et al., 2014).[9] The depth of a PTA is relatively strongly correlated with the number of environmental provisions, with a correlation coefficient of 0.67. It is essential to ensure that the effect of the overall depth of an agreement is not falsely captured as the effect of the inclusion of environmental provisions. Again, we use the maximum depth of *any* PTA between a country pair to measure the depth of the PTAs between a country pair. The depth index in the sample ranges from -1.4 to 2.2, which we normalize to range from zero to 3.6.

Table A1 in the Appendix contains a list of the countries included in the sample as either exporters or importers and their classification by income (high-income and developing countries) and into brown and green countries. The summary statistics of all variables at the PTA level are listed in Table A3. Table A4 includes a list of the summary statistics for all trade flow variables.

Our main interest is how environmental provisions affect the composition of trade flows between partner countries. We exploit the trade data's panel structure by using country-pair fixed effects in order to control for unobserved heterogeneity and the time-invariant characteristics of a trading relationship, such as distance and common-border fixed effects. By using country-pair fixed effects, we can also control for many selection effects into signing PTAs and the inclusion of environmental provisions. We include exporter- and importer-year fixed effects to capture time-variant multilateral resistance and country-specific developments. Thus, our baseline regression equation is as follows:

$$SHARE_{eit} = \beta * ENVPROVS_{eit} + \gamma * PTA_{eit} + \delta * DEPTH_{eit} + \alpha_{ei} + \alpha_{et} + \alpha_{it} + \varepsilon_{eit} \quad (1)$$

where e is the index for the exporter, i for the importer and t for the respective year. α_{ei} , α_{et} and α_{it} are the country-pair and exporter- and importer-year fixed effects, respectively, and ε_{eit} is an error term. *SHARE* is the share of dirty (*DIRTSHARE*) and environmental (*GREENSHARE*) products in overall exports. The shares of dirty and environmental goods in overall trade take on values between 0 and 1, so that the coefficients can be interpreted as changes in percentage points. The coefficient of interest is β, where *ENVPROVS* can be either the absolute number of environmental provisions, or the number of restrictive or liberal provisions, respectively. When including liberal and restrictive provisions, we include them jointly, along with the number of absolute provisions, because the respective numbers of provisions are positively correlated (see a discussion of the potential challenge of multicollinearity below). In all estimations, standard errors are clustered at the country-pair level in order to account for the possibility that country pairs are subject to idiosyncratic, correlated shocks.

The fixed effects approach exploits the dyadic panel structure of the data and allows us to control for many sources of endogeneity: Firstly, the country-pair fixed effects capture all time-invariant country-pair specific variables that may lead to countries signing a PTA and including more or less environmental provisions, such as distance and a common border or culture, and thus also the general (average) level of trade between the countries. Secondly, the exporter- and importer-year fixed effects capture all time-variant country-specific

[9] The DESTA depth index does not include information about environmental provisions in PTAs.

variables that may be correlated with both environmental provisions and trade levels, such as exporters' and importers' GDP. A potential source of endogeneity that this approach cannot control for is that (political actors in) a particular country know(s) that trade levels and compositions with another country (imports or exports) will change in the future and therefore include(s) more or less environmental provisions in the respective PTA. This problem is, however, common to the literature on the trade effects of PTAs, and the multiple fixed effects approach on panel data taken in this article is arguably the best one that can be pursued using observational data. In addition, we furthermore conduct some robustness checks with regard to the control variables, the inclusion of fixed effects, and the estimation method (see Section 5).

4. Empirical analysis and findings

The hypotheses to be tested formulated above refer to the share of dirty and green goods in overall exports. In order to be able to interpret these findings, it is helpful to understand how the levels of overall exports between partner countries are affected by the inclusion of environmental provisions in PTAs. We therefore estimate whether environmental provisions affect the overall level of exports between the partner countries of the PTAs they are included in by estimating Equation (1) with the log of exports (*EXPORTS*) as dependent variable. Since the inclusion of environmental provisions often follows protectionist interests (Lechner, 2016), particularly in relation to developing countries, if anything, we would expect to find a negative coefficient, indicating that the inclusion of environmental norms mitigates the trade-creating effect of PTAs (the number of environmental provisions never changes over time for a certain PTA).

The results of the estimation with overall exports as dependent variable are reported in Table 1. In all tables presenting the estimations results, we always first depict the results for all countries for comparison, and then on the sample of developing country exporters explicitly. The shares of trade flow observations in each sample in which exporter and importer had an active PTA, and the average numbers of the respective environmental provisions in each, are reported in the results tables. Complete regression results for the whole sample, including developed country exporters, are presented in the Appendix.

Table 1: The effect of environmental provisions on the level of exports

	(1)	(2)	(3)
	All countries	Developing country exporters	Developing country exporters
	EXPORTS	EXPORTS	EXPORTS
ENVPROVS	-0.000	-0.000	-0.001
	(0.001)	(0.001)	(0.001)
RESTRICTIVE			0.008
			(0.009)
LIBERAL			-0.007
			(0.032)
PTA	0.181***	0.148***	0.148***
	(0.041)	(0.052)	(0.052)
DEPTH	-0.044**	-0.051**	-0.048*
	(0.019)	(0.025)	(0.027)
Constant	14.263***	13.696***	13.698***
	(0.009)	(0.012)	(0.012)

Exporter-Importer Fixed Effects	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes
Observations	476,152	348,844	348,844
Share of Exports under PTA	0.29	0.3	0.3
Average ENVPROVS for exports under PTA	27.6	24.5	24.5
Average RESTRICTIVE for exports under PTA			0.78
Average LIBERAL for exports under PTA			0.84
R^2	0.884	0.861	0.861

This table shows the results from running a panel regression of the log of bilateral exports (*EXPORTS*) between 1984 and 2016 on whether a *PTA* was signed and overall environmental provisions (*ENVPROVS*, Columns 1-3) and trade-restrictive (*RESTRICTIVE*) and trade-liberalizing provisions (*LIBERAL*, both Column 3) included in the PTA. Column 1 reports the results for the entire sample of directed bilateral trade flows, Columns 2-3 report the result on only the sample of developing country exporters. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.

The results indicate that, contrary to common expectation, including environmental provisions in trade agreements does not reduce the level (or PTA-induced-increase) of trade significantly. This finding does not only hold for all countries in our sample, as shown in Column 1 in Table 1, but also for developing country exporters, as shown in Column 2. In neither case do we find a significant effect of the amount of environmental provisions on exports. This result indicates that the overall trade enhancing effect of PTAs is not necessarily undermined by the inclusion of environmental provisions.

Column 3 of Table 1 shows the results for the inclusion of trade-restrictive and liberal provisions in PTAs on overall trade. Neither of them has a statistically nor economically significant effect on overall trade flows (of all countries and of developing countries). As the level of trade is positively affected by the conclusion of a PTA, which is in line with previous results in the literature, we can conclude that signing a PTA with environmental provisions increases exports as much as one with no environmental provisions.[10,] The estimations including trade-restrictive and liberal environmental provisions for the entire sample can be found in Table A5 of the Appendix, and generally reveal the same results as for developing country exporters. [11]

Given that overall levels of exports, even from developing countries, do not seem to be affected by environmental norms in PTAs, we now analyze whether they affect the composition of these trade flows. In particular, we empirically assess whether they promote trade in green goods and restrict trade in dirty goods. To test Hypothesis 1a, we estimate whether environmental provisions reduce the export of environmentally harmful products.

[10] The number of environmental provisions never changes for a given PTA. Therefore, the overall effect of the provisions can only be compared between, but not within PTAs. This also implies that the effect of environmental provisions can be assumed to become effective at the same time the PTA does.

[11] Our estimations also reveal a negative effect of the depth of a PTA on the overall level of trade flows, which runs contrary to previous findings in Dür et al. (2014). This surprising side result does not stem from the correlation with environmental provisions, but rather from the extension of the sample by the period of 2010 to 2016. If we analyze the same time frame as Dür et al. (2014) in their study (with or without including environmental provisions in the estimation), we find the same results. This turnaround of the effect of a PTA's depth is interesting and deserves further investigation but is beyond the scope of this paper.

Table 2 shows the results of estimating Equation (1) with the share of dirty goods in overall exports as a dependent variable.

Table 2: The effect of environmental provisions on the share of dirty goods in overall exports

	(1)	(2)	(3)
	All countries	Developing country exporters	Developing country exporters
	DIRTSHARE	DIRTSHARE	DIRTSHARE
ENVPROVS	-0.037***	-0.049***	-0.026*
	(0.011)	(0.015)	(0.016)
RESTRICTIVE			-0.403***
			(0.135)
LIBERAL			0.538
			(0.496)
PTA	0.278	0.830	0.877
	(0.567)	(0.700)	(0.699)
DEPTH	0.559**	0.588	0.366
	(0.279)	(0.371)	(0.381)
Constant	15.545***	14.824***	14.769***
	(0.114)	(0.154)	(0.152)
Exporter-Importer Fixed Effects	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes
Observations	476,152	348,844	348,844
Share of export flows under PTA	0.29	0.3	0.3
Average ENVPROVS for exports under PTA	27.6	24.5	24.5
Average RESTRICTIVE for exports under PTA			0.78
Average LIBERAL for exports under PTA			0.84
R^2	0.452	0.454	0.454

This table shows the results from running a panel regression of the share of dirty products in overall merchandise exports (*DIRTSHARE*) between 1984 and 2016 on whether a *PTA* was signed and overall environmental provisions (*ENVPROVS*, Columns 1-3) and trade-restrictive (*RESTRICTIVE*) and trade-liberalizing provisions (*LIBERAL*, both Column 3) included in the PTA. Column 1 reports the results for the entire sample of directed bilateral trade flows, Columns 2-3 report the result on only the sample of developing country exporters. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.

The results show that environmental provisions indeed restrict exports of dirty goods for all countries (Column 1). This effect is even stronger in the case of developing countries (Column 2). The effect on developing country exports is also economically significant: the share of exports of dirty products from a developing country that take place under a PTA with the average number of environmental provisions is lower by 0.72 percentage points (than the average share of dirty exports of 14 percent in developing countries), which amounts to an average decrease of approximately 5 percent.

In line with Hypothesis 2a, we also find that trade-restrictive provisions significantly reduce the share of dirty goods in exports (Column 3). One restrictive provision alone reduces the overall share of dirty products by 0.4 percentage points. The results indicate that

including environmental provisions in PTAs can be a promising approach to change the composition of trade flows in terms of making them greener. The inclusion of restrictive environmental provisions has a particularly strong effect by significantly reducing dirty goods relative to overall trade.

These results are also interesting in light of the pollution haven hypothesis (Copeland & Taylor, 1994). We do not find evidence supporting the argument that liberalizing trade, as a result of the conclusion of a PTA, leads to an increase in exports of dirty products of developing countries. The estimated effect of PTAs on exports of dirty products is positive, but not significant. At the same time, the findings suggest that the inclusion of environmental provisions (Hypothesis 1a), and particularly restrictive ones (Hypothesis 2a) in PTAs can be a successful strategy to counter pollution haven effects in developing countries.

However, environmental provisions are not only aimed at reducing dirty trade, but they are also intended to encourage environmentally beneficial trade. To test Hypothesis 1b, we analyze whether including environmental provisions in PTAs also increases the share of exports in green goods. We, therefore estimate Equation (1) with the share of green goods as a dependent variable. Table 3 depicts the results.

Table 3: The effect of environmental provisions on the share of green goods in overall exports

	(1)	(2)	(3)
	All countries	Developing country exporters	Developing country exporters
	GREENSHARE	GREENSHARE	GREENSHARE
ENVPROVS	-0.000	0.000	0.002
	(0.004)	(0.006)	(0.006)
RESTRICTIVE			-0.114*
			(0.060)
LIBERAL			0.411**
			(0.184)
PTA	0.032	0.112	0.156
	(0.176)	(0.205)	(0.204)
DEPTH	-0.007	-0.059	-0.143
	(0.092)	(0.112)	(0.111)
Constant	2.820***	2.346***	2.343***
	(0.040)	(0.050)	(0.050)
Exporter-Importer Fixed Effects	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes
Observations	476,152	348,844	348,844
Share of export flows under PTA	0.29	0.3	0.3
Average ENVPROVS for exports under PTA	27.6	24.5	24.5
Average RESTRICTIVE for exports under PTA			0.78
Average LIBERAL for exports under PTA			0.84
R^2	0.225	0.213	0.213

This table shows the results from running a panel regression of the share of environmental products in overall merchandise exports (*GREENSHARE*) between 1984 and 2016 on whether a *PTA* was signed and overall environmental provisions (*ENVPROVS*, Columns 1-3) and trade-restrictive (*RESTRICTIVE*) and trade-liberalizing provisions (*LIBERAL*, both Column 3) included in the PTA. Column 1 reports the results for the entire sample of directed bilateral trade flows, Columns 2-3 report the result on only the sample of developing country exporters. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.

Columns 1 and 2 in Table 3 show that the overall number of environmental provisions, in contrast to Hypothesis 1b, does not affect the share of green goods in exports, neither in general, nor for developing countries. However, in line with Hypothesis 2b, explicitly liberal environmental provisions boost the share of green goods in overall exports in developing countries (Column 3).[12] One liberal provision increases the share of green goods by 0.4 percentage points, which equates to an average increase of 17 percent. Restrictive provisions, in contrast, tend to decrease the share of green goods, which suggests that intended trade-limiting effects pertaining to environmentally harmful trade flows spill over to green sectors as well. The growing share of green exports is in accordance with the strong Porter hypothesis, according to which stricter environmental regulations increase firms' competitiveness in regulated sectors.

The effect of environmental provisions on the export structure might, however, depend on the initial conditions in the exporting country. A developing country that already has greener regulatory frameworks might find it easier to comply with environmental provisions in PTAs and adapt its production structure and export composition. Moreover, innovations – triggered, for example, by strict environmental regulations – are typically cumulative and characterized by path-dependency because of the network and bandwagon effects they entail (Pegels & Altenburg, 2019). Regulations and other initial triggers of innovation and specialization thus tend to shape successive innovations and patterns of specialization (Dosi, 1988). Furthermore, as socio-technical development is path-dependent, the early mover advantage posited by the strong Porter hypothesis is strengthened by the fact that it helps to avoid costly lock-ins in terms of a "non-green" specialization and the production processes and infrastructure its involves (Pegels & Altenburg, 2019). When a "non-green" socio-technical development path has become stable, it is economically and politically very costly to leave this path because the costs of swapping paths rise due to the lock-in of investments and challenges concerning institutional and behavioural change (Unruh & Carrillo-Hermosilla, 2006). If, in contrast, a "green" path has been embarked upon, switching costs are much less relevant. In light of path dependency, green specialization thus increases the likelihood of further green specialization (Aghion et al., 2016; Mealy & Teytelboym, 2019).

We therefore also investigate whether the effects of environmental provisions on trade flows of developing countries might depend on their initial level of "greenness," i.e. their prior environmental performance. We expect firms in countries that have already embarked on the path towards a green transformation to more easily adapt to new environmental provisions in trade agreements and to more swiftly and substantially modify their production and export composition to the respective partner countries. We thus also expect the effects of environmental provisions to be stronger in "green" countries with better environmental performance than in other countries that do not perform well concerning environmental quality indicators. Accordingly, we expect liberal environmental provisions to increase green exports in these countries more strongly than they do in other countries.

[12] The results for the sample of all exporters, also including developed countries, on the effects of restrictive and liberal provisions are presented in Table A5 in the Appendix. The differences among them is driven by exports of developed countries. The result that liberal provisions increase the share of green goods is also present for high-income country exporters.

We also expect restrictive provisions to reduce dirty exports more strongly in green rather than in other countries.

To test this, we estimate the above regressions with the absolute number of environmental provisions and the number of trade-restrictive and liberal provisions for brown and green developing country exporters separately. To do so, we interact a dummy for whether, according to the EPI, an exporting-developing country is brown or green with the respective number of provisions in a PTA as explanatory variables in the estimation of Equation (1) with overall exports, and the shares of dirty and environmental products, as dependent variables, respectively. The coefficients reported thus show the effect of (absolute, restrictive, and liberal) environmental provisions on overall, dirty, and green exports for either group separately. The results are shown in Table 4.

Table 4: The effect of environmental provisions by "greenness" of the exporting country

	(1)	(2)	(3)
	Developing country exporters	Developing country exporters	Developing country exporters
	EXPORTS	DIRTSHARE	GREENSHARE
ENVPROVS			
--- Green exporters	-0.001	-0.050**	0.001
	(0.002)	(0.021)	(0.008)
--- Brown exporters	-0.002	-0.006	-0.001
	(0.002)	(0.017)	(0.007)
RESTRICTIVE			
--- Green exporters	0.001	-0.300**	-0.123*
	(0.010)	(0.143)	(0.069)
--- Brown exporters	0.079**	-0.702	-0.015
	(0.031)	(0.491)	(0.088)
LIBERAL			
--- Green exporters	-0.014	0.570	0.470**
	(0.034)	(0.532)	(0.209)
--- Brown exporters	0.062	0.933	0.177
	(0.092)	(1.296)	(0.200)
PTA	0.145***	0.795	0.232
	(0.052)	(0.731)	(0.209)
Depth	-0.047*	0.429	-0.173
	(0.027)	(0.395)	(0.113)
Constant	13.766***	14.875***	2.318***
	(0.013)	(0.167)	(0.051)
Exporter-Importer Fixed Effects	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes
Observations	333,507	333,507	333,507
Share of Exports under PTA	0.29	0.29	0.29
Average ENVPROVS for exports under PTA	23.4	23.4	23.4
Average RESTRICTIVE for exports under PTA	0.75	0.75	0.75

Average LIBERAL for exports under PTA	0.76	0.76	0.76
R^2	0.863	0.460	0.215

This table shows the results from running a panel regression of the log of bilateral exports (*EXPORTS*, Column 1), the share of dirty products in overall merchandise exports (*DIRTSHARE*, Column 2), and the share of environmental products in overall merchandise exports (*GREENSHARE*) between 1984 and 2016 on whether a PTA was signed and overall environmental provisions (*ENVPROVS*), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions (*LIBERAL*) included in the PTA by whether the developing country exporter is classified as green or brown. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.

Column 1 of Table 4 shows that overall exports are not affected for brown or green exporters by the inclusion of either type of environmental provision in a PTA with the importing country.[13] However, when looking at the share of green and dirty products in overall exports, as expected, the results indicate that the effects of environmental provisions on the composition of exports found above only hold for green exporters. Column 2 shows that the inclusion of environmental provisions, particularly restrictive ones, leads to a reduction in the share of dirty goods in the exports of relatively green developing countries. The results in Column 3 show that the absolute number of environmental provisions has no significant effect on the share of environmental goods in the exports of developing countries. Liberal provisions increase the share of environmental goods in overall exports only in green developing countries, while restrictive environmental provisions reduce the share of environmental goods. In sum, only developing countries that already have an environmentally healthier economy can actually green their exports in response to environmental provisions in trade agreements.[14]

Overall, our empirical findings show that PTAs that include environmental provisions are a promising way to foster trade, while at the same time greening the resulting trade flows into partner countries of developing economies. For developing countries, they can be a way to reap benefits of trade and at the same time foster their own structural transformation towards a more sustainable economy.

5. Robustness checks

In order to make sure that our main results do not critically depend on the specific model that we use, we conduct several robustness tests.[15] We conduct one robustness test at a time. First, we analyze to what extent the results depend on our use of fixed effects, which can offer insights into the usefulness of our preferred estimation strategy. Tables A6a (overall provisions) and A6b (including trade- restrictive and liberal provisions) show the results with different combinations of fixed effects for the sample of developing country exporters (the results are similar for the entire sample). Columns 1, 4, and 7 show the

[13] At the same time, there is a surprising positive effect of restrictive provisions for exports of brown countries.
[14] As the level of the EPI is only elicited at one point in time (2018), it could of course be argued that this result is driven by reverse causality in that those countries that managed to shift to greener exports in response to environmental provisions in their PTAs also then obtained higher scores on the EPI scale. As we use a binary variable for the classification into brown and green countries, it is unlikely that the result stems from those developing countries that shifted from brown to green countries because of some PTAs that they signed. Also, the EPI measures rather persistent country characteristics.
[15] Whenever possible, we report the results for the entire sample and for the sample of developing countries. If, due to limited space, we have to restrict ourselves, we report the results for the sample of developing country exporters only. In these cases, there are no large differences compared to the entire sample. These estimation results are available from the authors upon request. Moreover, in Section 5, also for reasons of space, we do not continue to report the shares of trade flows under a PTA and the respective average numbers of overall, trade-restrictive, and liberal environmental provisions in them, since the sample compositions stay either completely or largely identical to the above sections.

estimations on the pooled sample without any fixed effects, for the overall level of trade, and the shares of dirty and green goods, respectively. While there seems to be a negative effect of provisions on overall trade levels in the absence of fixed effects, even without the use of any fixed effects, the results indicate that (particularly restrictive) environmental provisions are associated with relatively less exports of dirty goods. Moreover, liberal provisions are associated with more exports of green goods. Including country-pair fixed effects (Columns 2, 5, and 8) does not substantially change this picture; although this specification ascribes the negative effect on dirty exports to the nature of –trade-restrictive and liberal provisions. Columns 3, 6, and 9 then show the results of our preferred specification for comparison. We see that including exporter- and importer-year fixed effects, and thus absorbing country-specific developments over time, is important in order to disentangle the idiosyncratic effects of environmental provisions and exports from the effects of omitted variables but that the general relationships can also be seen in the pooled data. However, our main findings are even robust to this choice.

Second, the potential correlation between PTA characteristics, such as that between the depth of a PTA and the number of environmental provisions it includes, may give rise to concerns of multicollinearity in our estimations. Table A7 therefore reports the Variance Inflation Factors (VIFs) of the estimation of Equation (1), including trade-restrictive and liberal provisions (VIFs are not affected by the choice of the dependent variable). None of the explanatory variables exhibits a variance inflation factor higher than 10, such that we can well assume no problems of multicollinearity in the estimations presented above.

Third, the analyses presented above shows how environmental provisions in a certain year are related to export structures in the same year. Since all PTAs (and consequently the environmental provisions they include) are only switching from non-existence to existence once over the sample period, the choice of the exact timing of assumed effectiveness is not likely to influence the findings, which basically compare the period before the PTA with the period after the PTA in force. At the same time, it is interesting to explore whether there might be phase-in effects due to environmental provisions potentially starting to exert influence only after a short period of coming into existence. We therefore lag our independent variables by 1, 2, and 3 years respectively. The results are depicted in Columns 1-3 of Tables A8a, b and c, respectively, for overall exports and the shares of dirty and green exports. There is no significant phase-in effect observable which confirms that simply using concurrent variables provides unbiased results, while keeping the sample as large as possible. Furthermore, in Columns 4 of Table A8a, b, and c, we include the lead variables. If they were significant, this could either point to the presence of anticipatory effects or to endogeneity problems. However, none of the lead variables in the estimations for the share of dirty or green goods are significant. Only for the overall level of trade, the results suggest that there might be an increase in exports before the PTA with environmental provisions enters into force. This does not affect our main findings at the sectoral level, however.

Fourth, we investigate the question of enforcement of environmental provisions in PTAs and whether and how it affects our findings. It is well conceivable that those environmental provisions for which there is no dispute settlement mechanism for enforcement might have a weaker effect on the composition of trade flows than those that do. We therefore classify PTAs according to whether or not they have in place a specific dispute settlement mechanism for environmental provisions or a general one that applies to environmental provisions. Roughly 18 percent of all country pairs under a PTA have included such an enforcement mechanism. We then interact the number of provisions in place with the dummy for the presence of an enforcement mechanism and include this interaction term in the estimation. The results are depicted in Table A9. They show that such a mechanism is not decisive for our empirical findings. Most importantly, all our main results

also hold for those provisions for which there is no dispute settlement mechanism in place.[16] Fifth, there are 4,363 cases in the data in which two countries that had already been members of the same PTA ratified another PTA (often including other countries). In 1,812 of these cases, the maximum number of environmental provisions in force between such country pairs increased in that instance (i.e. the new PTA contained more environmental provisions than the an existing one). To make sure that it is not the additional PTA per se which affects the composition of exports rather than its environment-related content, we replace the binary indicator that controls for a PTA in force by the number of PTAs in force between the exporter and the importer for robustness. The results are shown in Table A10 in the Appendix and demonstrate that our results are not driven by a potential correlation of our measure of environmental provisions with the number of PTAs in place.

Sixth, we also run all equations through Poisson Pseudo Maximum Likelihood (PPML) estimation (Santos Silva & Tenreyro, 2010), as is common practice in the literature on trade effects of PTAs. The results, depicted in Table A11 in the Appendix, are the same as the ones shown above. We opted for reporting the results of the linear estimation in Section 4 because this allows for a more straightforward interpretation, particularly of the interaction terms. Moreover, the main benefits of PPML, i.e. being able to deal with zeros (because no log-normalization of the dependent variable is necessary) and with heteroscedasticity, are not very relevant for our analysis given that our main explanatory variables range from zero to one and that our heteroscedasticity robust standard errors are clustered at the country-pair level. Furthermore, PPML has started being under some discussion in the literature recently (see Pfaffermayr, 2019). However, the results remain the same when using this approach.

Seventh, in order to be able to compare our results across different methods, we also run an additional regression that refrains from using any fixed effects. Instead, we now use the country-pair and country-year variables that are typically used to explain trade levels between countries, i.e. exporter- and importer-GDP, distance, contiguity, common historical ties and common language (Mayer & Zignago, 2011) as control variables. The results are depicted in Table A12 in the Appendix. Even under this completely different, and arguably less precise way of estimation, the general thrust of the results remains the same as the one that we presented above.

Eighth, there are alternative ways to control for selection into PTAs and environmental provisions that differ from the fixed effects approach that we pursue. At the same time, all of these approaches have to rely on country-pair or country-year variables as well in order to predict selection. We run two two-stage models to test for the robustness of our results. First, we predict selection into including environmental provisions in PTAs by running a regression of these on the gravity variables named above, plus the population (time-variant), and the EPI (time-invariant) of the exporter and importer. The fit of this model should be the expected number of environmental provisions that a country-pair will include in the PTA they conclude, given its characteristics. The residuals from this regression should thus be the unexpected, or "surprise", provisions between two countries. If one were to see these as exogenous, we can use these surprise provisions (the residuals from the first stage) as independent variables in the second stage. Table A13 reports the results of the second stage of this estimation. To account for the fact that the independent variables are themselves estimated, standard errors are bootstrapped in the second stage. The results of this two-stage estimation, controlling for selection on observables into including

[16] This finding is in line with research on environmental provisions in PTAs which shows that not only hard enforcement approaches, such as dispute settlement mechanisms, but also softer approaches, for example building on political dialogues, can be effective (Bastiaens & Postnikov, 2017).

environmental provisions, are the same as the ones reported in our main estimations. This procedure has the drawback that those country pairs that have not concluded a PTA (but would have potentially included environmental provisions, had they done so) also contribute to the prediction of environmental provisions included in PTAs but enter with a zero. To address this shortcoming, in an additional step, we estimate a Heckman (1976, 1979) – selection model. The relevant treatment (that country pairs select into) is whether they have entered a PTA. For the exclusion restrictions (i.e. explanatory variables for selection into a PTA), we use again the country-pair and country-year specific gravity variables mentioned before. The second stage then controls for the depth of the PTAs. It should be noted that using the gravity explanatory variables for selection does not generate perfect exclusion restrictions, i.e. variables that are correlated with selection into a PTA but not with the outcome variables, because most are correlated with the outcome variables of the share of dirty and green goods, although only weakly so. Not having a valid exclusion restriction makes the estimation less robust. The fixed effects are included by taking as outcome variables the estimated residuals of the regression of the dependent variables of interest on the fixed effects. The results of the second stage are reported in Table A14. Although the results on restrictive and liberal provisions are not significant in this estimation, all results point in the same direction as our main findings.

Lastly, we would also like to test how robust the results are to different definitions of the classification of dirty and green sectors. Unfortunately, there is no other definition of dirty sectors common in the literature, that can be connected to the UN COMTRADE data. The classification based on Low and Yeats (1992) that we base our analysis on is thus used by almost all studies on trade and the environment. For the definition of green sectors, however, there is also the WTO Friends' list available, which consists of a comparable amount of sectors as the combined OECD and APEC list, but with a different composition of goods included. To conduct our robustness check, we thus use this WTO classification to compute the share of green exports to be used as dependent variable in the estimation of Equation (1). The results are shown in Table A15 in the Appendix. Columns 1 and 2 depict the results for the entire sample, Columns 3 and 4 show the findings for developing country exporters. While the findings based on this rather politically determined list (see discussion above) suggest that it is overall environmental provisions, rather than explicitly liberalizing ones, that increase the share of products listed in it, the overall results also remain the same in the context of this robustness check.

6. Conclusion

The effects of environmental provisions in trade agreements on trade flows have to date not been assessed at the sectoral level even though environmental content in PTAs has become more relevant than ever. While developing countries are concerned that high-income countries use environmental provisions in PTAs to promote "green protectionism", we find that environmental provisions do not substantially limit the exports of developing countries. Accordingly, there does not seem to be a general trade-off between the environmental and the economic implications of including environmental provisions in PTAs.

Moreover, we find that environmental provisions can help to decrease dirty exports and promote green exports from developing countries. This, in turn, increases the options to create win-win scenarios for developing countries and leverage synergies between economic and environmental benefits by signing PTAs with environmental provisions.

Our findings are relevant for academic research on the relationship between international economic integration and environmental policy. Our empirical results lend support to the Porter hypothesis. The increasing share of green goods in developing

countries' exports is in line with the strong Porter hypothesis, which posits that more stringent environmental regulation enhances the competitiveness of green sectors and promotes green exports. At the same time, our evidence indicates that environmental provisions in PTAs, and the higher environmental standards and regulations they induce, can be effective policy tools to counter potential pollution haven effects.

From a policy perspective, our empirical evidence also suggests that the design of PTAs is important. We find that PTA provisions can be used as targeted policy tools: while restrictive environmental provisions reduce dirty exports, liberal environmental provisions facilitate exports of green goods. To date, only a few meaningful commitments to liberalize trade in environmental goods and services are included in PTAs. These win-win opportunities should be exploited more by decision-makers.

At the same time, we find that the effect of environmental provisions is only visible for exporters from developing countries that have a strong environmental performance. These "green" developing countries seem to be better positioned to green their exports in response to environmental provisions in trade agreements than other developing countries. This, in turn, offers support to those that call for adopting green policies straight away ("greening now") rather than a "grow first, cleaning up later" strategy for latecomer economies (Pegels & Altenburg, 2019). Environmental provisions in PTAs can, therefore, complement environmental reforms at the country level but they cannot be a substitute for them.

Future research could shed light on the effects of environmental provisions at the firm level. Moreover, in light of the importance of global value chains (GVCs) for development countries, future research could focus on analyzing the effects of environmental provisions on upgrading in GVCs. Recent empirical evidence suggests that environmental standards, which can by promoted by environmental provisions in PTAs, are indeed a key factor for GVC upgrading (Kummritz et al., 2017; Taglioni & Winkler, 2016) but whether environmental provisions can contribute to this upgrading has not been assessed and merits further attention.

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Appendix

Table A1: List of Countries included in the sample

High Income Countries

Andorra'	French Polynesia'	New Caledonia'
Argentina*	Germany*	New Zealand*
Aruba'	Greece*	Norway*
Australia*	Greenland'	Portugal*
Austria*	Guam'	Qatar*
Bahamas	Hong Kong'	San Marino'
Barbados	Iceland*	Singapore*
Bermuda'	Ireland*	Slovenia*
Brunei*	Israel*	Spain*
Canada*	Italy*	Sweden*
Cayman Islands'	Japan*	Switzerland*
Cyprus*	Kuwait*	United Arab Emirates*
Denmark*	Luxembourg*	United Kingdom*
Faeroe Islands'	Macao'	USA*
Finland*	Malta*	
France*	Netherlands*	

Non- High Income Countries

Afghanistan	Georgia	Paraguay
Albania*	Ghana	Peru*
Algeria	Grenada	Philippines
American Samoa'	Guatemala	Poland*
Angola	Guinea	Republic of Congo
Antigua and Barbuda*	Guinea-Bissau	Republic of Moldova
Armenia*	Guyana	Romania*
Azerbaijan*	Haiti	Russian Federation*
Bahrain	Honduras	Rwanda
Bangladesh	Hungary*	Saint Kitts and Nevis'
Belarus*	India	Saint Lucia
Belgium*	Indonesia	Saint Vincent and the Grenadines*
Belize	Iran	Samoa
Benin	Iraq	São Tomé and Príncipe'
Bhutan	Jamaica*	Saudi Arabia
Bolivia	Jordan*	Senegal
Bosnia Herzegovina	Kazakhstan	Serbia'
Botswana	Kenya	Serbia and Montenegro'
Brazil*	Kyrgyzstan	Seychelles*
Bulgaria*	Latvia*	Sierra Leone

Burkina Faso	Lebanon*	Slovakia*
Burundi	Lesotho	Solomon Islands
Cabo Verde	Liberia	Somalia'
Cambodia	Libya	South Africa
Cameroon	Lithuania*	South Korea'
Central African Republic	Madagascar	Sri Lanka*
Chad	Malawi	Sudan
Chile	Malaysia*	Suriname
China	Maldives	Swaziland
Colombia*	Mali	Syria'
Comoros	Marshall Islands'	Tajikistan
Costa Rica*	Mauritania	Tanzania
Côte d'Ivoire	Mauritius	Thailand
Croatia*	Mayotte'	Togo
Cuba*	Mexico*	Tonga*
Czech Republic	Mongolia	Trinidad and Tobago*
Democratic Republic of the Congo'	Morocco*	Tunisia*
Djibouti	Mozambique	Turkey
Dominica*	Myanmar	Turkmenistan*
Dominican Republic*	Namibia	Uganda
Ecuador	Nepal	Ukraine
Egypt*	Nicaragua	Uruguay*
El Salvador	Niger	Uzbekistan
Equatorial Guinea*	Nigeria	Vanuatu
Eritrea	North Korea'	Venezuela*
Estonia*	North Macedonia'	Viet Nam
Ethiopia	Oman	Yemen'
Fiji	Pakistan	Zambia
Gabon	Palau'	Zimbabwe
Gambia	Panama*	

This Table lists all countries that are included in the sample as exporting countries by their classification as High-Income or non-High-Income countries according to the World Bank classification in the year 2000, which is in the middle of the time span covered by the sample. "*" marks countries that are considered "green", according to whether they are above the median of all countries in the sample of the Environmental Performance Index (EPI, Wendling et al., 2018). " ' " marks countries for which there is no EPI information is available.

Table A2: List of Restrictive and Liberal Environmental Provisions

(Details are available in the codebook: http://www.chaire-epi.ulaval.ca/en/trend)

Restrictive environmental provisions

Specific trade restrictions

- Prohibit the export if import is prohibited
- Prohibit the import if export is prohibited
- Restrictions on trade in hazardous waste
- Illegal trade of endangered species
- Exclusion of water from the trade agreement

High level of protection

- Laws and regulations should provide for high levels of protection

Commitment to enhance levels of environmental protection

Precaution principle

Precaution principle

Not environmentally harmful

Trade measures should not be environmentally harmful
Harmonization not to be used to lower environmental protection
Environmental consideration in legal dispute
Environmental experts as panelists for state-state dispute
Environmental experts as panelists in investor-state dispute
Environmental report in state-state dispute
Environmental report in investor-state dispute
Panel shall consult or defer to relevant entity
Consent to use the DSM of a MEA

Assessment

Requirement to conduct environmental assessment
Environmental impact assessment of the agreement

Genetic resources

Disclosure of the source of genetic material
Prior informed consent
Equitable sharing of benefits arising from use of genetic resources

Coherence with economic sector

Interaction between tourism and the environment
Interaction between rural development and the environment
Interaction between urban development and the environment
Interaction between land-use planning and the environment
Interaction between construction activities and the environment
Interaction between agriculture and the environment
Interaction between industrial activities and the environment
Interaction between transport and the environment
Interaction between energy policies and the environment
Interaction between mining and the environment

Combat illegal exploitation

Combat illegal fishing
Combat illegal forest exploitation

Ratification and implementation of trade-related MEA

Ratification of CITES
Ratification of Montreal Protocol
Ratification of Basel Convention
Ratification of Rotterdam
Ratification of Stockholm
Ratification of Kyoto
Ratification of CBD
Ratification of Cartagena
Ratification of Nagoya
Implementation of CITES
Implementation of Montreal
Implementation of Basel
Implementation of Rotterdam
Implementation of Stockholm
Implementation of Kyoto
Implementation of CBD
Implementation of Cartagena
Implementation of Nagoya

Prevalence of trade-related MEA

Prevalence CITES
Prevalence Montreal Protocol

Prevalence Basel Convention
Prevalence Rotterdam Convention
Prevalence Stockholm Convention
Prevalence Kyoto
Prevalence CBD
Prevalence Cartagena
Prevalence Nagoya

Liberal environmental provisions

Environmental goods and services
Encourage production of environmental goods and services
Encourage trade or investment in goods and services
Encouragement for specific goods and services

Harmonization of domestic environmental measures
Harmonization of environmental measures
Alignment of a Party's legislation to the other Party's
Avoid exceptional national environmental standards
Mutual recognition

Promotion of international standards
International standards are presumed to be in conformity
International standards should be used
Party should use IOs' methods of risk assessment

Prevalence of trade
Prevalence of trade agreement in case of inconsistency
Exclusion of multilateral environmental agreements' DSM

Not for protectionist purposes
Environmental measures should not be adopted for protectionist purposes

Promotion of voluntary measures
Promotion of unspecified voluntary measures
Promotion of specific voluntary measures

Use of market instruments
Unspecified economic or market instruments
Specific economic or market instruments

Scientific basis
Scientific knowledge when designing environmental measures
Scientific knowledge when making risk assessment

Table A3: Summary Statistics PTAs

All PTAs

Variable	Obs	Mean	Std. Dev.	Min	Max
ENVPROVS	567	14.44444	21.61901	0	120
RESTRICTIVE	567	1.583774	3.481341	0	21
LIBERAL	567	0.4091711	0.9813385	0	6
DEPTH	567	1.582936	1.02003	0	3.687593

PTAs that include Developing Countries

Variable	Obs	Mean	Std. Dev.	Min	Max
ENVPROVS	505	14.73267	21.97604	0	120
RESTRICTIVE	505	1.653465	3.578029	0	21
LIBERAL	505	0.4178218	0.992871	0	6
DEPTH	505	1.585889	1.023272	0	3.687593

Table A4: Summary Statistics Trade Flow Observations

All Country Pairs

Variable	Obs	Mean	Std. Dev.	Min	Max
EXPORTS	476,152	14.29924	4.236119	0	26.9459
DIRTSHARE	476,152	15.5249	25.51327	0	100
GREENSHARE	476,152	2.822848	10.06015	0	100
ENVPROVS	476,152	8.424083	20.08451	0	120
RESTRICTIVE	476,152	0.6717162	2.607578	0	29
LIBERAL	476,152	0.1453086	0.6126786	0	6
PTA	476,152	0.2949835	0.4560358	0	1
#PTAs	476,152	0.6305465	1.295037	0	9
DEPTH	476,152	0.37225	0.8414226	0	3.687593
Brown Exporter	439,566	0.5010101	0.4999995	0	1

Developing Country Exporters

Variable	Obs	Mean	Std. Dev.	Min	Max
EXPORTS	348,844	13.72279	4.106227	0	26.9459
DIRTSHARE	348,844	14.88556	26.50783	0	100
GREENSHARE	348,844	2.362553	10.28965	0	100
ENVPROVS	348,844	7.238579	18.52078	0	120
RESTRICTIVE	348,844	0.2291626	1.352832	0	29
LIBERAL	348,844	0.0638968	0.3887953	0	6
PTA	348,844	0.2951434	0.4561078	0	1
#PTAs	348,844	0.5872711	1.210724	0	8
DEPTH	348,844	0.2936409	0.7509712	0	3.687593
Brown Exporter	333,507	0.6466311	0.4780167	0	1

Table A5: The Effect of Restrictive and Liberal Environmental Provisions in PTAs for all Countries, including Developed Countries

	(1)	(2)	(3)
	All Countries	All Countries	All Countries
	EXPORTS	DIRTSHARE	GREENSHARE
ENVPROVS	-0.003**	-0.021	0.002
	(0.001)	(0.013)	(0.005)
RESTRICTIVE	0.027***	-0.071	-0.050*
	(0.005)	(0.067)	(0.029)
LIBERAL	-0.021	-0.362*	0.176**
	(0.014)	(0.215)	(0.079)
PTA	0.159***	0.146	0.135
	(0.042)	(0.578)	(0.176)

DEPTH	-0.016	0.582**	-0.092
	(0.021)	(0.297)	(0.092)
Constant	14.266***	15.542***	2.811***
	(0.009)	(0.115)	(0.040)
Exporter-Importer Fixed Effects	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes
Observations	476,152	476,152	476,152
R^2	0.884	0.452	0.225

This Table shows the results from running a panel regression of the log of bilateral exports (*EXPORTS*, Column 1), the share of dirty products in overall merchandise exports (*DIRTSHARE*, Column 2), and the share of environmental products in overall merchandise exports (*GREENSHARE*, Column 3) between 1984 and 2016 on whether a *PTA* was signed and overall environmental provisions (*ENVPROVS*), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions *(LIBERAL*) included in the PTA for the sample of all exporters. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.

Table A6a: Estimations with varying Fixed Effects included – Overall Provisions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters
	EXPORTS	EXPORTS	EXPORTS	DIRTSHARE	DIRTSHARE	DIRTSHARE	GREENSHARE	GREENSHARE	GREENSHARE
ENVPROVS	-0.086***	-0.013***	-0.000	-0.212***	-0.058***	-0.049***	0.000	0.008	0.000
	(0.002)	(0.001)	(0.001)	(0.011)	(0.014)	(0.015)	(0.002)	(0.005)	(0.006)
PTA	1.288***	0.528***	0.148***	4.903***	-0.380	0.830	0.013	0.236	0.112
	(0.065)	(0.058)	(0.052)	(0.366)	(0.683)	(0.700)	(0.079)	(0.187)	(0.205)
DEPTH	2.209***	0.508***	-0.051**	2.399***	0.496	0.588	-0.035	0.170*	-0.059
	(0.049)	(0.027)	(0.025)	(0.279)	(0.354)	(0.371)	(0.062)	(0.096)	(0.112)
Exporter-Importer Fixed Effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	No	No	Yes	No	No	Yes	No	No	Yes
Observations	348,844	348,844	348,844	348,844	348,844	348,844	348,844	348,844	348,844
R^2	0.070	0.821	0.861	0.008	0.421	0.454	0.000	0.188	0.213

This Table shows the results from running a panel regression of the log of bilateral exports (*EXPORTS*, Columns 1-3), the share of dirty products in overall merchandise exports (*DIRTSHARE*, Columns 4-6), and the share of environmental products in overall merchandise exports (*GREENSHARE*, Columns 3) between 1984 and 2016 on whether a *PTA* was signed and overall environmental provisions (*ENVPROVS*) included in the PTA for the sample of developing country exporters. Columns 1, 4, and 7 include no fixed effects, Columns 2, 5, and 8 include only country-pair fixed effects, and Columns 3, 6, and 9 include all fixed effects as in the main text for comparison. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.

Table A6b: Estimations with varying Fixed Effects included – Restrictive and Liberal Provisions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters
	EXPORTS	EXPORTS	EXPORTS	DIRTSHARE	DIRTSHARE	DIRTSHARE	GREENSHARE	GREENSHARE	GREENSHARE
ENVPROVS	-0.086***	-0.019***	-0.001	-0.232***	-0.009	-0.026*	-0.002	0.006	0.002
	(0.002)	(0.001)	(0.001)	(0.011)	(0.014)	(0.016)	(0.003)	(0.005)	(0.006)
RESTRICTIVE	0.076***	0.093***	0.008	0.691***	-0.424***	-0.403***	-0.001	-0.074	-0.114*
	(0.026)	(0.009)	(0.009)	(0.134)	(0.147)	(0.135)	(0.028)	(0.060)	(0.060)
LIBERAL	-0.468***	-0.040	-0.007	-0.009	-1.213**	0.538	0.497***	0.456**	0.411**
	(0.082)	(0.034)	(0.032)	(0.465)	(0.493)	(0.496)	(0.114)	(0.181)	(0.184)
PTA	1.306***	0.531***	0.148***	4.772***	-0.554	0.877	-0.021	0.282	0.156
	(0.065)	(0.057)	(0.052)	(0.367)	(0.679)	(0.699)	(0.080)	(0.186)	(0.204)
DEPTH	2.237***	0.550***	-0.048*	2.489***	0.396	0.366	-0.054	0.110	-0.143
	(0.050)	(0.027)	(0.027)	(0.283)	(0.356)	(0.381)	(0.062)	(0.094)	(0.111)
Exporter-Importer Fixed Effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	No	No	Yes	No	No	Yes	No	No	Yes
Observations	348,844	348,844	348,844	348,844	348,844	348,844	348,844	348,844	348,844
R^2	0.071	0.821	0.861	0.009	0.422	0.454	0.000	0.188	0.213

This Table shows the results from running a panel regression of the log of bilateral exports (*EXPORTS*, Columns 1-3), the share of dirty products in overall merchandise exports (*DIRTSHARE*, Columns 4-6), and the share of environmental products in overall merchandise exports (*GREENSHARE*, Columns 3) between 1984 and 2016 on whether a *PTA* was signed and overall environmental provisions (*ENVPROVS*), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions *(LIBERAL*) included in the PTA for the sample of developing country exporters. Columns 1, 4, and 7 include no fixed effects, Columns 2, 5, and 8 include only country-pair fixed effects, and Columns 3, 6, and 9 include all fixed effects as in the main text for comparison. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.

Table A7: Variance Inflation Factors

Variable	VIF	1/VIF
ENVPROVS	4.62	0.216417
DEPTH	4.44	0.225363
RESTRICTIVE	2.93	0.341335
LIBERAL	2.82	0.355236
PTA	1.93	0.516902
Mean VIF	3.35	

This Table shows the variance inflation factors in the panel regression of Equation (1) with bilateral trade information from between 1984 and 2016 on whether a *PTA* was signed and overall environmental provisions (*ENVPROVS*), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions *(LIBERAL*) included in the PTA for the full sample.

Table A8a: Estimations with lags and lead of explanatory variables – Level of Exports

	(1)	(2)	(3)	(4)
	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters
	EXPORTS	EXPORTS	EXPORTS	EXPORTS
ENVPROVS	0.002	0.001	0.000	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)
-- L1.	-0.002	-0.003**	-0.002*	
	(0.001)	(0.001)	(0.001)	
-- L2.		0.001	0.002	
		(0.001)	(0.001)	
-- L3.			-0.001	
			(0.001)	
-- F.				0.002*
				(0.001)
RESTRICTIVE	-0.012	-0.011	-0.010	0.012
	(0.010)	(0.009)	(0.009)	(0.010)
-- L1.	0.016*	0.005	0.004	
	(0.009)	(0.009)	(0.009)	
-- L2.		0.012	-0.006	
		(0.009)	(0.008)	
-- L3.			0.028***	
			(0.010)	
-- F.				-0.013
				(0.009)
LIBERAL	0.020	0.032	0.038	0.041
	(0.037)	(0.037)	(0.037)	(0.045)
-- L1.	-0.021	-0.057	-0.037	
	(0.035)	(0.038)	(0.037)	
-- L2.		0.052	-0.003	
		(0.036)	(0.038)	
-- L3.			0.027	
			(0.029)	
-- F.				-0.040
				(0.045)

PTA	0.119*	0.138**	0.177***	0.155***
	(0.061)	(0.060)	(0.060)	(0.059)
-- L1.	0.030	-0.018	-0.065	
	(0.057)	(0.052)	(0.051)	
-- L2.		0.017	-0.046	
		(0.053)	(0.048)	
-- L3.			0.061	
			(0.051)	
-- F.				-0.018
				(0.064)
DEPTH	-0.084***	-0.082***	-0.083***	-0.026
	(0.029)	(0.029)	(0.028)	(0.029)
-- L1.	0.037	0.052**	0.046*	
	(0.029)	(0.025)	(0.025)	
-- L2.		-0.015	0.023	
		(0.028)	(0.025)	
-- L3.			-0.029	
			(0.027)	
-- F.				-0.021
				(0.027)
Exporter-Importer Fixed Effects	Yes	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes	Yes
Constant	14.264***	14.603***	14.856***	14.170***
	(0.013)	(0.014)	(0.014)	(0.013)
Observations	303,475	276,468	255,946	311,287
R^2	0.871	0.878	0.884	0.868

This Table shows the results from running a panel regression of the log of bilateral exports (*EXPORTS*) between 1984 and 2016 on the first (Column 1), second (Column 2), and third (Column 3) lag, respectively, of whether a *PTA* was signed and overall environmental provisions (*ENVPROVS*), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions *(LIBERAL*) included in the PTA for the sample of developing country exporters. Column 4 shows the results when including the on-year leads of the explanatory variables. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.

Table A8b: Estimations with lags and lead of explanatory variables – Share of dirty exports

	(1)	(2)	(3)	(4)
	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters
	DIRTSHARE	DIRTSHARE	DIRTSHARE	DIRTSHARE
ENVPROVS	-0.030	-0.031	-0.032	-0.021
	(0.020)	(0.020)	(0.020)	(0.018)
-- L1.	0.001	-0.004	-0.006	
	(0.020)	(0.022)	(0.022)	
-- L2.		0.017	0.017	
		(0.021)	(0.022)	
-- L3.			0.000	
			(0.020)	
-- F.				-0.008
				(0.015)
RESTRICTIVE	0.075	0.092	0.077	-0.539***
	(0.182)	(0.178)	(0.177)	(0.189)
-- L1.	-0.615***	-0.437**	-0.433**	
	(0.182)	(0.176)	(0.172)	
-- L2.		-0.268*	-0.135	
		(0.162)	(0.150)	
-- L3.			-0.186	
			(0.191)	
-- F.				0.138
				(0.166)
LIBERAL	-0.670	-0.896	-1.010	1.200
	(0.730)	(0.713)	(0.718)	(0.741)
-- L1.	1.521**	0.708	0.932	
	(0.681)	(0.684)	(0.684)	
-- L2.		1.214**	0.093	
		(0.536)	(0.582)	
-- L3.			1.245**	
			(0.540)	
-- F.				-0.639
				(0.770)

PTA	1.640*	1.989**	1.399	0.353
	(0.956)	(0.965)	(0.951)	(0.879)
-- L1.	-0.621	-0.808	-0.109	
	(0.880)	(0.930)	(0.893)	
-- L2.		-0.073	0.394	
		(0.827)	(0.849)	
-- L3.			-0.622	
			(0.767)	
-- F.				0.811
				(0.940)
DEPTH	0.041	-0.017	0.160	0.308
	(0.486)	(0.482)	(0.473)	(0.436)
-- L1.	0.347	0.424	0.154	
	(0.442)	(0.463)	(0.453)	
-- L2.		-0.217	-0.049	
		(0.443)	(0.451)	
-- L3.			-0.123	
			(0.405)	
-- F.				0.066
				(0.430)
Exporter-Importer Fixed Effects	Yes	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes	Yes
Constant	14.937***	14.997***	15.090***	14.878***
	(0.167)	(0.178)	(0.189)	(0.175)
Observations	303,475	276,468	255,946	311,287
R^2	0.503	0.530	0.551	0.495

This Table shows the results from running a panel regression of the share of dirty products in overall merchandise exports (*DIRTSHARE*) between 1984 and 2016 on the first (Column 1), second (Column 2), and third (Column 3) lag, respectively, of whether a *PTA* was signed and overall environmental provisions (*ENVPROVS*), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions *(LIBERAL)* included in the PTA for the sample of developing country exporters. Column 4 shows the results when including the on-year leads of the explanatory variables. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.

Table A8c: Estimations with lags and lead of explanatory variables – Share of green exports

	(1)	(2)	(3)	(4)
	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters	Developing Country Exporters
	GREENSHARE	GREENSHARE	GREENSHARE	GREENSHARE

ENVPROVS	0.004	0.005	0.008	0.004
	(0.010)	(0.010)	(0.010)	(0.007)
-- L1.	-0.005	0.012	0.005	
	(0.010)	(0.013)	(0.013)	
-- L2.		-0.017*	-0.017*	
		(0.010)	(0.010)	
-- L3.			0.006	
			(0.008)	
-- F.				-0.000
				(0.005)
RESTRICTIVE	-0.135	-0.137	-0.132	-0.111**
	(0.088)	(0.090)	(0.086)	(0.047)
-- L1.	0.025	0.051	0.075	
	(0.075)	(0.091)	(0.090)	
-- L2.		-0.032	0.036	
		(0.065)	(0.064)	
-- L3.			-0.106*	
			(0.060)	
-- F.				-0.024
				(0.054)
LIBERAL	0.748*	0.624	0.682*	0.525***
	(0.402)	(0.397)	(0.398)	(0.174)
-- L1.	-0.300	-0.408	-0.417	
	(0.387)	(0.456)	(0.460)	
-- L2.		0.100	-0.214	
		(0.302)	(0.308)	
-- L3.			0.295	
			(0.220)	
-- F.				-0.153
				(0.186)
PTA	-0.100	0.026	0.293	0.273
	(0.319)	(0.332)	(0.335)	(0.295)
-- L1.	0.276	0.095	-0.277	
	(0.297)	(0.407)	(0.389)	

-- L2.		0.099	0.204	
		(0.310)	(0.372)	
-- L3.			0.034	
			(0.317)	
-- F.				0.016
				(0.316)
DEPTH	0.187	0.110	-0.075	-0.187
	(0.178)	(0.182)	(0.177)	(0.134)
-- L1.	-0.325*	-0.413*	-0.132	
	(0.170)	(0.221)	(0.199)	
-- L2.		0.180	0.041	
		(0.161)	(0.182)	
-- L3.			0.010	
			(0.146)	
-- F.				0.021
				(0.140)
Exporter-Importer Fixed Effects	Yes	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes	Yes
Constant	2.236***	2.154***	2.093***	2.189***
	(0.053)	(0.055)	(0.055)	(0.053)
Observations	303,475	276,468	255,946	311,287
R^2	0.248	0.270	0.284	0.239

This Table shows the results from running a panel regression of the share of environmental products in overall merchandise exports (*GREENSHARE*) between 1984 and 2016 on the first (Column 1), second (Column 2), and third (Column 3) lag, respectively, of whether a *PTA* was signed and overall environmental provisions (*ENVPROVS*), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions *(LIBERAL*) included in the PTA for the sample of developing country exporters. Column 4 shows the results when including the on-year leads of the explanatory variables. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.

Table A9: Interactions with Enforcement Clauses

	Developing Country Exporters (1) EXPORTS	Developing Country Exporters (2) DIRTSHARE	Developing Country Exporters (3) GREENSHARE	Developing Country Exporters (4) EXPORTS	Developing Country Exporters (5) DIRTSHARE	Developing Country Exporters (6) GREENSHARE
ENVPROVS	0.000	-0.050***	0.005	0.002	0.021	0.003
	(0.001)	(0.019)	(0.007)	(0.002)	(0.025)	(0.008)
ENVPROVS X ENFORCEMENT	-0.001	0.002	-0.008	-0.002	-0.043**	-0.005
	(0.001)	(0.016)	(0.006)	(0.002)	(0.019)	(0.007)
RESTRICTIVE				-0.005	-0.546***	-0.122

				(0.011)	(0.165)	(0.079)
RESTRICTIVE X ENFORCEMENT				0.031	0.151	-0.016
				(0.019)	(0.292)	(0.104)
LIBERAL				-0.016	0.234	0.437**
				(0.036)	(0.561)	(0.218)
LIBERAL X ENFORCEMENT				0.118*	1.848*	-0.594**
				(0.065)	(1.034)	(0.294)
PTA	0.145***	0.839	0.079	0.129**	0.553	0.172
	(0.051)	(0.703)	(0.202)	(0.052)	(0.707)	(0.200)
DEPTH	-0.052**	0.591	-0.068	-0.068**	0.114	-0.103
	(0.025)	(0.372)	(0.114)	(0.028)	(0.394)	(0.114)
Constant	13.697***	14.821***	2.356***	13.699***	14.798***	2.341***
	(0.012)	(0.153)	(0.050)	(0.012)	(0.153)	(0.051)
Exporter-Importer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	348,844	348,844	348,844	348,844	348,844	348,844
R^2	0.861	0.454	0.213	0.861	0.454	0.213

This Table shows the results from running a panel regression of the log of bilateral exports (*EXPORTS*, Columns 1 and 4), the share of dirty products in overall merchandise exports (*DIRTSHARE*, Columns 2 and 5), and the share of environmental products in overall merchandise exports (*GREENSHARE*, Columns 3 and 6) between 1984 and 2016 whether a PTA was in in force between countries and the maximum number of overall environmental provisions (*ENVPROVS,* Columns 1-6), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions (*LIBERAL*, both Columns 4-6) included in the PTAs, and their interaction with a dummy variable on whether an enforcement clause was included in a PTA, for the sample of developing country exporters. Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.

Table A10: The Effect of Environmental Provisions in PTAs – Controlling for # of PTAs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All Countries	Developing Country Exporters	Developing Country Exporters	All Countries	Developing Country Exporters	Developing Country Exporters	All Countries	Developing Country Exporters	Developing Country Exporters
	EXPORTS	EXPORTS	EXPORTS	DIRTSHARE	DIRTSHARE	DIRTSHARE	GREENSHARE	GREENSHARE	GREENSHARE
ENVPROVS	-0.000	-0.000	-0.001	-0.037***	-0.049***	-0.026	-0.000	0.000	0.002
	(0.001)	(0.001)	(0.001)	(0.011)	(0.015)	(0.016)	(0.004)	(0.006)	(0.006)
RESTRICTIVE			0.006			-0.400***			-0.099*
			(0.009)			(0.135)			(0.060)
LIBERAL			-0.004			0.520			0.363**
			(0.032)			(0.492)			(0.183)
# of PTAs	0.056***	0.059***	0.059**	0.001	0.019	0.093	-0.272***	-0.334***	-0.304***
	(0.016)	(0.023)	(0.023)	(0.217)	(0.316)	(0.315)	(0.064)	(0.088)	(0.087)
DEPTH	-0.010	-0.033	-0.029	0.646***	0.841***	0.600*	0.119	0.133	0.059
	(0.015)	(0.022)	(0.023)	(0.223)	(0.326)	(0.337)	(0.073)	(0.099)	(0.098)
Constant	14.268***	13.699***	13.701***	15.593***	14.981***	14.902***	2.951***	2.519***	2.511***
	(0.009)	(0.011)	(0.012)	(0.115)	(0.157)	(0.157)	(0.034)	(0.044)	(0.046)
Exporter-Importer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	476,152	348,844	348,844	476,152	348,844	348,844	476,152	348,844	348,844
R^2	0.884	0.452	0.225	0.884	0.452	0.225	0.884	0.452	0.225

This Table shows the results from running a panel regression of the log of bilateral exports (*EXPORTS*, Columns 1-3), the share of dirty products in overall merchandise exports (*DIRTSHARE*, Columns 4-6), and the share of environmental products in overall merchandise exports (*GREENSHARE*, Columns 7-9) between 1984 and 2016 on the number (#) *of PTAs* in force between countries and the maximum number of overall environmental provisions (*ENVPROVS,* Columns 1-9), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions (*LIBERAL*, both Columns 3, 6, and 9) included in the PTAs for the samples of all exporters (Columns 1, 4, and 7) and developing country exporters (Columns 2, 3, 5, 6, 8, and 9). Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.

Table A11: The Effect of Environmental Provisions in PTAs – PPML Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All Countries	Developing Country Exporters	Developing Country Exporters	All Countries	Developing Country Exporters	Developing Country Exporters	All Countries	Developing Country Exporters	Developing Country Exporters
	EXPORTS	EXPORTS	EXPORTS	DIRTSHARE	DIRTSHARE	DIRTSHARE	GREENSHARE	GREENSHARE	GREENSHARE
ENVPROVS	0.000	0.000	0.000	-0.002***	-0.002**	-0.000	-0.000	-0.001	-0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
RESTRICTIVE			-0.000			-0.018***			-0.033***
			(0.001)			(0.006)			(0.012)
LIBERAL			0.002			0.007			0.170***
			(0.002)			(0.023)			(0.045)
PTA	0.011***	0.009**	0.009**	0.035	0.053	0.058	0.016	0.044	0.086
	(0.003)	(0.003)	(0.003)	(0.029)	(0.036)	(0.036)	(0.062)	(0.089)	(0.090)
DEPTH	-0.006***	-0.007***	-0.008***	0.009	0.005	-0.007	-0.006	-0.017	-0.078
	(0.001)	(0.002)	(0.002)	(0.014)	(0.018)	(0.019)	(0.028)	(0.044)	(0.049)
Observations	476,152	348,844	348,844	455,087	330,616	330,616	425,000	304,472	304,472
Exporter-Importer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.882	0.859	0.859	0.457	0.46	0.46	0.306	0.323	0.323

This Table shows the results from running a panel pseudo maximum likelihood regression of the log of bilateral exports (*EXPORTS*, Columns 1-3), the share of dirty products in overall merchandise exports (*DIRTSHARE*, Columns 4-6), and the share of environmental products in overall merchandise exports (*GREENSHARE*, Columns 7-9) between 1984 and 2016 on whether a *PTA* was signed and overall environmental provisions (*ENVPROVS,* Columns 1-9), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions (*LIBERAL*, both Columns 3, 6, and 9)) included in the PTA for the samples of all exporters (Columns 1, 4, and 7) and developing country exporters (Columns 2, 3, 5, 6, 8, and 9). Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.

Table A12: The Effect of Environmental Provisions in PTAs – Gravity with country-pair and country-year explanatory variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All Countries	Developing Country Exporters	Developing Country Exporters	All Countries	Developing Country Exporters	Developing Country Exporters	All Countries	Developing Country Exporters	Developing Country Exporters
	EXPORTS	EXPORTS	EXPORTS	DIRTSHARE	DIRTSHARE	DIRTSHARE	GREENSHARE	GREENSHARE	GREENSHARE
ENVPROVS	-0.065***	-0.063***	-0.062***	-0.094***	-0.141***	-0.151***	-0.005**	-0.002	-0.005*
	(0.002)	(0.002)	(0.002)	(0.009)	(0.012)	(0.012)	(0.002)	(0.003)	(0.003)
RESTRICTIVE			0.019			0.194			0.013
			(0.024)			(0.131)			(0.029)
LIBERAL			-0.299***			0.588			0.471***
			(0.072)			(0.463)			(0.121)
PTA	0.706***	0.958***	0.970***	2.105***	2.462***	2.426***	-0.243***	0.044	0.022
	(0.062)	(0.066)	(0.066)	(0.355)	(0.391)	(0.392)	(0.084)	(0.090)	(0.090)
DEPTH	1.743***	1.515***	1.523***	0.507**	0.605**	0.642**	0.373***	0.022	0.018
	(0.039)	(0.046)	(0.047)	(0.229)	(0.294)	(0.299)	(0.056)	(0.066)	(0.067)
GDP(EXP)	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	-0.000**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP(IMP)	0.000***	0.000***	0.000***	0.000	0.000	0.000	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DISTANCE	-0.859***	-0.863***	-0.870***	-3.790***	-4.087***	-4.025***	0.144***	0.129***	0.148***
	(0.027)	(0.032)	(0.032)	(0.159)	(0.192)	(0.194)	(0.034)	(0.039)	(0.039)
CONTIGUITY	1.142***	1.226***	1.247***	2.155***	2.608***	2.445**	-0.255**	-0.002	-0.057
	(0.132)	(0.149)	(0.149)	(0.834)	(0.978)	(0.975)	(0.125)	(0.136)	(0.137)
COMMON LANGUAGE	0.073	0.102	0.113*	-0.119	0.133	0.091	-0.309***	-0.175**	-0.196**
	(0.062)	(0.068)	(0.068)	(0.320)	(0.385)	(0.385)	(0.070)	(0.084)	(0.084)
COLONY	2.785***	2.827***	2.774***	-2.263***	-3.963***	-3.658***	-0.073	-0.921***	-0.800***

	(0.136)	(0.189)	(0.190)	(0.713)	(1.065)	(1.067)	(0.139)	(0.131)	(0.131)
COMMON COLONIZER	-1.020***	-0.841***	-0.832***	-0.889**	-1.444***	-1.526***	-0.509***	-0.326***	-0.352***
	(0.070)	(0.074)	(0.074)	(0.403)	(0.455)	(0.456)	(0.081)	(0.093)	(0.093)
Exporter-Importer Fixed Effects	No	No	No	No	No	No	No	No	No
Exporter-Year and Importer-Year Fixed Effects	No	No	No	No	No	No	No	No	No
Observations	415,614	306,793	306,793	415,614	306,793	306,793	415,614	306,793	306,793
R^2	0.292	0.271	0.271	0.020	0.025	0.025	0.002	0.001	0.001

This Table shows the results from running a regression of the log of bilateral exports (*EXPORTS*, Columns 1-3), the share of dirty products in overall merchandise exports (*DIRTSHARE*, Columns 4-6), and the share of environmental products in overall merchandise exports (*GREENSHARE*, Columns 7-9) between 1984 and 2016 on whether a *PTA* was in force and overall environmental provisions (*ENVPROVS, Columns 1-9*), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions *(LIBERAL, both Columns 3, 6, and 9)*) included in the PTA for the sample of all exporters. Instead of country-pair or country year fixed effects, the reported regressions include the exporter's and importer's GDP, the DISTANCE between their capitals, and dummy variables on whether they share a common border (CONTIGUITY), a COMMON LANGUAGE, a direct (COLONY) or indirect (COMMON COLONIZER) colonial link after 1945. Robust standard errors clustered at the exporter-importer level are reported in parentheses. $p<0.01$***; $p<0.05$**; $p<0.1$*.

Table A13: Two-Stage Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All Countries	Developing Country Exporters	Developing Country Exporters	All Countries	Developing Country Exporters	Developing Country Exporters	All Countries	Developing Country Exporters	Developing Country Exporters
	EXPORTS	EXPORTS	EXPORTS	DIRTSHARE	DIRTSHARE	DIRTSHARE	GREENSHARE	GREENSHARE	GREENSHARE
ENVPROVS'	0.001*	0.002	0.001	-0.040***	-0.052***	-0.024	-0.004	-0.005	-0.002
	(0.001)	(0.001)	(0.001)	(0.012)	(0.016)	(0.017)	(0.005)	(0.006)	(0.007)
RESTRICTIVE'			0.007			-0.313**			-0.136**
			(0.010)			(0.145)			(0.066)
LIBERAL'			0.005			-0.149			0.466**
			(0.035)			(0.533)			(0.197)
PTA	0.113***	0.081	0.079	0.043	0.355	0.441	0.124	0.180	0.227
	(0.043)	(0.055)	(0.055)	(0.623)	(0.772)	(0.773)	(0.199)	(0.235)	(0.233)
DEPTH	-0.014	-0.031	-0.027	-0.215	-0.437	-0.629*	-0.111	-0.175*	-0.263**
	(0.018)	(0.023)	(0.023)	(0.250)	(0.316)	(0.329)	(0.081)	(0.104)	(0.105)
Exporter-Importer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	390,308	294,392	294,392	390,308	294,392	294,392	390,308	294,392	294,392
R^2	0.888	0.864	0.864	0.461	0.462	0.462	0.233	0.216	0.216

This Table shows the results of the second stage regression from running a panel regression of the log of bilateral exports (*EXPORTS*, Columns 1-3), the share of dirty products in overall merchandise exports (*DIRTSHARE*, Columns 4-6), and the share of environmental products in overall merchandise exports (*GREENSHARE*, Columns 7-9) between 1984 and 2016 on whether a PTA was in force between countries and the residuals from a first stage regression. In this, the number of overall environmental provisions (*ENVPROVS, second stage results reported in* Columns 1-9), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions (*LIBERAL*, second stage results reported in Columns 3, 6, and 9) was regressed on the exporter's and importer's GDP, their POPULATION, their EPI in 2018, the DISTANCE between their capitals, and dummy variables on whether they share a common border (CONTIGUITY), a COMMON LANGUAGE, a direct (COLONY) or indirect (COMMON COLONIZER) colonial link after 1945, The residuals of these regressions (and thus the unpredicted number of the respective environmental provisions) are used as explanatory variables (marked with an " ' ") in the second stage. Because the estimations thus use estimated variables as explanatory variables, the standard errors in the second stage, which are reported in parentheses, are bootstrapped. Results are shown for the sample of all exporters (Columns 1, 4, and 7) and that of developing country exporters (Columns 2, 3, 5, 6, 8, and 9). p<0.01***; p<0.05**; p<0.1*.

Table A14: Heckman selection model, second stage regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All Countries	Developing Country Exporters	Developing Country Exporters	All Countries	Developing Country Exporters	Developing Country Exporters	All Countries	Developing Country Exporters	Developing Country Exporters
	EXPORTS	EXPORTS	EXPORTS	DIRTSHARE	DIRTSHARE	DIRTSHARE	GREENSHARE	GREENSHARE	GREENSHARE
ENVPROVS	0.000*	0.000	0.000	-0.004*	-0.005	-0.003	-0.001	-0.001	-0.000
	(0.000)	(0.000)	(0.000)	(0.002)	(0.004)	(0.003)	(0.001)	(0.001)	(0.001)
RESTRICTIVE			0.000			-0.069			-0.026
			(0.003)			(0.050)			(0.019)
LIBERAL			-0.002			-0.105			0.100
			(0.011)			(0.166)			(0.080)
DEPTH	-0.007*	-0.012***	-0.012***	0.080	0.072	0.057	-0.000	-0.006	-0.013
	(0.004)	(0.006)	(0.004)	(0.060)	(0.090)	(0.067)	(0.027)	(0.032)	(0.028)
Exporter-Importer Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	390,404	294,488	294,488	390,404	294,488	294,488	390,404	294,488	294,488

This Table shows the results of the second stage of a Heckman (1976, 1979) selection model estimation with the log of bilateral exports (*EXPORTS*, Columns 1-3), the share of dirty products in overall merchandise exports (*DIRTSHARE*, Columns 4-6), and the share of environmental products in overall merchandise exports (*GREENSHARE*, Columns 7-9) between 1984 and 2016 as outcome variables, using as explanatory variables the maximum sum of overall environmental provisions (*ENVPROVS, Columns 1-9*), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions *(LIBERAL, both Columns 3, 6, and 9)*) included in PTAs between exporter and importer. The first stage controls for selection into signing a PTA, predicted by the exporter's and importer's GDP, their POPULATION, their EPI in 2018, the DISTANCE between their capitals, and dummy variables on whether they share a common border (CONTIGUITY), a COMMON LANGUAGE, a direct (COLONY) or indirect (COMMON COLONIZER) colonial link after 1945. Because the fixed effects are controlled for by regressing the dependent variables on the fixed effects first, and then using the residuals as dependent variables, the regressions are on estimated variables, and the standard errors in the second stage, which are reported in parentheses, are bootstrapped. Results are shown for the sample of all exporters (Columns 1, 4, and 7) and that of developing country exporters (Columns 2, 3, 5, 6, 8, and 9). p<0.01***; p<0.05**; p<0.1*.

Table A15: Green Sector Classification based on WTO Friends' List

	(1)	(2)	(3)	(4)
	All Countries	All Countries	Developing Country Exporters	Developing Country Exporters
	$GREENSHARE_{WTO}$	$GREENSHARE_{WTO}$	$GREENSHARE_{WTO}$	$GREENSHARE_{WTO}$
ENVPROVS	0.030*	0.029	0.045**	0.050**
	(0.016)	(0.020)	(0.022)	(0.025)
RESTRICTIVE		-0.095		-0.065
		(0.096)		(0.185)
LIBERAL		0.598**		0.029
		(0.290)		(0.670)
PTA	1.712**	2.028**	2.458**	2.459**
	(0.848)	(0.862)	(1.065)	(1.066)
DEPTH	-1.879***	-2.103***	-2.811***	-2.842***
	(0.412)	(0.440)	(0.564)	(0.586)
Constant	43.865***	43.843***	36.229***	36.217***
	(0.169)	(0.170)	(0.233)	(0.234)
Exporter-Importer Fixed Effects	Yes	Yes	Yes	Yes
Exporter-Year and Importer-Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	476,152	476,152	348,844	348,844
R^2	0.645	0.645	0.602	0.602

This Table shows the results from running a panel regression of the share of environmental products, as classified by the WTO Friends' List, in overall merchandise exports ($GREENSHARE_{WTO}$) between 1984 and 2016 on whether a *PTA* was signed and overall environmental provisions (*ENVPROVS, Columns 1-4)*), trade-restrictive (*RESTRICTIVE*), and trade-liberalizing provisions *(LIBERAL, both Columns 2 and 4)*) included in the PTA for the samples of all exporters (Columns 1-2) and that of developing country exporters only (Columns 3-4). Robust standard errors clustered at the exporter-importer level are reported in parentheses. p<0.01***; p<0.05**; p<0.1*.